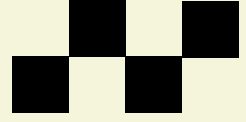


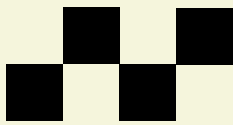
April 28-30, 2023

INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES-IV



EDITORS

Dr. Mehmet Fırat BARAN
Dr. Seyithan SEYDOŞOĞLU
Dr. Esra BİLİCİ



Turkish Republic of Northern Cyprus

**International Conference on
Global Practice of Multidisciplinary Scientific Studies-IV**

**DATE – PLACE
April 28-30, 2023
Turkish Republic of Northern Cyprus**

**CONFERENCE
PROCEEDINGS BOOK**

EDITORS

Dr. Mehmet Firat BARAN

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Dr. Esra BILICI

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IV. INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES

April 28-30, 2023 / Turkish Republic of Northern Cyprus

CONFERENCE PROGRAM



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- ❖ To be able to attend a meeting online, login via <https://zoom.us/join> site, enter ID "Meeting ID or Personal Link Name" and solidify the session.
 - ❖ The Zoom application is free and no need to create an account.
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 - ❖ The application works on tablets, phones and PCs.
 - ❖ The participant must be connected to the session 5 minutes before the presentation time.
 - ❖ All congress participants can connect live and listen to all sessions.
 - ❖ Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.
- Points to Take into Consideration - TECHNICAL INFORMATION**
- ◆ Make sure your computer has a microphone and is working.
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 - ◆ Attendance certificates will be sent to you as pdf at the end of the congress.
 - ◆ Requests such as change of place and time will not be taken into consideration in the congress program.

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- ❖ Kongremizde Yazım Kurallarına uygun gönderilmiş ve bilim kurulundan geçen bildirimler için online (video konferans sistemi üzerinden) sunum imkanı sağlanmıştır.
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 - ❖ Tüm kongre katılımcıları canlı bağlanarak tüm oturumları dinleyebilir.
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 - ◆ Kongre programında yer ve saat değişikliği gibi talepler dikkate alınmayacaktır

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CONGRESS LANGUAGES: **English and All Turkish Dialects**

28.04.2023 | SESSION-1



Kyrenia Time: 09:00–11:00



In Person Participation - The Olive Tree Hotel, Kyrenia

HEAD OF SESSION: Prof. Dr. Derya Yücel

Authors	Affiliation	Presentation title
Betül Kolay	GAP International Agricultural Research and Training Center	Direct Sowing in Wheat After Second Crop Maize Harvesting
Melekber Sülüoğlu Durul Hülya Ünver	Kocaeli University	New Trends in Strawberry Tree Breeding
Derya Yücel İrfan Erdemci Celal Yücel Medeni Yaşar Murat Koç	Şırnak University	Evaluation of Agricultural Characteristics of Chickpea Genotypes in Diyarbakir Ecological Conditions
Derya Yücel İrfan Erdemci Celal Yücel Medeni Yaşar Murat Koç	Şırnak University	Determination Of Some Technological Characteristics of Chickpea Genotypes Under Ecological Conditions of Diyarbakir
Zeynep Dumanoğlu Kağan Kökten Selim Özdemir	Bingol University	Determination of Some Physical Properties of Peas (<i>Pisum sativum</i> L.) Evaluated as Dry Food
Celal Yücel Cemal Deniz Derya Yücel İbrahim Halil Çetiner Celile Aylin Oluk	Şırnak University	Determination of Forage Quality and Its Related Characteristics of Some Pearl Millet Populations Under Gap Conditions
Celal Yücel Cemal Deniz Mustafa Apaydın Derya Yücel Rüştü Hatipoğlu	Şırnak University	Determination of Forage Yield and Its Related Characteristics of Some Pearl Millet Populations Under Gap Conditions
Gökhan Baktemur Ecem Kara Tolga Karaköy Yeter Çilesiz Faheem Shahzad Baloch Zemran Mustafa Betül Yücel Muhammad Tanveer Altaf Hatıra Taşkin Nihal Denli Davut Keleş	Sivas University of Science and Technology	Propagation Of Garlic Genotypes Grown in Turkey by Shoot Tip Culture
Yusuf Uzun Şeyda Çavuşoğlu Nurettin Yılmaz Sedat Kesici İsmail Acar Mustafa Emre Akçay Cemil Sadullahoğlu	Van Yuzuncu Yıl University	Doğal Mantar Türlerinde Antioksidan Kapasitesinin Mars Algoritması İle Tahmini
Meltem Uçar Yakup Kara Sevgi Kolaylı	European University of Lefke	Antioxidant Properties and Phenolic Components in The Leaf of Izabella Grape (<i>Vitis labrusca</i> L.)
Kader Aydın Mehmet Fırat Baran	Siirt University	Aronya yetiştiriciliğinde uygulanan mekanizasyon

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-2



Kyrenia Time: 11:30–13:30



In Person Participation - The Olive Tree Hotel, Kyrenia

HEAD OF SESSION: Prof. Dr. Halil Ibrahim Oguz

Authors	Affiliation	Presentation title
Meliha Feryal Sarikaya Muhammed Tatar İlker Yüce Ecem Kara Yeter Çilesiz Muhammad Azhar Nadeem Ömer Sözen Gökhan Baktemur Tolga Karaköy	Sivas University of Science and Technology	Ipbs-Retrotransposons Variations: The Evaluation of Genetic Diversity and Population Structure in International Sugar Beet Germplasm
Erdal Çağan Kağan Kökten	Bingol University	Microelement Contents of Alfalfa (<i>Medicago sativa</i> L.) Populations Cultivated in The Eastern Anatolian Region of Turkey
Erdal Çağan Kağan Kökten	Bingol University	Microelement Contents of Some Alfalfa (<i>Medicago sativa</i> L.) Cultivars
Siddık Keskin Nurhan Keskin Birhan Kunter	Van Yuzuncu Yıl University	Ankara-Kalecik Ekolojisinde Narince Üzüm Çeşidi için Sıcaklık ile Verim Arasındaki İlişkinin Modellenmesi
Suna Akkol Aslı Akilli	Van Yüzüncü Yıl University	Comparative Analysis of Lactation Curve Models in Holstein Friesian Cows
Ali Öztürk Recep Kara A. Fatih Fidan	Afyon Kocatepe University	Investigation of Heavy Metal Contamination and Microbiological Quality of Massage Oils Sold in Turkey
Halil Ibrahim Oguz Fırat Ege Karaat Mehmet İlhan Odabaşoğlu İlbiçe Oğuz	Adıyaman University	Early Season Grown of Mulberry (<i>Morus</i> spp.) Cultivation in The Mediterranean Region
İlbiçe Oğuz Ebru Kafkas	Cukurova University	A Study on The Biochemical Contents and Human Health Benefits of Raspberry (<i>Rubus idaeus</i> L.) Fruits
İlbiçe Oğuz Ebru Kafkas	Cukurova University	A Review on Determination of Physical and Biochemical Contents of Some Aronia (<i>Aronia</i> spp.) Berry Fruit Species
Salih Sezer Gülşah Akgül Esra Bilici	Uşak University	Rapid Etiological Diagnosis of Neonatal Calf Diarrhea with Immunochromatographic Test Kits in Esme District of Usak
Bülent Çakır İlker Inal Celal Yücel Derya Yücel Rüştü Hatipoğlu Hakan Özkan	Eastern Mediterranean Agricultural Research Institute	Determination of The Relations Between Forage Yield and Some Agricultural Characteristics in Pearl Millet Populations by Correlation and Path Analysis
Esra Çakır Hakan Özkan	Çukurova University	Evaluation of Yellow Rust (<i>Puccinia striiformis</i> f. sp. <i>tritici</i>) Disease in Durum Wheat (<i>Triticum durum</i> L.) Genotypes by Biplot Method in Cukurova Conditions

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-3



Kyrenia Time: 14:30–16:30



In Person Participation - The Olive Tree Hotel, Kyrenia

HEAD OF SESSION: Prof. Dr. Cetin Karademir

Authors	Affiliation	Presentation title
Gülşah Koyuncu Emine Karademir	Siirt University	The Effect of Different Applications of Calcium on Yield and Fiber Quality Characteristics in Cotton
Mehmet Kiliç Emine Karademir	Siirt University	The Effect of Different Foliar Fertilizer Applications on Cotton Yield and Fiber Quality Properties
Nurullah Tektaş Çetin Karademir	Siirt University	Determination The Effectiveness of Defoliation on Cotton (<i>Gossypium hirsutum</i> L.) At Different Development Periods
Hevin Kutat Çetin Karademir	Siirt University	Determination Effects of Sulfur Application on Yield and Fiber Quality Criteria in Cotton
Cihan Demir Osman Gökdoğan	Kırıkale University	Kırklareli İli Ceviz Atıklarının Biyokütlesi ve Enerji Potansiyeli
Gülcan Üren Mehmet Fırat Baran	Siirt University	Analysis of Some Energy Values of Grain Stem Wastes Grown In Şırnak Province
Mehmet Fırat Baran Ekrem Kadak	Siirt University	Input Usage and Gross Profit Analysis in Pomegranate Production: Siirt Province Example
Melekber Sülüsoğlu Durul Mehmet Polat	Kocaeli University	An Overview of Japanese Quince (<i>Chaenomeles japonica</i>)
Alamettin Bayav Bahri Karli Bektaş Kadakoğlu	Isparta University of Applied Sciences	Development of Foreign Trade in Medicinal and Aromatic Plants in Türkiye
Alamettin Bayav Bahri Karli Orhan Gündüz	Isparta University of Applied Sciences	Apple Production and Foreign Trade in The World and Türkiye
Alamettin Bayav Mevlüt Gül Orhan Gündüz	Isparta University of Applied Sciences	Changes in Red Meat Prices and Marketing Margin in Türkiye
Ali Kipel Cüneyt Yurt Hamit Yılmaz Yıldırım Adigüzel Zehra Sude Sari Mehmet Fatih Akay	Cukurova University	Time Series Based Financial Forecasting Models
İlker İnal Bülent Çakir Celal Yücel Celile Aylin Oluk Abdullah Çil Atalay Ergül	Eastern Mediterranean Agricultural Research Institute	Determining The Relations Between Some Feed Quality Parameters in Pearl Millet Populations by Correlation and Path Analysis

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28.04.2023 | SESSION-4



Kyrenia Time: 17:30–19:30



In Person Participation - The Olive Tree Hotel, Kyrenia

HEAD OF SESSION: Assoc. Prof. Dr. Nezahat Hamiden Karaca

Authors	Affiliation	Presentation title
Kürşad Sayın Abdullah Karaman	Selcuk University	Natural Heritage Asthma Cave and Tourism Potential
Alper Ateş Islam Islamzade	Near East University	Refugees and Tourism
Alper Ateş Özlem Dağdelen	Near East University	Tourism Sector in The Process of Adaptation to The European Green Deal
Nursel Aşan Baydemir Şükrü Tüzmen	Kırıkkale University	Distribution and The Conservation Status of Egyptian Fruit Bat in Cyprus
Duygu Toygür Eroğlu Umur Eroğlu	Bursa Uludağ University	Differences in Adaptive Behavior Levels of Salespeople in Automotive Dealers According to Their Demographic Characteristics
Kürşad Sayın Abdullah Karaman	Selcuk University	Evaluation Of Kitchen Chefs' Perspectives to Menu Planning in Restaurants in Mersin
Mehmet Biçici	Gaziantep University	Türk Siyasal Hayatında Hürriyet Partisi
Nebile Dayılar Nezahat Hamiden Karaca	Afyon Kocatepe University	Can Emotion Regulation Skills in Preschool Period Be Supported with Motor Creativity Activities?
Ayşegül Karakaya Nuray Kurtdele Fidan	Afyon Kocatepe University	A Qualitative Study on Raising Sustainable Environmental Awareness in Life Science Course
Nezahat Hamiden Karaca Halil Uzun Mehmet Oğuz Göle Rasim Aydoğuş	Afyon Kocatepe University	Teachers' Perceptions of Risky Play and Children's Motor Creativity Skills
Meryem Öksüzöğlü	Akdeniz Karpaz University	Historical Process of Inspection in Cyprus Turkish Education
Aytaç Demiray H. Arif Tunçez	Selcuk University	A Research on Jevons Paradox in Developing Countries
Eda İlhan	Bursa Uludağ University	Understanding The Effects of Inflation on Consumer Behavior
Gizem Öksüzöğlü	Final International University	Memories of Social Identity: Time and Space
Nedime Karasel Eylem Menteşoğulları Şevket Şafakoğulları	Uluslararası Kıbrıs University	Comparative Analysis of Research Published in The Last Five Years In The Field of Educational Audit In Trnc
Alim Malta Mete Ünal Girgen	Girne Final University	Gastronomide Yeni Trendler: Konsept Restoranlar Üzerine Bir Literatür Çalışması
Ilkcan Cilasın Mete Ünal Girgen	Girne Final University	Gastronomide Yeni Trendler: Kuzey Kıbrıs Slow Food Akımı Örneği

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28.04.2023 | SESSION-5



Kyrenia Time: 21:00–23:00



In Person Participation - The Olive Tree Hotel, Kyrenia

HEAD OF SESSION: Prof. Dr. Nuray Kurtdede Fidan

Authors	Affiliation	Presentation title
Mehmet Metin Yeliz Eratlı Şirin	Cukurova University	The Effect of Athlete Leadership on Team Cohesion in Team Sports
Tuğçe Metin Ibrahim Arslan	Cukurova University	An Assessment from A Green Economy Perspective; Kahramanmaraş-Centered Earthquakes
H. Arif Tunçez Aytaç Demiray	Selcuk University	According to Turkish Accounting Standards, The Cash Flow Statement and The Methods Used in The Analysis of The Cash Flow Statement
Nuray Kurtdede Fidan Ayşe Aydın Biol Karabulut	Afyon Kocatepe University	Social Studies Course in Distance Education According to Primary School Students
Dicle Özavci	Siirt University	Cas From Past to Present
H. Arif Tunçez Aytaç Demiray	Selcuk University	Logistics Costs and Accounting Transactions
Aytaç Demiray H. Arif Tunçez	Selcuk University	The Informal Economy and Its Effects on The Turkish Economy
Şemsi Yazıcı Demet Yavuz	Ege Universty	Effect of Cement/aggregate Ratio on Mechanical and Hydraulic Properties of Pervious Concrete
Gökhan Başman Erdoğan Karip Tuğçe Özcan Mehmet Serkan Yılmaz Cengiz Yaşin	Eti Krom	Enrichment of Fine-Grain Chrome Ore with Multi Gravity Separator, Pilot Scale Yield Analysis
Arkın Akalın Hasan Acar	Girne American University	Early Usg and Doppler Findings in Children of Mothers with Hashimoto's Disease
Volkan Çetintaş Mehmet Emin Sönmez	Gaziantep University	Golan Tepelerinin Mevcut Durumu ve Geleceği
Özlem Firtina Filiz Pars Uçağı	Gazi University	A Comparative Analysis of Martin Walser's Narrative "Ein Fliehendes Pferd" and Its Theatrical Adaptation
Şahin Ay	Siirt University	Violation Of Tax Privacy and Consequences
Şahin Ay	Siirt University	An Assessment On The European Union And Turkey's Financial Cooperation
Selim Akyulaf	University of Limerick	Turkish Cypriots' Social Identity Processes and Categorisation
Nihayet Koçyiğit	Batman University	Her Çağın Malzemesi Akıllı Polimerler ve Uygulama Alanları

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-1 | HALL-1



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Korkmaz Bellitürk

Authors	Affiliation	Presentation title
Sebiha Erol Emine Budakli Çarpici Barış Bülent Aşık	Bursa Uludağ University	The Effects of Sowing Date and Harvest Stages on Silage Quality in Quinoa (<i>Chenopodium quinoa</i> Willd.)
Zohaib Hassan Sain	Superior University	Students Assessment of Online Education during the Covid-19 Epidemic
Meltem Türkeri	Eastern Mediterranean Agricultural Research Institute	Breeding Research on Dried Pea Suitable for Mediterranean Climate
Pushkar Pandey Renu Kundu	Indian Institute of Technology	UX study on Handheld Augmented Reality Games by Applying Spradley's Nine Dimensions Design Principle
Korkmaz Bellitürk	Tekirdag Namık Kemal University	Determination of Plant Nutrition Capacities of Agricultural Areas by Soil Analysis: The Case of Ipsala District of Edirne Province
Pushkar Pandey	Indian Institute of Technology	Applying UX Principles to find Pre-Patterns in Handheld Augmented Reality Games
Korkmaz Bellitürk	Tekirdag Namık Kemal University	Productivity Parameters Decreased Over Time in Agricultural Soils: Soil Organic Matter and The Case of Süleymanpaşa District of Tekirdağ Province
Khanifah Auliana Sultan Mubarak	Halal Center of UIN	Halal Behavior in Media Technology System
Korkmaz Bellitürk	Tekirdag Namık Kemal University	Productivity Parameters Destroyed Over Time in Agricultural Soils: Soil Reaction (Ph) and The Case of Keşan District of Edirne Province
Balasubramani G L Rinky Rajput Manish Gupta Pradeep Dahiya Jitendra K Thakur Rakesh Bhatnagar Abhinav Grover	Jawaharlal Nehru University	Structure-based Drug Repurposing to Inhibit the DNA Gyrase of <i>Mycobacterium tuberculosis</i>
Sabiq Muhammad Zaki Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	The Role of Traditional Markets in Community Economic Growth

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-1 | HALL-2



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Prof. Dr. Aydın ADİLOĞLU

Authors	Affiliation	Presentation title
Harun Hurma Korkmaz Bellitürk İsmet Başer Alpay Balkan	Tekirdağ Namık Kemal University	Economic and Environmental Evaluation of Sustainable Durum Wheat Production
Gheorghe Giurgiu Manole Cojocaru	Titu Maiorescu University	Natural Modulation of The Gut Microbiota in Dogs with Spinal Cord Injury
Bağnu Çolakoğlu Harun Hurma	Tekirdağ Namık Kemal University	Evaluation of Producer Awareness on The Potential Uses of Agricultural Wastes
Mahmood Ahmed	University of Education	Investigation of Minerals in Fruit Peels Powder: Ultrasound Assisted Extraction Followed by Flame Atomic Absorption Spectrometry
Aydın Adiloğlu Serdar Kadakal	Tekirdağ Namık Kemal University	Investigation of Suitable Extraction Methods for Determining the Available Sulphur Contents of Trakya Region Soils Which Growing Canola (<i>Brassicca napus oleifera</i> spp)
Sevinç Khasayeva Saida Siracova Fidan Gurbanova	Azerbaycan Devlet Ekonomi University	Health Problems Caused by Urbanization and Solutions
Aydın Adiloğlu Tuncay Sari	Tekirdağ Namık Kemal University	An Investigation of Some Heavy Metal Pollution Along the Tem Motorway Agricultural Areas in Edirne
P. Manoj Kumar J. Sravani	Department of Civil Engineering	Analysis and Design of Residential Building on Wind Load Analysis
Esra Cura Sevin Teoman Duran Meryem Ipek Ahmet Ipek	Bursa Uludağ University	Farklı Ön Uygulamaların Sarımsak (<i>Allium sativum</i> L.) Tohumlarında Dormansinin Kırılması Üzerine Etkileri
Nurhan Keskin	Van Yuzuncu Yıl University	Effective and Economical Biostimulant in Proper with the Vision of Sustainable Viticulture: Seaweed Extract
Dinda Safira Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Self-Awareness of the Khamr Effects

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-1 | HALL-3



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Hatun Barut

Authors	Affiliation	Presentation title
İlker Yüce Yeter Çilesiz Tolga Karaköy	Sivas University of Science and Technology	Evaluation of The Performances of Some Common Vetch Genotypes Under Sivas Ecological Conditions
İlker Yüce Yeter Çilesiz Tolga Karaköy	Sivas University of Science and Technology	Evaluation of Some Hungarian Vetch (<i>Vicia pannonica</i> Crantz.) Genotypes in Terms of Agro-Morphological Traits Under Sivas Ecological Conditions
Ezelhan Şelem Murat Tunçtürk Hüseyin Eroğlu Rüveyde Tunçtürk Lütfi Nohutçu	Van Yuzuncu Yıl University	Morpho-Anatomical Observations on <i>Colchicum Szovitsii</i> Fisch. Et Mey. and <i>Colchicum kurdicum</i> (BORNM.) Stef. In Van Region
Artini Fatikhata Yaa Siinta Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Pengaruh Pengelolaan Sistem Akuntansi Keuangan Daerah Terhadap Kualitas Laporan Keuangan Kabupaten Pekalongan
Lütfi Nohutçu Rüveyde Tunçtürk Ezelhan Şelem Murat Tunçtürk	Van Yuzuncu Yıl University	Determination of The Effect of Salt Stress on Plant Growth and Color Values in Fenugreek (<i>Trigonella foenum graecum</i> L.) Grown in Medium Containing Different Levels of Vermicompost
Fatma Azzahra Puspita Sari Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Introduction of Financial Accounting Standards to Sma/Smk Students In Batang District
Sabita Khadiqoh Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	An Overview of E-Wallet
Suci Rahmawati Hendri Hermawan Adinugraha Happy Sista Devy	UIN K.H. Abdurrahman Wahid Pekalongan	Characteristics of the Islamic Economy
Hatun Barut Sait Aykanat Rukiye Kara Hakan Yilmaz Halil Aytop Selim Eker	Eastern Mediterranean Agricultural Research Institute	Determination of Optimum Nitrogen Requirements of Some Bread Wheat Varieties in Kahramanmaraş Conditions
Siska Yuliana Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Tax Function for The State
Chaoui Ayoub	Ibn Zohr University	Efficient Valorization of Poultry By-Products via Methane Production Optimization

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-1 | HALL-4



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Behlül Sevim

Authors	Affiliation	Presentation title
Muhammed Tatar Meliha Feryal Sarikaya Tolga Karaköy	Sivas University of Science and Technology	Evaluation of the Performances of Some Prune Genotypes Under Sivas Ecological Conditions
Michelle Prajna Prameswari Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Pillars And Terms of Sale and Purchase
Meliha Feryal Sarikaya Muhammed Tatar Tolga Karaköy	Sivas University of Science and Technology	Evaluation of Agro-Morphological Performance of Some Field Pea (<i>Pisum arvense</i> L.) Genotypes Under Sivas Ecological Conditions
Ajeng Nafilatun Nikmah Hendri Hermawan Adinugraha Ade Gunawan Ria Anisatus Sholihah	UIN K.H. Abdurrahman Wahid Pekalongan	Micro Small Medium Enterprises (Msmes) Perception on The Importance of Financial Reports
Duygu Udum Deniz Ekin Yildirim	Bursa Uludağ University	Measurement of Nesfatin-1 Hormone in Breast Milk of Lactational Sheep
Nilay Gül Suzan Yalçın	Selçuk University	Health Benefits of Thyme Essential Oil
Behlül Sevim Tugay Ayaşan	Aksaray University	Moringa Oleifera'nın Yumurta Tavuklarının Beslenmesinde Kullanılması
Nailun Naja Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Effective Time Management Strategies for College Students
Mehmet Zahit Yeken	Bolu Abant İzzet Baysal University	The Effect of Trinexapac-Ethyl on Plant Height, Yield and Some Agricultural Traits of Winter Bread Wheat (<i>Triticum aestivum</i> L.)
Anggun Herawati Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	The Decision to Marry Without Having Children (Childfree) From Human Rights Perspective (Women's Reproductive Rights)
Nazhifah Meydyna Silva Hendri Hermawan Adinugraha Tamamudin	UIN K.H. Abdurrahman Wahid Pekalongan	The Latest Developments in The Islamic Economy in Indonesia

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-1 | HALL-5



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Cemil Sadullahoğlu

Authors	Affiliation	Presentation title
Songül Yumuşak Büşra Altinel	Selcuk University	Improper Use of Emergency Services
Sulis Setiyaningrum Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Ethic And Moral Problems in The Present
Ihedigbo, Kingsley Sunday Olughu, Christopher Egwu Bello, Abdulkabir Opeyemi	Federal University of Technology Minna	Influence of Welfare Packages on Construction Workers Productivity in Nigeria: A Review
Yusril Bariki Hendri Hermawan Adinugraha Susminingsih Ali Muhtarom	UIN K.H. Abdurrahman Wahid Pekalongan	Production Factors in The Development of The Islamic Economy in Indonesia
Tülin Yıldız Cagla Avcu	Tekirdag Namık Kemal University	The Effect of Team Communication on Patient Safety in The Operating Rooms: Systematic Review
Fatma Azzahra Puspita Sari Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	The Importance of Vocational Competence Certification for Students For The Needs of Future Life
Elif Önsoz Kansu Büyükaşar Leyla Bahar Badel Arslan Gamze Ayar	Mersin University	Possible Regenerative Effect of Bone Marrow Mesenchymal Stem Cell-Derived Exosomes in Oleic Acid-Induced Lung Injury in Rats
Tsania Umairo Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	The Role of Financial Literacy in Financial Management
Gamze Korkmaz Gülseren Keskin	Ege University	Cinsel İstismar Mağdurlarında Travmatik Hafıza Açısından Değerlendirme
Fenti Febriani Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	The Importance of Private Finance Management
Adhi Riza Aulia Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Pentingnya Bahasa Indonesia Yang Baik Dan Benar

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-1 | HALL-6



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Cihan DEMİR

Authors	Affiliation	Presentation title
Burcu Demirbağ Ebru Ballı Hakan Ünver Deniz Kibar Evren Değirmenci Mustafa Kemal Yılmaz	Mersin University	Investigation of the Anti-Cancer Effects of Photodynamic Therapy by Using the Schiff-Base Ligand Complex As Photosensitizers on Human Breast Cancer Cell Line
Wulan Oktaviani Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	The Role of Parents in Overcoming Teen Fanaticism Towards Online Games
Haşim Bağcı	Aksaray University	Determining the Significance Level of Activity (Turnover) Ratios in the Human Health and Social Services Industry: An Empirical Analysis with the Copeland Method Based on Sd – Critic and Lopcow
Wulan Oktaviani Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Factors Triggering Teen Fanaticism Towards Online Games
Alime Selçuk Tosun Elif Nisa Kara	Selcuk University	Investigation of Intervention Programs Applied for Frailty in Older Adults
Dwi Mutiara Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	The Influence of Social Media on Business Activities
Ayşen Tezel	Gendarmerie and Coast Guard Academy	Will Snps Replace Strs in Forensic Identification
Osamah Ihsan Ali	University of Pannonia	Advances of TiCN CVD Coatings for Enhanced Cutting Tool Performance
Kerim Kaan Göküstün Betül Ulu	Malatya Turgut Ozal University	Is Depression Effective on Eating Attitudes and Behaviors? A Cross-Sectional Research
Stephen Ofori Yeboah Fatma Köprülü Behçet Öznacar	Near East University	Improving The Academic Performance of Students
Hendri Hermawan Adinugraha Susminingsih Husein Ali Muhtarom	UIN K.H. Abdurrahman Wahid Pekalongan	Bank Muamalat Indonesia Information Saifudin

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-2 | HALL-1



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Sevilay Gül

Authors	Affiliation	Presentation title
Rukiye Gezer	Siirt University	Post Harvest Treatments for Cut Flowers
Mala Khatuniswah	UIN K.H. Abdurrahman Wahid Pekalongan	E-Commerce Practices in Indonesia in A Sharia Economic Review Implementation Tolerated Happily
Sevilay Gül Levent Coşkuntuna	Tekirdag Namık Kemal Univesity	In Vitro Techniques for Prediction of Nutritional Quality of Ruminant Feeds
Khairun NISA	UIN K.H. Abdurrahman Wahid Pekalongan	The Urgency of Education and Research Technology in Launching an Independent Curriculum
Aynur Bilmez Özçınar	Siirt University	Expressing Genes of Canola (<i>Brassica napus</i> L.): A Review
Salah Belaidi Yasmine Chennai	Mohamed Khaidhar University	Electronic and Structural Properties of Novel Series of Heterocyclic of Coumarin and Quantitative Structure Activity Relationship (QSAR) Studies and Golbraikh and Tropsha's Criteria of Validation
Tolga Ahmet Kalayci Kaan Pekel Öztürk Saraçoğlu Zehra Sude Sari Mehmet Fatih Akay	Cukurova University	Development of A Machine Learning-Based Seller Ranking Algorithm for E-Commerce Marketplaces
Artini Fatikhatu Yaa Siinta Hendri Hermawan Adinugraha	UIN K.H. Abdurrahman Wahid Pekalongan	Pengaruh Pengelolaan Sistem Akuntansi Keuangan Daerah Terhadap Kualitas Laporan Keuangan Kabupaten Pekalongan
Djellouli Amir Berredjem Yamina Hattab Zhou Khechai Mohamed Barbari Fateh Azri Naima Sara Ncibi	Université mohammed chérif mesaadia de Souk-Ahras	Removing Aqueous Waste with Cost-Effective Bioadsorbents
Afidah Rozi Anti Hendri Hermawan Adinugraha Ali Muhtarom Susminingsih	UIN K.H. Abdurrahman Wahid Pekalongan	Islamic Economic Review About E-Money
J. Sravani P. Manoj Kumar C. Bala Sai	Department of Civil Engineering	Experimental Study on Partial Replacement of Cement with Ggbs In Concrete

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-2 | HALL-2



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Yusuf Dilay

Authors	Affiliation	Presentation title
Tuba Beşen	West Mediterrenian Agricultural Research Institute	Portakal Üreticilerinin Su Kaynaklarının Değerlendirilmesi Üzerine İnceleme
C. Bala Sai P. Manoj Kumar J. Sravani	Department of Civil Engineering	Study on Mechanical Properties of Concrete by Partial Replacement of Aggregates with Ceramic Waste
Ayberk Subaş	Ondokuz Mayıs University	Gebe Bir Köpekte Kronik Diyafram Fıtığının Tedavisi
Andreea Irina Barzic Maria Teresa Buscaglia Lavinia Petronela Curecheriu Raluca Marinica Albu Iuliana Stoica	“Petru Poni” Institute of Macromolecular Chemistry, Iasi, Romania	Assessment of the Dielectric Properties of Barium titanate/polymer Composites: Effects of the Polymer Matrix Structure
H. Deniz Şireli Ali Murat Tatar Murat Turan Gökhan Gelir	Dicle University	Büyükbaş İşletmelerinde Hayvan Refahına Bağlı Buzağı Kayıpları
Simona Luminita Nica Constantin Găina Raluca Marinica Albu Iuliana Stoica Andreea Irina Barzic	“Petru Poni” Institute of Macromolecular Chemistry	Absorption Edges and Morphology of Reinforced Polyvinyl Alcohol with Variable Amounts of Pristine/Modified Carbon-Based Filler
Murat Turan H. Deniz Şireli Ali Murat Tatar Fırat Bülbüller	Dicle University	Büyükbaş ve Küçükbaş işletmelerinde Biyogüvenlik Uygulamalarının Önemi
Moses Adeolu AGOI Oluwanifemi Opeyemi AGOI	Lagos State University of Education	The Implicit Effect of Cyber Crimes and Its Explicit Implication on Modern Society
Ali Murat Tatar Murat Turan H. Deniz Şireli	Dicle University	Sığırcılık İşletmelerinde Buzağı ve Düvelerde Isı Stresi
Ayberk Subaş	Ondokuz Mayıs University	Sol Antebrachiumda Osteosarcoma Meydana Gelen Bir Köpekte Tümörlü Dokunun Osteotomi Yöntemi ile Uzaklaştırılması
Yaser Rahmaty Mansora Pooya	Kirsehir Ahi Evran University	The Relationship Between Human Rights, and Economic Rights with Foreign Investment

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-2 | HALL-3



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Ali Beyhan Ucak

Authors	Affiliation	Presentation title
Gözde Kiliç Sakine Yaşın	Amasya University	The Effect of Fermentation Process on Garlic (<i>Allium sativum</i>) Composition and The Use of Raw and Fermented Garlic in Poultry Nutrition
Raluca Marinica Albu Iuliana Stoica Andreea Irina Barzic	“Petru Poni” Institute of Macromolecular Chemistry	Evaluation of the Dielectric Performance of a Modified Cellulose Matrix Containing Different Metal-Based Fillers
Ali Beyhan Uçak	Siirt University	Determination of Plant Water Consumption of Dry Beans in Semi-Arid Climate Conditions with Two Different Methods
Abel Maharramov Afaq Abdullayeva Gulnar Atakishiyeva Nigar Ahmedova Irada Shikhaliyev Namiq Shikhaliyev	Baku State University	4-Azido-2-(4-İkamelifenil)-5-(3-Nitrofenil)-2h-1,2,3-Triazolollerin Sentezi
Ali Beyhan Uçak	Siirt University	Direct Determination of Plant Water Consumption of Pumpkin Plant
Abel Maharramov Ayten Qajar Gulnar Atakishiyeva Gulnara Babayeva Namiq Shikhaliyev	Baku State University	(E)-1-(1-(4-(Tert-Bütil)Fenil)-2,2-Diklorvinil)-2-(P-İkameli) Diazenlerin Sentezi
Elif Tuğçe Samsunlu Ö. Faruk Lenger	Afyon Kocatepe University	Apoptotic Effect of Cynarin on Cancer Cells
Abel Maharramov Shafiga Ibrahimova Gulnar Atakishiyeva Ayten Niyazova Namiq Shikhaliyev	Baku State University	Metil (E)-4-(2,2-Diklor-1-(Fenildiazenil) Vinil) Benzoat Türevlerinin Sentezi
Pınar Cubukcu	Eastern Mediterranean Agricultural Research Institute	Evaluation of Soybean Breeding Lines for Cultivar Development in Mediterranean Region As A Main Crop Conditions
Misir Bayramov Anar Abdullayev	Department of Human Anatomy and Medical Terminology of Azerbaijan Medical University	Histochemical Analysis of The Sympathetic Nervous Structures in the Wall of the Internal Iliac Arteries
Lamara Kadagidze Beka Tchankotadze	Grigol Robakidze University	Personalized Tourism Recommendations for Visitors to Georgia Using Hybrid Clustering

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-2 | HALL-4



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Prof. Dr. Süleyman Kozat

Authors	Affiliation	Presentation title
Hatice Baş Hülya Doğan	Yozgat Bozok University	Investigation of Antibacterial Activity of <i>Capsicum annuum</i> L. Extract on Escherichia coli and Staphylococcus aureus
B. Rohini T Raghavendra Chodavarapu Giridhar Kumar	Rajeev Gandhi Memorial College of Engineering and Technology	Study on Use Waste Plastic Bottles in Concrete Mix as Partial Replacement of Coarse Aggregate
Hatice Baş Hülya Doğan	Yozgat Bozok University	Fumigant Toxicity of Essential Oil of <i>Capsicum annuum</i> L. (Solanaceae) to <i>Tenebrio molitor</i> L., 1758 (Coleoptera: Tenebrionidae)
Binyam Zigta	Wachemo University	The Influence of Thermal Radiation and Chemical Reaction on MHD Micropolar Fluid in The Presence of Heat Generation/ Absorption
Süleyman Kozat	Van Yüzüncü Yıl University	Köpeklerde ve Kedilerde Hemotoraks
Tsegmid Namsraijav Malovichko Lyubov Vasilievna Tsoggerel Baldandugar Khiliinchuluun Soninbaatar Gavrilov Alexander Igorevich	Senior Lecturer Mongolian Agricultural University	Avifauna of the Province (Aimak) Dornogov In Mongolia
Süleyman Kozat	Van Yüzüncü Yıl University	Hayvan Sağlığında Selenyum Önemi
Nguyen Huy Hoang	Tra Vinh University	Compare the Provisions of the Civil Code of Vietnam 2015 and the Civil Code of Vietnam 2005 on Fake Civil Transactions
Süleyman Kozat	Van Yüzüncü Yıl University	Prevention Strategies for Calf Loss in Perinatal and Neonatal Period
Nguyen Huy Hoang	Tra Vinh University	Grounds For Invalidity of Fake Civil Transactions Under Vietnamese Law
Iuliana Stoica Ion Sava Raluca Marinica Albu Andreea Irina Barzic	“Petru Poni” Institute of Macromolecular Chemistry	Involvement of Polyimide Structure on the Optical Properties of the Corresponding Azochromophore Systems
Sabina Lachowicz-Wiśniewska Ireneusz Kapusta Michał Świeca	Calisia University	Polyphenol Powders of White Grape – The Potential Bioaccessibility and Bioavailability of Polyphenolic Compounds and Biological Activities

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-2 | HALL-5



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Arzu Coşkuntuna

Authors	Affiliation	Presentation title
Valeh Ismailov Niftali Yusubov Iskender Mammedov Nurlana Sadihova	Baku State University	Some Transformations of Ethyl Cyanoacetate
Vatan Aşkin Arzu Coşkuntuna	Tekirdag Namık Kemal University	Destructive Fungal Diseases of Turfgrass
Baiju Thomas	Ramakrishna Mission Vivekananda Educational and Research Institute	Promoting a Study on the Importance of Maintaining Adequate Nutrition and Health Diet for Children with Cerebral Palsy in modern Society
Dürdane Mart	Eastern Mediterranean Agricultural Research Institute	Investigation of Chickpea (<i>Cicer aritimum</i> L.) Lines and Varieties in the Mediterranean Region
Farhad Mikayilov Ibrahimli Shams Ibrahim	Azerbaijan State Technical University	Problems Of Integrating Artificial Intelligence and Automation Into The Labor Market
Celile Aylin Oluk	Eastern Mediterranean Agricultural Research Institute	Effects of Pasture and Concentrate-Based Feeding on Milk and Dairy Products
Rodrigo M. S. de Oliveira Caio B. O. de Oliveira Gustavo G. Giroto Licinius D. S. de Alcantara Nathan M. Lopes Ronaldo F. Zampolo Frederico H. R. Lopes Victor Dmitriev Fernando S. Brasil	Federal University of Pará	Numerical and Experimental Investigation of Ozone Production and Transport from Defective Hydrogenerator Stator Bar in An Ozone Reaction Chamber
Mustafa Güçlü Muammer Özkan Cihan Büyük Onur Gezer	Yildiz Technical University	Experimental Investigation of the Behavior of Modulated Kinetic Combustion Strategy in a Diesel Engine at Different Engine Loads
Gëzim PUKA	University of Shkodra “Luigj Gurakuqi”	About the Literature That Was Written Through the Pages of An Islamic Magazine in Albania During the Second World War
Ahmad Zaky Abyan Setyo Widagdo	University of Lampung	The Effect of Combination of Chicken Manure Extract With AB-Mix Nutrition on The Growth and Yield of Mustard Greens in Hydroponic System
Afrasyab Khan	University of Engineering and Technology Taxila	Machine Learning Classification Algorithms for Ensuring Smart Manufacturing in Welded Joints

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-2 | HALL-6



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Zekiye Şengül

Authors	Affiliation	Presentation title
Meryem Aksoy Semra Benzer	Gazi University	Environmental Ethics Awareness of Pre-Service Science Teachers
Carole Serhan Nour Nasr Georges El Cheikh Gerard Nachar	University of Balamand	Workplace Context, Management Practices and Young Employee Retention: The Case of Hospitality and Tourism in Lebanon
Meryem Aksoy Semra Benzer	Gazi University	Environmental Behavioral Status of Pre-Service Science Teachers
Muhammad Waseem Bari Asad-Ur- Rahman	Government College University	Mediating Role of Public Service Motivation Between Management Practices and Taking Charge Behavior: A Multi-Mediation Model
Sumru Kaleli	Trakya University	Marketing Cities and Branding in The Context of the City Edirne: A Swot Analysis
Vinaytosh Mishra	Gulf Medical University	Framework for Healthcare Organization Governance- A System Thinking Approach
Aysu Altaş Öznur Cumhur	Aksaray University	A Conceptual Research on Mixology
Hüseyin Kaş Burak Poyraz Aygün Tokay	Bursalı Tekstil San ve Tic. A.Ş	Development of Lamel Separator System on Weaving Looms
Nguyen Thi Tu Trinh	University of Science and Technology	English Language Education in Vietnam: A Historical, Sociocultural Perspective
Güzin Yılmaz Bilge Incekara Aygün Tokay	Bursalı Tekstil San ve Tic. A.Ş	Investigation of The Dyeability of Cellulosic Products with Pretreatment and Reactive Dyeing Materials in A Single Bath
Ebtehal Gameel Abdelghaffar Hany Ahmed Hafney Hala Mohamed Ebaid Heba Nageh Gad EL-Hak	Suez Canal University	Clinical, Histopathological, and Ultrastructural Studies on the Effects of Chlorella Vulgaris Supplementation in Protecting Healthy Tissue from Toxicity Brought on by the Therapeutic Regimen of Cisplatin
Naci Aybek Mehmet Salih Aydın Zekiye Şengül	Siirt University	Tüketicilerin Bal ve Katma Değeri Yüksek Diğer arı Ürünlerinin Satınalma Tercihi: Siirt İli Merkez İlçesi

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-3 | HALL-1



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Leila IMANPARAST

Authors	Affiliation	Presentation title
Elif Tokdemir Demirel Muzaffer Öztürk Zeynep Betül Çiçek Yağmur Sude Toprakçı	Kırıkkale University	The Use of A Reference Corpus As A Translation Aid: A Case Study With Student Translators
Lenida Lekli	University of Elbasan	Teachers' Burnout, the "Fatigue Syndrome" of Educators' Physical, Mental and Psychological Exhaustion in Albania
Semih Özen Mahir Terzi	Ministry of National Education	The Situation of Migration in International Political Economy
Augustine Chinedu Ihim Chioma Innocentia Okere Samuel Chukwuemeka Meludu Alfred Friday Ehiaghie Patrick Chinedu Obi	Nnamdi Azikiwe University	Evaluation of Apolipoproteina-1, Apolipoprotein B and Glucose Levels of The Elderly, Actively Exercising and Non-Exercising Individuals in Nnewi
Melike Somuncu	Siirt University	Toplumsal Olaylara Toplum Dilbilimsel Açından Nasıl Yaklaşılmalıdır?
Alexander V. Lagerev Igor A. Lagerev	Kuban State Technological University	Forecasting the Reliability of Mobile Ropeways Based on Self-Propelled Wheeled Chassis
Mehmet Batkı Vildan Ateş	Ankara Yıldırım Beyazıt University	Determining Critical Success Factors of Green Supply Chain Management Practice
Favour C. Uroko	University of Nigeria Nsukka	Exploring faith-based interventions in food insecurity in Nigeria: A Phenomenological approach
Veli B. Shakhmurov	Antalya Bilim University	Regularity Properties for Fractional Boussinesq Equations and Applications
Pramod K Singh	Sharda University	Energy Devices Based on Plaste Waste Materials and Ionic Liquid Doped Polymer Electrolyte
A. K. Ayapbergenova	Al-Farabi Kazakh National University	Role of creative hubs and producing new media products towards the SDGs, as a tool for achieving the goal of Sustainable Cities SDG 11.
Redouane En-Nadir Haddou El-Ghazi Hassan Abboudi	University of Sidi Mohamed Ben Abdullah	Intense Laser Field Effect on The Electronic and Optical Characteristics of Harmonic and Anharmonic Oscillators Within An Ingan/Gan Heterostructure

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-3 | HALL-2



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Betül GIDIK

Authors	Affiliation	Presentation title
Meryem Bostanci Kübranur Ağtoprak Uğur Karaaslan	Senior R&D Specialist, Automotive, Marine and Grease Oils	Investigation of Tribological Properties of Calcium Sulfonate Complex Greases Prepared With Mineral and Different Synthetic Base Oils
Prateek Singh T.R. Dilip	Delhi University	Exploring the Persistence of Hypertension Despite Medication: Implications for Advancing Treatment and Policy Perspectives in India
Hazel Çelik Güzel Fatih Enzin	Bandırma Onyedü Eylül University	Evaluation Of Symptoms of Dysfagia In Individuals With Diabetic Foot Ulcer
Dinesha, B.L. Sharanagouda Hiregoudar	University of Agricultural Sciences	Optimization And Prediction of Nitrite and Sulphate Removals from Wastewater By Iron Oxide Nano-adsorbent Using Different Modeling Approaches
Salsabila Nadianisa Maruto Adi Indrayanto Ade Irma Anggraeni	Universitas Jenderal Soedirman	Being Creative Through Emotional Stability in Choosing Coping Strategies
Le Tran Thanh Liem Pham Van Trong Tinh Nguyen Thi Bach Kim Pham Ngoc Nhan Nguyen Thi Kim Phuoc Nguyen Thu Hien	Kien Giang University	Research on the Financial Efficiency of The Rice-Lotus Rotation Model – A Case Study In The Vietnam Mekong Delta
Adnan Celik	Selcuk University	The Importance of Management Functions in Natural Disasters: Evaluation of Kahramanmaraş-Centered Earthquakes
Farhad Ali	Kohat University of Science and Technology	Lie and Noether Symmetries of Second-Order Partial Differential Equations
Adnan Celik	Selcuk University	Entrepreneurship Workshop Proposal for The Least Developed Countries
Daniela Matušiková Tünde Dzurov-Vargová	University of Prešov	Increasing The Quality of Services Provided in The Hotel Industry Through A Quality Management System
Burcu Türkcan Gül Ş. Huyugüzel Kışla Çağla Bucak	Ege University	The Nexus Between Earthquakes and House Prices: A Systematic Literature Review
Kübranur Ağtoprak Meryem Bostanci Uğur Karaaslan	Belgin Madeni Yağlar Tic. Ve San. A.Ş.	Effect Of Different Polymers on Water Spray Resistancy of Calcium Sulfonate Complex Greases
Nazarov Vugar Hajiyev Jamal Ahadov Vasif Aghabaji Aghazada Adalat	Azerbaijan Tourism and Management University	The Impact of Financial Crises on the Activities of Financial Institutions

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-3 | HALL-3



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Sevim AKÇAĞLAR

Authors	Affiliation	Presentation title
Cagfer Yanarates	Gumushane University	Switch Mode Power Supply-Based Multifunctional Emulator
Tanzeela Rubab	Kohat University of Science and Technology	Combinatorial Properties of Power Graphs Over Gyrogroups
Mehmet Sezgin Mustafa Kahya	Çankırı Karatekin University	Bitkilerde Abiyotik Strese Karşı Bitki Büyüme Düzenleyicilerinin Rolü
Adriana Madya Marampa Pramono Hari Adi Ade Irma Anggraeni	Universitas Kristen Indonesia Toraja	Understanding the Role of Covenant Orientation in Knowledge Sharing: A Study of Indonesian Small and Medium Enterprises
Mehmet Sezgin Mustafa Kahya	Çankırı Karatekin University	Bitki Steroid Hormonu: Brassinosteroidler
Kumail Raza	Kohat University of Science and Technology	Certain Topological Properties of Commuting Graphs Over Semi-dihedral Groups
Oğuz Düzgün	Bandırma Onyedli Eylül University	The Adventure of The Modern Subject from Descartes To Habermas
Diellza Misini Alberta Tahiri Arjeta Momqilli	University of Applied Sciences in Ferizaj	Contemporary Management Functions in The Tourist Agency Sann-Fly
Mansur Beştaş	Siirt University	Blok Zinciri Ve Ipfs Destekli İot Veri Yönetimi
Natraj Mishra	Adamas University	Dynamic Modelling and Control of Two Link Flexible Arm Robotic Manipulator
Alime Selçuk Tosun Neslihan Lök Tuba Köse	Selcuk University	Peer Bullying/Victimization in Adolescents and Investigation of Affecting Factors
Yevheniia Khmelova	Institute of Business Education named after Anatolii Poruchnyk	The Influence of Urban Environment on Human Psycho-Emotional State

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-3 | HALL-4



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Ali Beyhan UÇAK

Authors	Affiliation	Presentation title
Hasan Esat Vural Hakkı Bağcı	Sakarya University	Covid-19 Pandemi Döneminde Uzaktan Eğitimde Öğretmenlerin Dijital Öğretim Materyali Geliştirmedeki Yeterliliklerin Çeşitli Değişkenler Açısından İncelenmesi
Shokrpour, N. Nasiri, E.	Shiraz University of Medical Sciences	To What Extent Is Academic Burnout Influenced by Positive Thinking Education
Sedat Yaşın Rabia Taşdemir	Gaziantep Islam, Science and Technology University	Persistent Trigeminal Artery and Its Clinical Significance: A Case Report
Nasiri, E. Shokrpour, N.	Shiraz University of Medical Sciences	Readiness for E-Learning from the University Students and Professors' Perspectives
Vefa Çelikci Ahmet Mutlu Karabacak Mustafa Yeşilyurt	Amasya University	The Effect of Using Technological Materials in 4th Grade Fraction Teaching on Students' Achievement Level
Sunshine Harriet Isiakpere Joseph Onyema Ahaotu	University of Port Harcourt	A Multimodal Discourse Analysis of Online Advertisements of Selected Anti-aging Beauty Products
Metin Samancı	Bilecik Şeyh Edebali University	An Original Ghazal of Emri Depicting Hand
Ilir Hebovija Nevila Xhindi	Mediterranean University of Albania	Digital Leaders' Promotors to Learning and Development
Can Denizci	Dokuz Eylul University	Fransızca Öğretim Yöntemlerinde Ders Kitabı Etkinliklerinin Evrimi
Davide Ialongo	Sapienza University of Rome	Pyrimidine-Based Compounds As Innovative Protein-Protein Interaction Inhibitors In Cancer Treatment
Fari Bushi	University of Applied Sciences in Ferizaj	The Role of Social Media Marketing in Consumer Behavior in The Tourism Industry
Marcquin Chibuzo Iheagwara	Federal University of Technology	Influence of Ginger Extract on Stability and Sensorial Quality of Smoked Mackerel (<i>Scomber scombrus</i>) Fish

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

28.04.2023 | SESSION-3 | HALL-5



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Bosse Omar Ndhatwa

Authors	Affiliation	Presentation title
Bosse Omar Ndhatwa	Kocaeli University	Kongo Demokratik Cumhuriyeti Sömürgelikten Günümüze Siyasal ve Kültürel Değişimi
Subhashish Dey	Gudlavalleru Engineering College	Performance of Mechanical & Durability Properties of Ternary Blended Cement Concrete
Bosse Omar Ndhatwa	Kocaeli University	Romania-EU Relations from Full Membership to the Present
Renny P Varghese	Catholicate College	On The Spectra Of A New Corona Type Graph And Applications
Osman Ferda Beytekin Gözde Yılmaz Çildir	Ege Universty	The Reflections Of January 24, 1980 Decisions On Education Policies Of Türkiye
Burbuçe Kurtaj-Bajrami	College of Medical Sciences “Rezonanca”	Importance of Nutritional Biochemistry
Hasan Emre Kiliç	Sakarya University	Disaster Management In Smart Cities
Nupur Luharia Ku.Kuldeep Kaur	Shri Mathuradas Mohota College Of Science	Review of environmental DNA metabarcoding for freshwater Benthic monitoring
Osman Ferda Beytekin Şükrü Güler	Ege University	Analyzing Teachers’ Views Regarding School Administrators’ Social Justice Leadership Implementations
Erhan Albayrak Sevgi Özen	Recep Tayyip Erdogan University	Effect Of Material Calcination On Geopolymer Synthesis
Hüseyin Çelik Bahar Burtan Doğan	Dicle University	The Effect Of Globalization On Consumption Expenditure: An Empirical Analysis For Türkiye
Ernyasih Anwar Mallongi Anwar Daud Sukri Palutturi Stang Abdul Razak Thaha	Hasanuddin University	Model Prediction of Potential Disease Effects from PM2.5 Emission Among School Children in Coming 30 years in South Tangerang

(All speakers required to be connected to the session 10 min before the session starts)

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28.04.2023 | SESSION-3 | HALL-6



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Aslı ÖZCAN

Authors	Affiliation	Presentation title
Elif Betül Kiliç Dilek Dülger Altiner	Kocaeli University	Usage of Bitter Gourd (Momordica charantia) in Food Products
Thi-Hoang-Anh Tran	Can-Tho University	Exploring Factors Influencing Tourist Satisfaction With Floating Market Cuisine In Can Tho City, Vietnam
Rıdvan Oruç	Ağrı İbrahim Çeçen University	Nox Modeling Of Aircraft With Mixed Flow Turbofan Engines Using Cuckoo Search Algorithm
Çeljana Toti Almiro Gurakuqi Etleva Qeli Gerta Kaçani	University of Medicine	Effectiveness Of Prefabricated Functional Appliances During Orthodontic Treatment In Young Patients
Sümeyye Bozbayir Nermin Demirkol Özge Parlar Öz Irem Karagözoğlu	Gaziantep University	Aesthetic Analysis To Be Done Before Restoration Of Porcelain Laminate Veneer
Rezvan Khalvandi Mehrdad Karimimoshaver	Bu-Ali Sina University	The effects of urban microclimates on controlling the intensity of heat islands and adjusting climatic conditions
Aslı Özcan	Suleyman Demirel University	Investigation Of Social Media Use Of Municipalities That Are Local Government Units By Analytical Methods
Florentina Udrea	National Institute of Heritage	Brâncoveni Monastery – National And Universal Movable Cultural Heritage. Case Study: Fund Category.
Aslı Özcan	Suleyman Demirel University	Determination Of Criteria Weights Used In 3pl (Third Party Logistics) Company Selection By Mcdm Methods
Ribaha Sultan Ayesha Jabeen	University of Management and Technology	Social Comparison, Self-Compassion, Self-Improvement, And Mental Health Problems In Young Adults
Mustafa Çakir	Iskenderun Technical University	Modeling Of Cooling Strategy By Artificial Intelligence Techniques In The Analysis Of Residual Stress Occurred In The Machining Of Super Alloy

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-1 | HALL-1



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Yelderem AKHOUNDNEJAD

Authors	Affiliation	Presentation title
Mesut Budak Hikmet Günel Ismail Çelik	Siirt University	Spatial Variability of Mean Weight Diameter As A Quality Indicator of Yüksekova Soils Under Different Land Uses
Monica Garoiu	University of Tennessee-Chattanooga	Victor Brauner: from Dada to Surrealism
Mesut Budak Ismail Çelik Hikmet Günel	Siirt University	Water Filled Pore Space and Nitrogen Denitrification Potential of the Soil Series in Yüksekova Plain
Renata Nagy Alexandra Csongor Vilmos Warta	University of Pécs Medical School	Changing Trends and Attitudes Towards Online Assessment
Mesut Sirri Hikmet Günel Mesut Budak	Siirt University	A General Overview of the Yüksekova Plain within the Scope of Ecosystem Service; Problems, and Solutions
Nuno Baptista Maria Dos-Santos Fernando Mata Natacha Jesus-Silva Nelson Matos	Polytechnic Institute of Lisbon	Exploring The Relationship Between Anti-Consumption and Consumerism
Mesut Sirri Mesut Budak Mehmet Fidan Shahid Farooq	Siirt University	Some Endangered Plant Species Naturally Growing in Yüksekova Basin
Nuno Baptista Maria Dos-Santos Fernando Mata Natacha Jesus-Silva Nelson Matos	Polytechnic Institute of Lisbon	Attitudes Towards Consumption: The Development of Na Operacional Scale
Ebru Kondolot Solak Seçil Kaya	Gazi University	Total Phenolic, Total Flavonoid and Antioxidant Activities of Artemisia absinthium Extracts: A Review
Kalashnyk Nadiia	National Forestry University of Ukraine	Public Administration Conceptual Transformations Under the Martial Law in Ukraine
Malachynska Mariya	Odesa Regional Institute of State Administration	The Perinatal Assistance System State Regulation: Approaches and Changes

29.04.2023 | SESSION-1 | HALL-2



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Betül GIDİK

Authors	Affiliation	Presentation title
Yattani Buna Nyakwara Begi	Kenya University	Cultural Practices Hindering Girl Child's Access to Early Years Education. A Case of Nomadic Pastoralists of Marsabit County, Kenya
Uğur Ata Cemil Çelik Naile Esra Saka	Tekirdağ Namık Kemal University	Boyunda İki Keskin Kuvvet Yaralanması; Ölüm Şeklinin İncelenmesi
Volodymyr Yukalo	Lviv Polytechnic National University	Development Problems of Assisted Reproductive Technologies Management
Uğur Ata Cemil Çelik Naile Esra Saka	Tekirdağ Namık Kemal University	2013-2021 Yıllarındaki Adli Tıp Kurumuna Ait Ölüm İstatistiklerinin İncelenmesi Ve Negatif Otopsi
Cihan Öner Yıldız	Gaziosmanpaşa Eğitim ve Araştırma Hastanesi	Hastanelerde Bilgi Güvenliği ve Kalite Sisteminin Hasta Güvenliği Üzerine Etkisi
I. Sancar Şimşek	Mersin İdealdent Clinic	The Effect of Gender Structure and Female Employment on Oral and Maxillofacial Surgery and Orthodontic Treatments
Monsurat Olajide Babalola Joseph Onyema Ahaotu	University of Port Harcourt	Multimodal Discourse Analysis of Sexism and Gender Stereotyping Popular Nigerian Online Comic Skits
Veysel Dinç	Gaziosmanpaşa Eğitim ve Araştırma Hastanesi	Anestezi ve Reanimasyon yoğun bakım ünitesinde travma hastaların takip ve tedavi yaklaşımı
Yassine Bouhouchi Youness Ighris Yassine Amari Sadiki	Sultan Moulay Slimane University	Thermal Lattice Boltzmann Method for Rarefied Gas Flow in A Micro Cavity with Obstacles
Özlem Çınar Özdemir Nurgül Özdemir	Izmir Demokrasi University	Examination Of Low Back Pain and Quality of Life Level in Pregnant Women
Fatih Atalar	Istanbul University-Cerrahpaşa	Investigation of Silicone Insulator Surface Resistance by using Empirical Mode Decomposition Method

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

29.04.2023 | SESSION-1 | HALL-3



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Ferhat ÖZTÜRK

Authors	Affiliation	Presentation title
Burcu Bıçakhan	S.B.Ü. Gaziosmanpaşa Eğitim ve Araştırma Hastanesi	Travmatik Damar Yaralanmaları Ve Tedavi Yaklaşımı
Yassine Bouhouchi Youness Ighris Yassine Amari Sadiki	Sultan Moulay Slimane University	Numerical Analysis of Natural Convection in A Square Cavity Filled with Nanofluid Using the Lattice Boltzmann Method
Makbule Nihan Somuncu Ayşe Gul Zamani Emine Goktas Kazım Gezginc Mahmut Selman Yildirim	Necmettin Erbakan University	Rare Mutation in Androjen Receptor Gene with a Case of Primary Amonerrhoea
Gergana Zaemdzhikova	Forest Research Institute - Bulgarian Academy of Sciences	Study On Flight of The Summer and Winter Form of Pine Processionary Moth
Sıtkı Özbilgeç Makbule Nihan Somuncu Emine Türen Demir Ali Acar	Necmettin Erbakan University	A Variant of c-KIT Gene in Vulvar Melanoma May Be a Chance of Molecular Therapy?
Gergana Zaemdzhikova	Forest Research Institute - Bulgarian Academy of Sciences	Survival of Summer and winter Form of Thaumetopoea Pityocampa in The Hibernation Period
Emral Gülçek	Siirt University	Toplum Temelli Ruh Sağlığı Hemşireliği: Bir İnceleme
Liliana Mihaela Moga Lucia Durac Ionica Simbanu Daniel Tecu	Dunarea de Jos University of Galati	Applications of Jiao Theory in Decision Making for Social Entrepreneurship Adopting
Leyla Tutuş Irem Karagözoğlu Özge Parlar Öz Nermin Demirkol	Gaziantep University	Aesthetic Rehabilitation of Patients with Anterior Diestema with Porcelain Laminas
Samir Chandra Das Manas Kumar Sanyal Jatindra Kumar Das Nabarun Bhattacharyya	University of Calcutta	Vision SDG 2030 Clean Water, Sanitation and Zero Emission Industry Pollution Management using nWSN based Green IoT Applications: A Techno-legal aspects for Smart World
Irem Karagözoğlu Derya Doğan Evlice Nermin Demirkol Özge Parlar Öz	Gaziantep University	Current Parameters in Aesthetic Restorations

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

29.04.2023 | SESSION-1 | HALL-4



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. H. Deniz ŞİRELİ

Authors	Affiliation	Presentation title
Mustafa Karagülle	Eskişehir Yunus Emre Devlet Hastanesi	Bir Devlet Hastanesinde Kan Transfüzyon Merkezinin İşlevselliğinin Değerlendirilmesi
C.Vijai Joyce M. Elayaraja	St Peter's Institute of Higher Education and Research	The Emerging Technologies in The Insurance Sector
Tülin Yıldız Cagla Avcu Merve Oyuktaş	Tekirdag Namık Kemal University	Nursing Practices for Sleep Quality of Patients in Intensive Care After Cardiovascular Surgery: A Systematic Review
Garcia, Jean B. Ochotorena, Corazon B. Jacinto, John Wayne	Jose Rizal Memorial State University	Parental Roles in Relation to Adolescent Risk Behavior: Basis for Intervention Program
Manotar Tampubolon Konrad Manurung Mulyono Konstantinus Budi Hendra Simak	Universitas Kristen Indonesia	Corruption and Bureaucratic Reform in Indonesia
Tülin Yıldız Cagla Avcu Nurse Nese Altincekic	Tekirdag Namık Kemal University	Team Behavior and Awareness in Safe Surgical Checklist Use: A Systematic Review
Alya Fadhilah Darwin H Pangaribuan Setyo Widagdo	The University of Lampung	Effects of Lamtoro Leaf (<i>Leucaena leucocephala</i>) Extract Concentration on Mustard Green (<i>Brassica juncea</i> L.) in Hydroponic System
Chems Eddine Boukhedimi	University of Tizi Ouzou	Effect of Gender on the Willingness to Pay for Organic Food in the Future: Turkish's and Algerians Experience
Tülin Yıldız Cagla Avcu Özge Topçu Demircan	Tekirdag Namık Kemal University	Digital Nursing Care in Orthopedic Surgery: A Systematic Review
Muhammad Idrian Bin Harun Xander Andree Raysner Freno Rayced Ardiano Deron Hassan	Keningau Vocational College	Creating Ergonomic Workspace with A Trolley Adapted to Suit Various Purposes

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

29.04.2023 | SESSION-1 | HALL-5



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Leila İMANPARAST

Authors	Affiliation	Presentation title
Öner Demirel Meryem Bihter Bingül Bulut Tuba Gizem Aydoğan	Kırıkkale University	Water-Sensitive Urban Design in The Fight Against Climate Change: The Role of Urban Green Spaces and Water Conservation
Musfirah Nasyitah Jyfreena Ryzza Binti Yanik Mohamad Shahrin Bin Ali	Keningau Vocational College	Teaching Children the Basic Skills in Numeracy Through Picture Cards
Selim Koroglu Özgür Özdemir Akif Demirçali Selami Kesler	Pamukkale University	Design and Simulation of Dynamic Voltage Regulator for Regulation of Voltage Disturbances Events
Alaa Iskandar Béla Kovács	University of Miskolc	Decentralized Control Algorithm for Efficient Power Management in Microgrids using Multi-Agent Systems
Sana Mekki Leila Sriti Azzedine Chettih Bidjad Arigue Giovanni Santi	University of Biskra	The Revalorization of The Technique of Rammed Earth in The North of The Algerian Sahara, (Case Ksar of Ain Madhi)
Christian Chijioke Amah Mercy Ebere Egele Osmund Chukwuma Enechi Jacob Ikechukwu Okoro Ursula Chidimma Obelenwa	University of Nigeria Nsukka	Investigation of the Anti-inflammatory Activity and Nutritional Value of the Leaves of Calopogonium Mucunoides
Ismail Mert Özdemir Esra Aksoy Hüseyin Önlem Ersöz	Aydın Adnan Menderes University	A Study on Cultural Heritage Awareness: The Case of Karacasu
Nouioura Ghizlane Lyoussi Badiaa Derwich El Houssine	Sidi Mohammed ben Abdellah University	Optimization of a New Antioxidant Formulation Using a Simplex Lattice Mixture Design of <i>Apium graveolens</i> L., <i>Coriandrum sativum</i> L., and <i>Petroselinum crispum</i> M. Grown in Northern Morocco
Taner Sayım Elif Bayrakdar Şebnem Arlı M. Fatih Akay	Cukurova University	Delivery Time Prediction Using Supervised Machine Learning
Merve Kaplan	Gaziantep University	The Effect of Organizational Justice on Job Satisfaction and Performance: An Application On 5-Star Hotel Employees

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

29.04.2023 | SESSION-1 | HALL-6



Kyrenia Time: 09:00–11:00



Ankara Time: 09:00–11:00



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. İsmail ACAR

Authors	Affiliation	Presentation title
Eyüp Debik Sümevra Yaka	Yıldız Teknik University	Recovery of Industrial Wastewater in Organized Industrial Zones
Mohammed El Sallah Zagane Abdelmadjid Moulgada Abderahmen Sahli Abdelghani Baltach	University of Ibn Khaldoun Tiaret	Analyse Numerique Sur Le Comportement Mecanique Des Structures Reparees Par Patch
Melek Adışen Akilli Zeynep Yeşim Ilerisoy	Gazi University	Design Guidelines for High-Structures and Assessment of the Situation in Turkey
Seracchiani Marco Maurilio D'angelo Alessio Zanza Rodolfo Reda Valentina Bellanova Chiara Bramucci Dario Di Nardo Luca Testarelli	Sapienza University of Rome	A New Protocol for Endodontic Treatment, From In Vitro Studies to A Clinical Approach
Serap Sevgi Ünkaracalar Zeynep Yeşim Ilerisoy	Gazi University	Definition of Brand Architect Through Pritzker Architecture Prize-Winning Architects
Adefemi Aka Chikezirim Okoroafor Naomi U. Ijalija	Federal University of Technology	Assessing the Underlying Strategies for Effective Management of Job-stress in Nigerian Construction Projects
Seda Özkeçeci Ramazan Koç	Gaziantep University	Performance of Aluminum Air Battery for Different Demonstrated Cathodes
Teuta Starova Mirela P. Bogdani	University of Tirana	The Authoritarian Regime and Its Effects on Disappearance of Persons and Their Political Persecution - The Case of Albania from A Human Rights Approach
Seda Özkeçeci Ramazan Koç	Gaziantep University	Air Cathode and Gel Electrolyte Construction for Metal Air Batteries
Obiora Ebuka Muojama	Science and Engineering Unit,	Application of Polymeric Wastes as Corrosion Inhibitors: a Review
Gerta Kaçani Çeljana Toti Almiro Gurakuqi Etleva Qeli	University of Medicine	Prosthetic Dentistry After the Pandemic of Covid 19

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

29.04.2023 | SESSION-2 | HALL-1



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Korkmaz BELLİTÜRK

Authors	Affiliation	Presentation title
Nural Karagözlü	Manisa Celal Bayar University	İklim Değişikliğinin Mikotoksin Riski Üzerine Etkisi
Mostafa Azad Mehrdad Karimimoshaver	Bu-Ali Sina University	Comparative study on the effect of different kinds of urban contexts blocks (traditional and modern) on using natural wind flow for creating thermal comfort in urban crossings (case Study: Kashan, Iran)
Husam Bawadikji Abdullah Yıldız Hayrettin Ahlatcı Ismail Esen	Karabük University	Fatigue properties for 3D printed PLA with carbon fibre
Mostafa Azad Mehrdad Karimimoshaver	Bu-Ali Sina University	The effect of the urban context forms on using natural wind flow for creating thermal comfort in urban crossings (The marginal cities of the deserts in Iran)
Süreyya Yiğit	New Vision University	Rose Revolution: Exoteric Red, or Esoteric Black, or Blue?
Vikram Singh Chouhan	Jaypee University of Engineering & Technology	Association Between Work-Life Balance And Job Satisfaction Of Employees
Nisrine Nouj Naima Hafid Noureddine El Alem Ingrid Buciscanu Amane Jada Igor Cretescu	“Gheorghe Asachi” Technical University of Iasi	Convention Of Fish Waste Into An Eco-Friendly Biosorbent For Dyes In Aqueous Solution
Sajad A. Algazali Adhraa Baqir Hassan Ali Abid Abojassim Arshad Noori Al-dujaili Haider Salih Jaffat Alaauldeen Subhi Mohsin Al-Sallam	University of Kufa	Physiological Study for Effecting of Radon Gas on Estrogen Level of Female Rats
Seda Yapici Sunaç Züleyha Değirmenci	Gaziantep University	Investigation Of Recycling Methods Of Polypropylene Fiber Used In The Carpet Industry
Branislav Radjenović Nikola Bošković Marija Radmilović-Radjenović	University of Belgrade	Simulation Of Microwave Tumor Ablation Based On Multiphysics Software Package

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-2 | HALL-2



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Erhan KAHYA

Authors	Affiliation	Presentation title
Marija Radmilović-Radjenović Nikola Bošković Branislav Radjenović	University of Belgrade	Finite Element Analysis Of The Efficiency Of Multislot Antenna In Microwave Tumor Ablation
Vivek M. Raut Sachin S. Bangade Harshada S. Gaikwad Shikhil S. Wanjari Divya L. Chouhan Manish M Katiya	G. V. I. of Science & Humanities	Synthesis and characterization of Mg-Ni nanosized spinal ferrite
Cumali Türkmenoğlu Bülent Bedir Rüzgar Ersin Kanar Zehra Sude Sari Mehmet Fatih Akay	Cukurova University	Comparison Of Machine Learning And Monte Carlo Simulation Based Models For System Marginal Price Prediction
Onyeka Stanislaus Okwundu	Science and Engineering Unit	Progress in the development of cassava-based instant noodle food
Erhan Kahya Yasin Aslan	Tekirdağ Namık Kemal University	Determining The Position Of The Cucumber On The Seedling With Deep Learning For Robotic Cucumber Harvesting
Mirjana Nikolić Slađana Milenković Isidora Korać	College of Vocational Studies for preschool teachers and business IT specialists - Sirmium	Development Of Phonological Abilities At The Preschool Age
Bilal Taşdemir Necaattin Barışçı	Gazi University	Dynamic Image Scaling for Imbalanced Brain MRI Dataset
Mirjana Nikolić Slađana Milenković Isidora Korać	College of Vocational Studies for preschool teachers and business IT specialists - Sirmium	Education In The New World
Murat Kasaplar Ümran Tezcan Ün	Eskisehir Technical University	Pesticide Removal From Wastewater By Electro-Fenton Method
Sándor Földvári	Debrecen University	Serbian Orthodoxes And Greek Phanariots Under Ottoman Turkish Rule An The Balkans In The 16-18 Centuries

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-2 | HALL-3



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Melis BALOĞLU

Authors	Affiliation	Presentation title
Handan Atalay Erođlu Feryal Akbal Mevlüt Gürbüz	Ondokuz Mayıs University	Optimization of Textile Wastewater Treatment by Tio ₂ Based Photocatalysts
José Luis Vázquez-Burguete Ana Lanero-Carrizo César Sahelices-Pinto José Luis Vázquez-García José María Vázquez-García	University of León	A Prospective Study on the Willingness to Act and Sustainable Purchasing of Young Consumers
Eyüp Yıldırım Mustafa Engin	Ege Universty	IoT Supported Predictive Maintenance Application Using Machine Learning
Lien Thi Kim Phan	Nha Trang University	The Benefits of Mindfulness In Teaching Engagement for Teaching Effectiveness: A Literature Review
Ayşen Çakir	Bursa Uludağ University	Endoplazmik Retikulum Stresi Ve Alzheimer Benzeri Patoloji
Sujan Bandhu Chakraborty Pubalika Bhattacharya Maitra Solanki Chakraborty	Brainware University	Open Repositories of Open Universities in India: A Study
Dođa Dinemis Aman Dođa Bitik	Özyeđin University	Building Information Modeling for Assessment of Climate Adaptive Smart Campus Design
Vishwanath B. Awati Akash Goravar	Rani Channamma University	Semi-Numerical Analysis of Mhd Boundary Layer Flow of A Casson Fluid Over An Exponentially Shrinking Sheet Via Collocation Technique Using Shifted Chebyshev Polynomials
Melis Balođlu	Istanbul Technical University	Calligrams, Infographics and Concept Maps to Represent Design Ideas in Architectural Education
Vishwanath B. Awatia Parashuram M. Obannavara	Rani Channamma University	Multigrid Method for The Solution of Thermal Elastohydrodynamic Lubrication Point Contact Problem with Surface Asperities

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-2 | HALL-4



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Fatih TAŞ

Authors	Affiliation	Presentation title
Zehra Zeynep Sahinbasoglu Elif Tuna Atif Evren	Yıldız Teknik University	Comparison of Shannon, Renyi, Tsallis Mutual Information in Detecting Nonlinearity
Arnab Mahajan Pubalika Bhattacharya Maitra	University of Calcutta	Post-Pandemic Times of Covid-19 and Role of Libraries: A Study of Goethals Indian Library and Research Society; Kolkata
Şener Ilter Bahar Burtan Doğan	Dicle University	Türkiye’de Savunma Harcamaları İle Ekonomik Büyüme Arasındaki İlişki
Mersiha Kolčaković Mirela Vasić-Hadžihalilović	Herzegovina University	Challenges of Curriculum Reform in the Canton of Sarajevo, Bosnia and Herzegovina from Parents' Perspectives
Sara Shokrpoor Samansa Salehi	University of Tehran	Cutaneous Myxoma in A Dog
Kashish Garg Shreyash Singhal	Aligarh Muslim University	Cannabis Legalization
Gözde İlhan Semra Aki Mustafa Yeşilyurt	Amasya University	Kesirlerle Toplama ve Çıkarma İşleminde Teknolojik Materyalin İlkokul 4. Sınıf Öğrenci Başarısına Etkisi
Alexandrov V.S.	Kazan National Research Technical University	Application of intelligent systems in the design of production systems
Beytullah Bahadır Duyar Ali Kemal Altaş Mustafa Yeşilyurt	Amasya University	Effect of Geogebra Software on Students' Academic Achievement on Ordering and Comparison of Fractions
Talha Usman	University of Technology and Applied Sciences	Analysis of Generalized Bessel-Maitland Function and Its Properties
Fırat Aşır Fikri Erdemci Fatih Taş	Siirt University	The Effect of Post-Graft Gallic Acid in Rats with Calvarial Defect
Fatih Taş Fikri Erdemci Fırat Aşır	Siirt University	Effect of Ellagic Acid on Alveolar Nerve Damage

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-2 | HALL-5



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Seda Dilay

Authors	Affiliation	Presentation title
Tuğba Atagün Mustafa Yeşilyurt	Amasya University	Evaluation of Preschool Children's Performance of Technological Material with Puzzle Creation for the Acquisition of The Part-Whole Relationship
Seden Turamberk Özerden Zeynep Dumanoglu	Girne American University	Edible Plants of Northern Cyprus Within the Scope of Cultural Heritage Tourism
Fusun Gülser Arzu Çiğ	Siirt University	Improving of Growth and Quality Characteristics of Ornamental Plants with Selenium Treatments: A Review
Eze, Solomon Uchechukwu Cosmas Anayochukwu Nwankwo Ezeanolue Ekwutosi Theresa Nnebe Ekwutosi Gloria Chendo Nkoli Augustina	Nnamdi Azikiwe University Awka Anambra state	Entrepreneurship Education and Human Capital Development: Nexus from Nigerian Perspective
Kartal Demirgüneş	Niğde Ömer Halisdemir University	Retail Cash Conversion Cycle and Profitability New Evidence from A Cointegration Test with Multiple Structural Breaks for Turkey
Ziad Shakeeb Al Sarraf	University of Mosul	Design A Horizontal Axis Wind Turbine Blades Based on Inspiration of Biomimicry for Whale Tubercles
Sevinç Özcan Mehmet Dağlı	Amasya University	R-Circulant Matrices with Fibonacci-Like Number Entries
P. Abitha Pl. Meenakshi	Avinashilingam Institute for Home Science and Higher Education for Women	α J**-Separation axiom in Topological Spaces
Özge Nur İşler Dülger Altiner	Kocaeli University	Digital Footprint in Tourism Industry
Tawseef Ahmad Mahesh Lokhande	Bharat Institute of Engineering and Technology	Using Machine Learning to Predict Mental Health Trends Post Covid-19 Pandemic In Conflict Settings
Ishwari Shrawan Bhoi Manushree Makarand Chopdekar Yashodip Rajaram Ahire	Department of Environmental Science	Assessment of Air Quality During Covid 19 Period with Reference to Nashik City of India

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-2 | HALL-6



Kyrenia Time: 11:30–13:30



Ankara Time: 11:30–13:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Levent COŞKUNTUNA

Authors	Affiliation	Presentation title
Habeeb Olaniyi Olayiwola	The Federal Polytechnic	Achievement of A Favourable Balance of Payment: The Role of Monetary Policy in Nigeria
P. Charumathi Pl. Meenakshi	Avinashilingam Institute for Home Science and Higher Education for Women	δ -J-Irresolute Functions in Topological Spaces
Betul Yildiz Salli	Bursa Technical University	The Attitudes of Female and Male Employess Working in The Industrial Sector Towards Gender Roles
Shravani Kailas Mansi Narendra Pardeshi Yashodip Rajaram Ahire	Department of Enviornment Science	Bioremediation of Marine Oil Spiils
Özge Uçar Sipan Soysal Abdurrahim Yilmaz	Siirt University	Importance of Harvest Time in Field Crops
"Harshada Girish Chaudhari Jdipti Kailas Pawar Sanika Bhaskar Bagade Tejal Ramdas Tuplondhe Sakshi Dnyaneshwar Mandale Siddhi Dattatraya Dhage Sarala Radhakrishna Shirsath "	Department of Environmental Science	Systematic Review of Importance of Environment Education in New Education Policy of India
Abdurrahim Yilmaz Özge Uçar Sipan Soysal	Siirt University	The Importance of Cooperativization in The Agricultural Sector
Mina Todorova Miglena Milusheva Lidia Kaynarova Deana Georgieva Vassil Delchev Yulian Tumbarski Stoyanka Nikolova	University of Plovdiv Paisii Hilendarski	Silver Nanoparticles – A New Insight Into Indandiones
Sipan Soysal Özge Uçar Abdurrahim Yilmaz	Siirt University	Use of Microalgae in Agriculture

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-3 | HALL-1



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Yusuf DİLAY

Authors	Affiliation	Presentation title
Deniz Aydoğan Gülcan Demiroğlu Topçu	Ege University	Establishment of Football Turf
P.H. Najafgulyeva I.N. Gasimova	Scientific Surgical Center named after Topchibashev	Modern Prevention of Relapses of Gastroduodenal Hemorrhage
Yusuf Dilay Adem Özkan	Karamanoğlu Mehmetbey University	Ergonomic Analysis of Working Postures of Workers in Machine Shop
Hoai T. Bui	Nha Trang University	Counterfeit Brand Shoes and Purchase Intention in Vietnam– Is Morality Factor Significant Enough to Mitigate The Problem?
Sümeyye Erdem Yusuf Dilay Adem Özkan	Karamanoğlu Mehmetbey University	Strength Analysis of Levelling Shovel Used in Tillage by Finite Element Analysis
Vaibhav Kant Singh	Central University	New Classification Using Nlp Technique
Seda Dilay	Karamanoğlu Mehmetbey University	Alternative Forming Methods in Ceramic Art
Hassane Abd-Dada Saïd Bouda Abdelmajid Haddioui	Sultan Moulay Slimane University	Genetic Diversity of Medicinal Plant (Euphorbia Resinifera O. Berg) Using Morphological Traits and Issr Markers
Seda Dilay	Karamanoğlu Mehmetbey University	Critical and Analytical Approaches in Art
Vaishnavi Ramdas Karve Janhavi Motiram Jondhale Jayashri Dattatray Jamdade Priyanka Santosh Garud Kaveri Vijay Mulane Gayatri Anil Kandekar Jayashri Sanjay Thorat	Department of Environmental Science	Assessment of Current Scenario of Air Quality Index in Selected Cities of India"
Semih Sağlık	Siirt University	Covid-19 Hastalarında Toraks Bilgisayarlı Tomografi (Bt) Bulgulari İle Vücut Kitle İndeksi (Vki) Arasındaki İlişki

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-3 | HALL-2



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Fatma ERTAŞ

Authors	Affiliation	Presentation title
Ecehan Yildirim Onur Seveli	Burdur Mehmet Akif Ersoy University	Importance, Impact and Future Potential of Extended Reality Applications in The Metaverse
Léa Blandine Mboulou Ndoulou	Denis Sassou N'guessou University	Black Women Revolt in the Struggle for Freedom: An Exploration of Toni Morrison's Fiction
Naile Mısırlıoğlu	Gaziosmanpaşa Eğitim ve Araştırma Hastanesi Biyokimya Uzmanı	Biyokimyasal Bakışla Transfüzyon Merkezi Donanım Ekipman Kritik Stok Seviyesi Değerlendirmeleri
Skender Demaku Donika Sylejmani Arbnorë Aliu	University of Pristina "Hasan Prishtina"	Heavy Metal Status of Soil and Underground Water in Urban Area of Pristina District, Kosovo
Selcuk Dogru Utku Akkaya Mehmet Battal Ferit Cakir	Gebze Technical University	Structural Performance and Analysis of Triangular Prismatic Facade Cladding Systems
Vaibhav Kant Singh	Central University	Video Forgery Detection Using K-Means Clustering Algorithm
Hasan Sungur Civelek E. Mennan Yildirim Mehmet Fatih Tolga	Muğla Sıtkı Kocman University	Baseline Monitoring of <i>Cacopsylla pyricola</i> (Hem.: Psyllidae) When Tested Against <i>Spinetoram</i>
Vaibhav Kant Singh	Central University	Predicting Heart Risk Level -Multivariable Linear Regression
Hasan Sungur Civelek E. Mennan Yildirim Mehmet Fatih Tolga	Muğla Sıtkı Kocman University	Baseline Monitoring of <i>Frankliniella occidentalis</i> Pergande (Thysanoptera: Thripidae) When Tested Against <i>Spinetoram</i>
Priya J Jaya Varsha	Deemed to be University	The Importance of Cognitive Psychology in Our Daily Lives
Pavishna A M Deeksha R Nikitha G Praveen Kakada	Vellore Institute of Technology	The Influence of Deviant Behaviour and Trust on Employee Productivity
Sinchana S Sagaya Aurelia	Christ University	A Comparison Analysis of Simulation Tools for Internet of Things

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29.04.2023 | SESSION-3 | HALL-3



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assist. Prof. Dr. Emre AKÇAY

Authors	Affiliation	Presentation title
Nurgül Özdemir Özlem Özdemir	Izmir Democracy University	Gender Towars Men
Tien Dung Khong Nguyen Thuy Huynh Nguyen Thanh Thuy Vu Thuy Duong	Can Tho University	Applying The Gap Model of Service Quality to Assess Individual Customer Satisfaction with Atm Card Services of Mb Bank Can Tho City Branch in Vietnam
Samarjit Roy Debashis De	D Y Patil International University	Computational Musicology in Society 5.0
O. A. Lykholat T. Y. Lykholat M. O. Kvitko Y. V. Lykholat Oleh M. Marenkov	University of Customs and Finance	Possibilities of Introducing Plants of The Dnipro Steppe
Shitu, S. Salihu, K. N. Shehu, I.	Federal University Dutsin-Ma	Bacteriological Quality Assessment of Commonly Used Cosmetic Brands in Kaduna Metropolis, Kaduna, Nigeria
Cornelia Nichita	University of Bucharest	In-Vitro Antioxidant Activities of The Selective Extracts of Plantago Lanceolata L. Obtained by Supercritical Fluid Extraction
Mohammed Alaa Alwafaie	The University of Miskolc	Harvesting Pedal Energy for Automotives (HPE)
Dmytro Hanaba	Khmelnyskyi National University	Vitality of trees in the conditions of urbogenic environment
Ansam Yaroub Khyoon Mayada Zuhair	University of Baghdad	The Depiction of Mesopotamian Queens in Children's Literature
Shafiq Ur Rehman Mujahid Ali Malik Muhammad Akram Habibullah Habib Muhammad Mohsan	Water Management Training Institute	Bridging Gender Gaps in Agriculture: Unlocking Rural Development in Pakistan
Ghina Jazila	State Islamic University K.H Abdurrahman	Analysis of the Application of the Principles of Islamic Business Ethics at Daddy Bro Coffeshop Tulis Batang District
Dalila Khalfa Oussama Meghlaoui Abdelouahab Benretem	Annaba University	Optimized The Prediction Fatigue Life of Wind Turbine Blade Under Hygrothermal Conditions

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-3 | HALL-4



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Leila İMANPARAST

Authors	Affiliation	Presentation title
Svitlana Hanaba	Khmelnyskyi National Academy of the State Border Guard Service of Ukraine Khmelnytskyi	Education As a Space for Personal Development
Jelena Lutovac Mladen Milić	Megatrend University	Marketing Activities and Financial Management in Companies with Internal Control Mechanisms for The Example of The Republic of Serbia
Mladen Milić Jelena Lutovac	Megatrend University	The Use of Internal Audit as A Form of Control in Creating and Managing the Marketing and Financial Management of Numerous Various Companies in Developing Countries
Principal Res.Fell Ivan Pavlovic	Scientific Institute of Veterinary Medicine of Serbia	First Occurrence of Cat Lice Felicola Subrostrata in Cats in The Belgrade Area
Yassir Soulaïmani Nehéz Károly	University of Miskolc	Decentralized Ledger Database Management Through Blockchain Technology Utilizing Crypto Hash Algorithms
Vidya Sunil Kadam	Rajarambapu Institute of Technology Affiliated to Shivaji University Maharashtra	Analytical Study of Savings and Investment Patterns of Cooperative Industry Workers
Sinchana S Sagaya Aurelia	CHRIST University	A Comparison Analysis of Simulation Tools for Internet of Things
Rehman Khan Hasnain Saleem	Swedish College of Engineering and Technology Wah	Design and Fabrication of Wheat Straw Pressing Machine
Samuel Akpadiagha Etuk	Akwa Ibom State Polytechnic	Nigeria's Electoral Act 2022: The Novel Innovations and Recent Judicial Interpretations
Madhuri Sharon Anuradha Pandey-Dubey Jayashree Shukla	Parishkar College of Global Excellence	Waste Derived Carbon Nanofiber for Water Purification
Drita Yzeiri Havziu Arlinda Haxhiu Zaimi Edita Alili Idrizi Merita Dauti Sihana Ameti Lika Lulzime Balazhi Arlinda Tefiki	University of Tetova	Cardiotoxicity of Antidepressants
Sara Shokrpoor Siavash Shahsavarani	University of Tehran	Cutaneous Fibrosarcoma in A Persian Cat

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-3 | HALL-5



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Assoc. Prof. Dr. Harun BEKTAŞ

Authors	Affiliation	Presentation title
Vidya Kadam Aniket Chougule	Rajarambapu Institute of Technology	A Study on Impact of Employability Skill on Career Development of college students
Manita Matharu	Amity School of Business, Amity University	Understanding Green Brand Equity
David Wortley	Vice President of the International Society of Digital Medicine	21st Luddites and Etidduls in the 4th Industrial Revolution
Marici Marius Carmen Marici Remus Runcan Patricia Runcan	Stefan cel Mare University	Parental Abandonment as a Trigger for Shame and Guilt in Adolescents?
Abhishek Anand Sagaya Aurelia	Deemed to be University	Internet of Things Based Patient Health Monitoring System
Kayode David Ileke Abiola Elizabeth Olaposi	Federal University of Technology	Suppression of Rust red flour beetle, <i>Tribolium castaneum</i> Herbst [Coleoptera: Tenebrionidae] with two Ocimum species powders on wheat grains
Devayani J. Meenakshi P.L	Department of Mathematics	J*P-Irresolute Functions in Topological Spaces
M. K. Ganeshan	Alagappa University	The Impact of Chatgpt in Human Resource Management
Swaroopaa Rani gurram Mohammed Afzal Azam	Vikas College of Pharmaceutical Sciences	Design, Synthesis, Molecular Docking Studies of Some Newer Benzothiazole Containing Aryl and Alkaryl Hydrazides
Asha Devi. J K. S Chandrasekar	University of Kerala	Greening of The Kerala University Campus-Agriculture and Horticulture to The Fore
Omar Mardenli Hussam Aryan	University of Aleppo	Contributions of Genetic Engineering in Raising the Efficiency of Genetic Selection in Livestock
Pham Duc Thuan Pham Thi Phuong Linh	Can Tho University	Diplomatic Relations Between Vietnam and Campodia From 1997 To 2022
Muhammad Faisal	Ministry of Human Rights	Dr. Faisal Director (Hrim/IsMohr) Carried Out That Ai Modules in Pakistan Like Moderate Nations It Is Significant Prerequisite for The Development of Pakistan

(All speakers required to be connected to the session 10 min before the session starts)

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29.04.2023 | SESSION-3 | HALL-6



Kyrenia Time: 14:30–16:30



Ankara Time: 14:30–16:30



Meeting ID: 869 2364 3653 / Passcode: 282930

HEAD OF SESSION: Dr. Tuba BEŞEN

Authors	Affiliation	Presentation title
Oyewo Isaac. O	Federal College of Forestry	Technical Efficiency Differentials of Maize Farmer's Productivity in Oyo State, Nigeria
Inass Hamdi	Ibn Tofail University	Anaerobic Digestion of Olive Oil Mill Waste: Inoculum/Substrate Ratio For Biogas Production
Coffi Martinien Zounhin Toboula	University of Abomey Calavi	Unpacking the Impacts of Educational Technology on Beginner Learners' Dispositions Toward EFL Pedagogy at Tanguiéta Secondary School in Benin
Dèkandé Sylvestre Tchagnonhou Coffi Martinien Zounhin Toboula	Djibo Hamani University of Tahoua	Exploring Effective Strategies For Managing Classroom Conflicts: A Study On The Importance Of Conflict Management For Enhancing Classroom Interaction
Arben Tërstena Gazmend Deda Sokol Krasniqi Ismail Mehmeti	University of Applied Sciences in Ferizaj	The Consequences of The Pandemic on Businesses As Carriers of Economic Development– Evidence From Kosovo
Subhashish Dey	Gudlavalleru Engineering College	Study on Biosorbents for The Removal of Chloride Ion from Water
Keyvan Asefpour Vakiliian	Gorgan University of Agricultural Sciences and Natural Resources	A Glucose Biosensor Using Mediated Electrochemistry of P-Benzoquinone and Glucose Oxidase and Machine Learning
Vidya Padmakumar Murugan Shanthakumar	Bangalore University	The Impact of Climate Change on Marine Kelp Forests and Their Ecosystem Services
Kaberi Pramanik Isha Samal	Banasthali University	Various Ways of Waste Management
Ismayil Alizada	Lenkeran Devlet University	Assessment of the Current State of Tourism Development in the Regions
Ugwu Obiora Celestine Felix Keneolisa Asogwa Ali Ibeabuchi Jude	Enugu State University of Science and Technology Agbani	Antidiarrheal Activity of Ethanol Leaf Extract of Polyalthia Longifolia on Rat Models
Kunal Gunjal Suraj Surkutla Vinay Ankushe Varad Kulkarni Prutha Kulkarni	Vishwakarma Institute of Information Technology	Design and Development of A Generic Iot Gateway
Gülşah Bengisu Seyithan Seydoşoğlu	Harran University	Silage Notes: Fermentation & Mycotoxin Ecology and Sequencing Tools

(All speakers required to be connected to the session 10 min before the session starts)

Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

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Kaydediliyor... Kalan: 09:44:51

Katılımcılar (14)

Observer - Hall 4

Hall 4 Merve Oyuktaş

Hall 4- ÖZGE TOPÇU DE...

S1-H4 Chems Eddine BO...

Observer... (Ortak oturum sahibi, ben)

H4 Hall 4 - Alya

Session-1, Hall-4 Levent YORULMAZ

Hall 4 - Jean B. Garcia

H4 Hall 4 - Konrad Manurung

H4 Hall 4 Merve Oyuktaş

H4 Hall 4 - Jean B. Garcia

Ç Hall 4- Nege Altınkeçiç

H4 Hall 4- ÖZGE TOPÇU DEMİRCAN

H4 Hall 4-Hendra

HM Hall-4 Mustafa Karagülle-Eskişehir Y...

Konstantinus Budi

MT Manotar Tampubolon (UKI Jakarta)

SC S1-H4 Chems Eddine BOUKHEDIMI

Tümünü Sessize Al Daha fazla

Kaydediliyor... Kalan: 08:42:39

Katılımcılar (5)

Observer - Hall 4

Hall- 4 ,Drita Yzeri Hav...

Hasnain Saleem S3 H4

The tissue was approximately 8x12 (cm) in size.

It was well circumscribed, unencapsulated, firm and white to yellow.

Three samples were fixed in 10% neutral-buffered formalin, routinely processed and sectioned at 5µm in thickness.

Stained with H&E and Masson's trichrome.

Immunohistochemical studies were performed using Vimentin, SMA and Desmin.

Observer... (Ortak oturum sahibi, ben)

S3 H4 Sara Shokrpooor

H4 Hall- 4 ,Drita Yzeri Havziu

HS Hasnain Saleem S3 H4

SD S3,H4 Dr Ivan Pavlović

Tümünü Sessize Al Daha fazla

PHOTO GALLERY

Observer - H... Hall 4 Merve... S1-H4 Chem... Kaldediliyor... Kalam: 09:25:28

Indonesia Corruption Perception Index 2022

Score **34** Rank **110**

Standard error: 1.78 | Lower CI: 31 | Upper CI: 37

Transparency International

Katılımcılar (14)

- Obse... (Ortak oturum sahibi, ben)
- Manotar Tampubolon (UKI Jaka...)
- Hall 4- Jean B. Garcia
- Hall 4 - Alya
- Hall 4 - Jean B. Garcia
- Hall 4 - Konrad Manurung
- Hall 4 Merve Oyuktaş
- Hall 4- Neşe Altınçekiç
- Hall 4 - ÖZGE TOPÇU DEMİRCAN
- Hall 4-Hendra
- Hall 4-Konstantin Budi (UKI Jakarta
- Mulyono (UKI Jakarta)
- S1-H4 Chems Eddine BOUKHEDIMI
- Session-1, Hall-4 Levent YORULMAZ

Tümünü Sessize Al Daha fazla

Observer - H... Hasnain Sale... Hall- 4 ,Drita... hall - 4 Anura... Kaldediliyor... Kalam: 09:52:51

S3_H4 Dr. Ivan Pavlovic.ppt [Compatibility Mode] - Microsoft PowerPoint

- The domestic cat as a pet originates from a species similar to the Libyan forest cat, a rare type of cat, and belongs to the first domesticated animal and is much older than the dog, because it has lived with humans for at least 9 million years.
- Cats have a great ability to learn and remember, which they use primarily for information that is of some use to them. These include: first of all, her favorite food, the place where the water bowl and cat toilet are, the most comfortable place to sleep and the place where her favorite toy is.

Katılımcılar (7)

- Obse... (Ortak oturum sahibi, ben)
- S3_H4 Dr Ivan Pavlović
- hall - 4 Anuradha Dubey
- Hall- 4 ,Drita Yzeri Havziu
- Hasnain Saleem S3 H4
- S3 H4 Engr Rehman Khan
- S3 H4 Sara Shokrpoor

Tümünü Sessize Al Daha fazla

ABSTRACTS

**AVRUPA BİRLİĞİ VE TÜRKİYE’NİN, MALİ İŞBİRLİĞİ ÜZERİNE BİR
DEĞERLENDİRME**

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Özet

Yirmi yedi ülkeden oluşan Avrupa Birliği, dünya ekonomisi için son derece önem arz etmektedir. Hem birlik içerisindeki ülkeler arasındaki mali yardımlaşma hem de üyelik başvurusunda bulunan ülkelere yapılan mali yardımlar ekonomi kapsamında tartışılmaktadır. Avrupa Birliği’nin önemli amaçları arasında ortak bir pazarın kurulması ekonomi politikalarının üye ülkeler içerisinde birbirleriyle uyumlaştırılması yer almaktadır. Bu doğrultuda Avrupa Sosyal Fonu kurulmuştur. Türkiye’nin Avrupa Birliği ile olan ekonomik ilişkilerini iki döneme ayırmak mümkündür. Bu dönemlerden ilki adaylık öncesi mali yardımların yapıldığı dönemdir. Bu süreç 1964-1999 arasındaki yılları kapsamaktadır. İkinci dönem ise 2000 yılından günümüze kadar olan adaylık sonrası dönemdir. Mali yardımların önemli bir kısmı Avrupa Birliği tarafından verilen krediler ve hibeler olarak karşımıza çıkmaktadır. Süreç içerisinde özellikle IPA kapsamında uygulanan mali yardımlar oldukça önemlidir. Mali yardımların müktesebat uyumu, uyum için idari kapasite ile ekonomik ve sosyal uyum projeleri temelinde hibeler verilmektedir. Mali yardımlar konusunda bir takım eksikliklerin olduğu da değerlendirilmiştir. Bu hususta Avrupa Birliği’nin ekonomik yapısını iyi bilmek, AB mevzuatına hâkim olmak ve açılan ilanlar kapsamında hareket etmek gerekmektedir. Yine mali protokoller, tamamlayıcı protokol ve özel mali işbirliği çerçevesinde alınan mali yardımların incelenmesi önemlidir. Üzerinde durulması gereken bir diğer durum ise 2021-2027 dönemini kapsayan IPA III. döneminde belirlenen yaklaşık 14 milyar euroluk bütçenin adil paylaşımdan kaynaklı olacak biçimde yararlanılmasının sağlanmasıdır.

Anahtar Kelimeler: Avrupa Birliği, Mali Yardım, IPA

**AN ASSESSMENT ON THE EUROPEAN UNION AND TURKEY FINANCIAL
COOPERATION**

Abstract

The European Union, consisting of twenty-seven countries, is extremely important for the world economy. Both the financial assistance between the countries in the union and the financial aids to the countries applying for membership are discussed within the scope of economy. Among the important objectives of the European Union is the establishment of a common market and the harmonization of economic policies within the member states. Accordingly, the European Social Fund was established. It is possible to divide Turkey's economic relations with the European Union into two periods. The first of these periods is the period in which financial aids are made before the candidacy. This process covers the years between 1964-1999. The second period is the post-candidacy period from 2000 to the present. A significant part of the financial aids appear as loans and grants given by the European Union. In the process, especially the financial aids applied within the scope of IPA are very important. Grants are awarded on the basis of financial aid alignment with the *acquis*, administrative capacity for harmonization, and economic and social cohesion projects. It has also been evaluated that there are some deficiencies in financial aids. In this regard, it is necessary to know the economic structure of the European Union well, to have a good command of the EU legislation and to act within the scope of the announcements. It is also important to examine the financial aids received within the framework of financial protocols, complementary protocols and special financial cooperation. Another situation that needs to be emphasized is the IPA III, which covers the 2021-2027 period. It is to ensure that the budget of approximately 14 billion Euros determined in the period of

Keywords: European Union, Financial Aid, IPA

**DOĞAL MANTAR TÜRLERİNDE ANTIÖKSİDAN KAPASİTESİNİN MARS
ALGORİTMASI İLE TAHMİNİ**

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Özet

Mevcut çalışmada, Soğanlı yaylasında (Kars/Sarıkamış) toplanan *Lepista nuda* (Bull.) Cooke, *Hypholoma*, *Agaricus* sp., *Paxillus involutus* (Batsch) Fr., *Suillus luteus* (L.) Roussel, *Marasmius oreades* (Bolton) Fr., *Lyophyllum* sp., *Hebeloma* sp. ve *Lactarius spp* toplam dokuz adet yenilebilir mantar türü toplandı. Çalışmanın amacı mantar türlerinde toplam fenolik ve

antioksidan kapasitesi içerik analizleri yapılarak elde edilen sonuçların, çok değişkenli uyarlanabilir regresyon uzanımları (MARS) algoritması aracılığıyla mantarlarda bağımlı ve bağımsız değişkenlerin antioksidan kapasitesi üzerine etkisini ortaya koymaktır. Çalışmadan elde edilen bulgulara göre, en yüksek antioksidan kapasitesi sırasıyla 62.12 (*Marasmius oreades*), 60.45 (*Paxillus involutus*), 42.40 (*Suillus luteus*), 38.68 (*Lyophyllum* sp.), 28.47 (*Agaricus* sp.), 25.77 (*Repsida nuda*), 24.65 (*Hebeloma* sp.), 22.34 (*Lactarius* sp.) ve 13.79 $\mu\text{mol TE g}^{-1}$ ile *Hypholoma* türünde tespit edildi. Ayrıca, MARS algoritmasına göre *Marasmius oreades* ve *Paxillus involutus* mantar türlerinin antioksidan kapasitesi üzerinde artan bir değere sahip olmasının yanı sıra artan değerlerde toplam fenolik içeriğinin de antioksidan kapasitesi üzerinde pozitif bir etkiye sahip olduğu gözlemlendi.

Anahtar Kelimeler: Doğal mantar türleri, toplam fenolik içeriği, antioksidan kapasitesi, MARS

Bu çalışma Van YYÜ Bilimsel Araştırma Projeleri Koordinasyon Birimi (BAP) tarafından **FBA-2022-9963** no'lu proje olarak desteklenmiştir.

**ANTIOXIDANT PROPERTIES AND PHENOLIC COMPONENTS IN THE LEAF OF
ISABELLA GRAPE (*Vitis labrusca* L.)**

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Abstract

Izabella grape (*Vitis labrusca* L.) is one of the endemic grape species of the Black Sea region, and the leaves of this species, which are called fragrant grapes, are used for cooking, and wrapping. In this study, the antioxidant properties and phenolic composition of Isabella grape leaves, collected from Akçaabat of Trabzon, Turkey were investigated. The Total Phenolic Content (TPC), Total Flavonoid Content (TFC), total antioxidant capacity and phenolic profile of the 70% ethanolic extracts of dried fresh grape leaves were examined. As a result of the HPLC-PDA analysis with 25 phenolic components including resveratrol, the resveratrol was not detected in the extract, but ellagic acid and rutin were determined as the major phenolic components. In addition, chromogenic acid, luteolin, quercetin, chrysin, pinocembrin, apigenin, and p-OH benzoic acid were determined in a lower concentration. The average TPC and TFC values of grape leaf extracts were measured as 23.327±0.049 mg GAE/g and 2.598±0.105 mg QUE/g respectively. The total antioxidant capacity of grape leaf extracts was measured in terms of Ferric Reducing Antioxidant Power (FRAP) and 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity and was found to be 215.501±1.326 µmol Fe₂SO₄.7H₂O/g and 0,299±0,011 mg/mL, respectively. As a result, Izabella grape leaf was determined as a food with high antioxidant capacity and high antioxidant properties.

Keywords: Izabella grape, leaf, *Vitis labrusca* L., antioxidant, ellagic acid, rutin

**TÜRKİYE'DE SATIŞA SUNULAN MASAJ YAĞLARINDA AĞIR METAL
KONTAMİNASYONU VE MİKROBİYOLOJİK KALİTENİN ARAŞTIRILMASI**

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Özet

Bu araştırmada, rastgele örneklem metoduyla seçilen farklı firmalara ait ve farklı özleri içeren 10 adet, ISO9001 standardına sahip, aromatik masaj yağının ağır metal içeriği ve mikrobiyolojik kontaminasyon düzeylerinin belirlenmesini amaçlanmıştır. Ağır metal düzeylerinin belirlenmesinde ICP-MS tekniği kullanılmıştır. Mikrobiyolojik kontaminasyonun belirlenmesi amacıyla, aerobik mezofil genel bakteri, maya ve küf sayımı, Enterobacteriaceae, koliform bakteri sayımı, *Escherichia coli* sayımı, Staphylococcus-Micrococcus varlığı analizleri gerçekleştirilmiştir. Masaj yağlarında gerçekleştirilen analizlerde hiçbir örnekte Maya/Küf, Koliform Bakteri *E. Coli* olmadığını, bununla birlikte 2 örnekte Enterobactericea ve 5 örnekte Staphylococ üremesi olduğunu ortaya koymuştur. Masaj yağı örneklerinin hiçbirinde Arsenik tespit edilmemiştir. Ancak, bazı örneklerde alüminyum, kurşun, civa, kadmiyum gibi oldukça toksik ağır metallerin varlığı, endişe verici bir durum olarak görülmüştür. Bir numunede yüksek çıkmış olsa da çinko önemli bir toksik metal olarak görülmemektedir. Bu sonuçlar, masaj yağlarında bir halk sağlığı problemi oluşturabileceği için, ürünlerin üretim ve pazarlaması süreçlerinin daha dikkatli izlenmesi ve mevcut standartların yeniden gözden geçirilmesinin önemli olacağını düşündürmektedir.

Anahtar Kelimeler: Aromatik Yağlar, Mikrobiyoloji, Ağır Metal, Masaj

**RAPID ETIOLOGICAL DIAGNOSIS OF NEONATAL CALF DIARRHEA WITH
IMMUNOCHROMATOGRAPHIC TEST KITS IN ESME DISTRICT OF USAK**

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Abstract

This study was carried out for rapid etiological diagnosis of neonatal calf diarrhea by using immunochromatographic test kits in the Eşme district of Uşak. The animal material of the study consisted of 100 1-28 days old neonatal calves of different breeds and genders in the Eşme district of Uşak. Stool samples were taken from calves with diarrhea as a result of clinical examination. When stool samples were examined by a rapid diagnostic test, none of the disease factors sought in the study were found in 10 (10%) of 100 calves, while one or more disease factors were detected in 90 (90%) of calves. Rotavirus was detected in 27 (27%) calves, Escherichia coli 14 (14%) calves, Coronavirus in 8 (8%) calves, Clostridium perfringens in 19 (19%) calves, Cryptosporidium spp. in 17 (17%) calves, Rotavirus + Coronavirus in 2 (2%) calves, Rotavirus + Clostridium perfringens in 1 (1%) calf, Rotavirus + Cryptosporidium spp. in 1 (1%) calf, and Escherichia coli - Clostridium perfringens in 1 (1%) calf. As a result, data on the presence and distribution of enterogenous pathogens that cause diarrhea in neonatal calves in the Eşme district of Uşak were presented, and it was concluded that it would shed light on future studies on diarrheal calves in the Eşme.

Keywords: Immunochromatographic test kit, Neonatal calf, Prevalence

**KIRKLARELİ İLİ CEVİZ ATIKLARININ BİYOKÜTLESİ VE ENERJİ
POTANSİYELİ**

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Özet

Bu çalışmada, Türkiye'nin Kırklareli ilindeki ceviz atıklarının biyokütle ve enerji potansiyeli hesaplamaları yapılmıştır. Çalışmada Türkiye İstatistik Kurumu verileri (2022 yılı) ve diğer çalışmalar referans olarak kullanılmıştır. Kırklareli ilinde hububat ve diğer bitkisel ürünlerin toplam alanı 243257.2 ha, nadas alanı 306.7 ha, sebze alanı 1448.1 ha, meyveli içecek ve baharat bitkileri alanı 3216.5 ha ve toplam tarım alanı 248228.5 ha'dır. Kırklareli ilinde 2022 yılında 1762.4 ha alanda ceviz üretimi yapılmış ve 2279 ton ceviz üretimi gerçekleştirilmiştir. Kırklareli ilinin toplam ortalama ceviz taze atık potansiyeli 158616 ton olarak hesaplanmıştır. Bu miktardaki ceviz üretiminin toplam 48466 ton/yıl kuru madde verebileceği hesaplanmıştır. Kırklareli ilinde ceviz atıklarından elde edilebilecek toplam enerji potansiyeli 948479.6 GJ/yıl ve 22658.1 TEP/yıl olarak hesaplanmıştır. Bu atıklar enerji dönüşüm sistemlerinin kullanılmasıyla enerjiye dönüştürülerek tarım işletmelerinin enerji ihtiyaçları için enerji kaynağı olarak kullanılabilir.

Anahtar Kelimeler: Biyokütle, ceviz, Kırklareli.

BIOMAS AND ENERGY POTENTIAL OF WALNUT WASTES IN KIRKLARELI PROVINCE

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Abstract

In this study was done the biomass and energy potential computations of the walnut wastes in Kırklareli province of Turkey. Turkish Statistical Institute data (2022 year) and other studies were used as reference in study. The total area cultivated with cereals and other herbal products is 243257.2 ha, fallow area is 306.7 ha, vegetable area is 1448.1 ha, fruits beverage and spice herbs areas are 3216.5 ha and the total agricultural area covers 248228.5 ha in Kırklareli province. Walnut cultivation was taken place in area of 1762.4 ha and yielded 2279 tons of walnut in Kırklareli province in 2022. The total average walnut fresh waste potential of Kırklareli province was computed as 158616 tons. It was computed that this quantity of walnut production can yield a total of 48466 ton/year dry matter. The total energy potential that can be acquired from walnut wastes in Kırklareli province were computed as 948479.6 GJ/year and 22658.1 TEP/year. These wastes can be converted into energy by the use of energy conversion systems and used as an energy source for the energy needs of agricultural farms.

Keywords: Biomas, walnut, Kırklareli.

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Abstract

The process of financial planning in business is designed to forecast future financial trends and determine how best to use financial resources in pursuit of the organization's short- and long-term objectives. This study aims to develop financial forecasting models using univariate time series methods. For this purpose, deep learning based Convolutional Neural Networks – Long Short Term Memory (CNN- LSTM), Multi-Horizon Quantile Recurrent Forecaster (MQRNN) and statistics based AutoRegressive Integrated Moving Average (ARIMA) have been used. The performance of the developed models has been evaluated using Mean Absolute Percentage Error (MAPE). The dataset includes 291 rows of total revenue and cash revenue data in weekly format from January 1st, 2017 to July 31st, 2022. Forecast models have been developed for two different months randomly selected from the dataset. The MAPE's obtained using CNN-LSTM, MQRNN and ARIMA for total revenue are 4.28%, 5.61% and 6.31% for June and 2.45%, 4.24% and 3.28% for July, respectively. The MAPE's obtained using CNN-LSTM, MQRNN and ARIMA for cash revenue are 5.09%, 4.15% and 3.41% for June and 4.77%, 2.44% and 5.88% for July, respectively. The results show that CNN-LSTM model for total revenue forecasting outperforms other models whereas there is no specific order on the performance of the models for cash revenue forecasting.

Keywords: Time Series, Machine Learning, Statistics, Financial Forecasting

**İNCİ DARISI POPULASYONLARINDA BAZI YEM KALİTE PARAMETRELERİ
ARASINDAKİ İLİŞKİLERİN KORELASYON VE PATH ANALİZLERİ İLE
SAPTANMASI**

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Özet

Yem bitkilerinde yem kalitesi ve kalite ile ilişkili özelliklerin bilinmesi, ıslah çalışmalarına yardımcı olmasının yanı sıra hayvan besleme içinde önemlidir. Bu çalışmada, ICRISAT'tan temin edilen 225 adet inci darı (*Pennisetum glaucum* (L.) R. Br.) popülasyonunun yem kalitesi ve kalite ile ilişkili bazı özelliklerin korelasyon ve path analizi ile belirlenmesi amaçlanmıştır. Araştırma, Adana'da 2021 yılı ikinci ürün yetiştirme döneminde, Alfa Latis (15 x 15) deneme deseninde yürütülmüştür. Bitkilerin hasatları, salkımdaki tanelerin süt-hamur olum dönemine denk geldiği zamanda yapılmıştır. Araştırma sonucunda; nispi yem değerinin (NYD) 75.14-124.81, kuru ot verimlerinin 239.31-2425.58 g/bitki, asit deterjan lif (ADF) %33.43-%45.73, nötral deterjan lif (NDF) %46.85-%65.96, ham protein (HP) oranının %5.59-11.94, kuru madde

oranı (KMO) %90.94-%97.08, kuru madde tüketiminin (KMT) %1.82-%2.56, sindirilebilir kuru madde (SKM) oranının %53.28-%62.85 ve net enerji laktasyon değerinin 1.247-1.421 mcal/kg arasında değiştiği saptanmıştır. Yapılan korelasyon analizi sonucunda; nispi yem değeri (NYD) ile HP ($r=0.575^{**}$), KMT ($r=0.982^{**}$), SKM ($r=0.935^{**}$) ve net enerji ($r=0.942^{**}$) arasında olumlu önemli bir ilişki saptanırken, ADF ($r=0.942^{**}$), NDF ($r=-0.980^{**}$) ve KMO ($r=-0.165^{**}$) arasında olumsuz önemli bir ilişki saptanmıştır. NYD ile kuru ot verimi ($r=0,039$) arasında olumlu önemsiz bir ilişki saptanmıştır. Path analizi sonuçlarına göre; KMT ve net enerjinin NYD'ye doğrudan etkilerinin olumlu (sırasıyla 0.6325 ve 0.3044) ve çok yüksek (sırasıyla %60.81 ve %30.64), kuru ot verimi ve ADF'nin ise olumlu (sırasıyla 0.0075 ve 0.0763) ve yüksek (sırasıyla %8.71 ve %7.68) olduğu saptanmıştır.

Anahtar Kelimeler: İnci darı (*Pennisetum glaucum*), Popülasyon, Ot Kalitesi, Korelasyon, Path analizi

Bu çalışma, Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) tarafından "219O103" numaralı proje ile desteklenmiştir.

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Özet

Akdeniz Havzasının sıcak noktasında yer alması Kıbrıs'ın biyolojik bakımdan korumasını daha da önemli hale getirmektedir. Son yıllarda Kıbrıs'ta biri meyveyle, 21'i böceklerle beslenen 22 yarasa türünün yayılışı belirlenmiştir. Türkiye'de yayılış gösteren 39 yarasa türü ile karşılaştırıldığında, izole bir ada için bu oldukça önemli bir sayıdır. Güney Kıbrıs'tan Kıbrıs yarasaları üzerine birçok çalışma yapılmış olmasına karşılık ne yazık ki Kuzey Kıbrıs yarasa türleri için yapılan çalışmalar çok azdır. Palearktik bölgede yayılış gösteren ve Afro-tropikal bir tür olan Mısır meyve yarasası, *Rousettus aegyptiacus*, adadaki tek meyve yarasasıdır. Fırsatçı bir toplayıcı olan bu türün adadaki diyet tercihi, mevsimsel meyvelere ve tüneme ortamına göre farklılık göstermektedir. Bu çalışmada Güzelyurt, Gazimağusa, Beşparmak dağlarından meyve yarasasının yeni yayılış yerleri kayıt edilmiştir. Güzelyurt'taki mağaralar yıl boyunca her iki eşey tarafından kullanılmaktadır. Bu mağaralarda aynı anda uçabilen yavrular ile çiftleşen ergin bireyler de kaydedilmiştir. Bir akar türü olan ve Pteropodidae familyası ile özelleşmiş *Meristaspis* sp., türü adadan ilk defa bu çalışma ile tespit edilmiştir. Günümüzde Kuzey Kıbrıs'taki Mısır meyve yarasası popülasyonları, çeşitli antropojenik tehditler nedeniyle önemli ölçüde azalmaktadır. Giderek artan turizm faaliyetleri, elektrik telleri, yoğun aydınlatma, mağaraların girişlerinde yanlış tasarlanmış kapılar, zehirlenme, yasa dışı öldürme, meyve ağaçlarının kesilmesi ve kalker ocakları gibi antropojenik etkiler türün adada yayılışını geri dönüşü olmayan şekilde etkilemektedir. Bu çalışma ile, türün Kuzey Kıbrıs coğrafyasına ilişkin mevcut yayılış ve koruma durumunu belirlenmiş ve etkili bir koruma için yaşadığı habitatların önceliklendirilmesine yönelik öneriler sunulmuştur.

Anahtar kelimeler: Mısır Meyve Yarasası, Palearktik bölge, Antropojenik tehditler

**OTOMOTİV BAYİLERİNDEKİ SATIŞ ELEMANLARININ UYARLAMACI
DAVRANIŞ DÜZEYLERİNİN DEMOGRAFİK ÖZELLİKLERİNE GÖRE
FARKLILAŞMASI**

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Özet

Literatürde; satış elemanlarının müşterileriyle etkileşim halindeyken sergiledikleri uyarlamacı davranış düzeylerinin satış performansları üzerinde belirleyici etkileri olduğuna dair anlamlı sonuçlar sunulmaktadır. Akademik verilerin ışığında, uygulamacılar tarafından da uyarlamacı satış davranışı sergilemek için gerekli özelliklere sahip satış elemanlarının istihdam edilmesi ve tutulmasına dair verilen önemin gün geçtikçe artmakta olduğu görülmektedir. Uyarlamacı satış davranışı, “müşteri ile etkileşim sırasında algılanan bilgilere dayalı olarak satış davranışlarının değiştirilmesi” olarak tanımlanmaktadır (Weitz, 1981). Durumsallık teorisiyle öne sürülen uyarlamacı satış davranışına göre; satış elemanları karşılaştıkları her bir müşterinin kendine özgü olduğunu kabul ederek, davranışlarını müşterinin durumuna göre değiştirebilme esnekliğine sahip olduklarında, müşterinin o ürünü ya da hizmeti satın alma kararı üzerinde pozitif etki yaratabilmektedirler. Uyarlamacı davranış düzeyleri yüksek olan satış elemanları; müşterilerinin tepkilerini gözlemleyerek, hızlı strateji ayarlamaları yapabilmektedirler. Dikkatli gözlemleri, müşteri ihtiyaçlarını ve beklentilerini de anlamalarını kolaylaştırmaktadır (Zhou & Charoensukmongkol, 2021). Bu sayede satış elemanı-müşteri arasında uyum sağlanarak, müşterilerle olan ilişkiler de beslenmektedir. Satış elemanları, müşterilerine uygun olarak farklı satış sunumları kullandıklarında ve davranışlarında ayarlamalar yaptıklarında yüksek düzeyde uyarlamacı davranış sergilemekte, buna karşılık tüm satış ortamlarında aynı satış sunumunu kullandıklarında ise uyarlamacı davranış düzeyleri düşük olmaktadır (Spiro & Weitz, 1990). Çalışmada; satış elemanlarının uyarlamacı davranış düzeylerinin ölçümü için Spiro ve Weitz (1990)’in geliştirdikleri ADAPTS ölçeğine dayanarak, Robinson vd. (2002) tarafından kısa versiyonu geliştirilen tek boyutlu beş maddelik ADAPTS-SV ölçeği kullanılmıştır. Değerlendirmeler için ise 5’li Likert Ölçeği kullanılmıştır. Araştırma, otomotiv sektörü

bayilerinde müşterilerle direkt iletişim halinde olan satış elemanları üzerinde gerçekleştirilmiştir. Araştırma neticesinde elde edilen bulgular cinsiyete göre incelendiğinde; kadınların erkeklere oranla daha yüksek düzeyde uyarlamacı davranış sergiledikleri, medeni durumlarına göre incelendiğinde, bekarların evlilere oranla daha yüksek düzeyde uyarlamacı davranış sergiledikleri ve eğitim düzeylerine göre incelendiğinde ise; eğitim düzeyi arttıkça uyarlamacı davranış düzeylerinin de anlamlı bir şekilde arttığı tespit edilmiştir. Bulgular pozisyona göre incelendiğinde, satış müdürlerinin, satış danışmanlarına oranla daha fazla uyarlamacı davranış sergiledikleri dikkat çekmekte ve bu bulgu da eğitim düzeyine göre anlamlı artışı desteklemektedir. Örneklemin satış deneyimine göre incelenmesi yapıldığında ise; deneyime göre anlamlı bir farklılaşma tespit edilmemiştir. Benzer şekilde yaşa göre incelendiğinde de anlamlı bir bulgu ortaya çıkmamıştır.

Anahtar Kelimeler: Uyarlamacı Satış Davranışı, Satış Performansı, Demografik Özellikler

TÜRK SİYASAL HAYATINDA HÜRRİYET PARTİSİ

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Özet

Beyaz devrim olarak nitelendirilen 1950 seçimleri Türk siyasal hayatının dönüm noktalarından biridir. Türkiye’de iktidar ilk kez demokratik seçimler sonucu el değiştirmiştir. Demokrat Parti’nin iktidara geldiği bu döneme 487 meclis üyeliğinden 408 üyelik kazanmıştır. almıştır. 1954 seçimlerine hazırlanan Demokrat Parti ülkedeki meclisi 1953’te olağanüstü toplantıya çağırmıştır. Demokrat Parti meclis grubu yeni çıkaracakları kanunların toplumsal ve siyasi düzeni koruyarak hazırlanması bahanesiyle meclise sunulan önerilerin de kabulü gerçekleşmeden meclisi tatile çıkarma kararı almıştır. 1953 yılında iktidar ve muhalefet ilişkileri de gerginleşmeye başlamıştır. Cumhuriyet Halk Partisi’nin Ulus Gazetesi’nde Demokrat Partiye karşı yaptığı propagandasına karşı Adnan Menderes *Moskova Radyosu’nun yayınları kadar iğrenç*” diyerek iki parti arasındaki ilişkiyi tanımlamıştır. 1954 seçimlerinden sonra muhalefet güç kaybederken Demokrat Parti kendi içinde parti muhalefeti belirginleşmeye başlamıştır. Demokrat Parti’nin ülkede uyguladığı ekonomi politikaları toplumsal hoşnutsuzluğu arttırmıştır. Tek parti rejiminin devrilmesi amacı ile bir araya gelen Demokrat Partililer arasında fikir çatışması ve ayrılıklar yaşanmaya başlamıştır. Bu ayrılıklar Demokrat Partinin iktidar sürecinde sürekli artmıştır. İktidar sahiplerinin demokratik rejimin gelişmesini sağlayacak asgari bir zihniyete sahip olmaması sonucu program ve tüzüğündeki ana prensip ve hedeflerden aykırı bir yol tutmuş olması ile sonuçlanmıştır. Bu noktada partide aradığını bulamayan muhalefet düşünce ve ifade özgürlüğü amacıyla kurulan Demokrat Partiden ayrılarak yeni partiler kurmaya başlamışlardır. Bu partilerden biri olan Hürriyet Partisi Çalışma konumuzu oluşturmuştur.

Anahtar Kelimeler: Hürriyet Partisi, Demokrat Parti, Türk Siyasal Hayatı

**HAYAT BİLGİSİ DERSİNDE SÜRDÜRÜLEBİLİR ÇEVRE BİLİNCİ
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Özet

Bu araştırmada Hayat Bilgisi dersi okutan sınıf öğretmenlerinin sürdürülebilir çevreye ilişkin görüşlerini ortaya çıkarmak, öğrencilere sürdürülebilir çevre bilinci kazandırmak adına yapmış oldukları etkinlikler ve yürüttükleri projeler hakkında bilgi edinmek, sürdürülebilir çevre bilincinin oluşmasına engel olan etmenler ve bu bilincin oluşturulması için öğretmen önerilerini belirlemek amaçlanmıştır. Araştırma nitel araştırma desenlerinden fenomenolojik yaklaşımla gerçekleştirilmiştir. Araştırmanın çalışma grubunu 2021/2022 eğitim öğretim yılında Afyonkarahisar ilinin merkezinde bulunan devlet okullarında görev yapan ve ölçüt örnekleme ile belirlenen 9 kadın, 7 erkek olmak üzere 16 sınıf öğretmeni oluşturmaktadır. Araştırmanın verileri açık uçlu on sorulardan oluşan yarı yapılandırılmış görüşme formu ile toplanmış, toplanan veriler ise tematik analizi ile incelenmiştir. Araştırma sonucunda katılımcıların çoğunluğunun sürdürülebilir çevre bilincinin küçük yaşlarda kazandırılması gerektiğini belirtmişlerdir. Bu bilincin oluşturulmasında ailenin bilinçli olmasının ve aile desteğinin olması ön koşul olarak bildirmişlerdir. Katılımcıların görüşlerinden elde edilen bulgular doğrultusunda öğretmenler, rol model olunması, eğitim yöneticilerinin desteğinin artırılması, öğretim programlarında sürdürülebilir çevre ile ilgili kazanımların artırılması ve kazanımların içeriğinin uygulamaya ve yaparak-yaşayarak öğrenmeye dayalı bir şekilde düzenlenmesi, velilerin bilinçlendirilmesi önerisinde bulunmuşlardır.

Anahtar Kelimeler: Sürdürülebilir çevre, geri dönüşüm, sınıf öğretmenleri, nitel araştırma, Hayat Bilgisi

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Özet

Çalışmada Öğretmenlerin riskli oyun algıları ile çocukların motor yaratıcılık becerileri arasındaki ilişkinin incelenmesi amaçlanmıştır. Bu amaç doğrultusunda 2022-2023 Afyonkarahisar İl Millî Eğitim Müdürlüğü'ne bağlı okullarda görev yapmakta olan okul öncesi öğretmeni ve aynı öğretmenlerin sınıfında yer alan çocuklar çalışma grubunu oluşturacaktır. Çalışmada öğretmenlere Torrance (1981) tarafından geliştirilen Karaca ve Aral (2017) tarafından Türkçe'ye uyarlanan Eylem ve Harekette Yaratıcı Düşünme Testi" ölçme aracı ile Karaca ve Uzun (2020) tarafından geliştirilen "Erken Çocukluk Riskli Oyun Değerlendirme Aracı-Öğretmen Formu (EÇRODA-ÖF)" kullanılacaktır. Çalışmada veri analizi için veriler toplandıktan sonra normallik testi yapılacak ve test sonucuna göre analizler belirlenecektir. Araştırmadan elde edilen sonuçlar doğrultusunda öneriler bulunulacaktır.

Anahtar Kelimeler: risk, riskli oyun, yaşam becerileri, erken çocukluk dönemi

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Özet

Bu çalışma, tarihsel süreç içinde Kıbrıs Türk eğitim sisteminde denetimin günümüze gelene kadar geçirdiği süreçlerin incelenmesi amacıyla yapılmıştır. Yönetim süreçlerinin önemli bir basamağı olan denetim, diğer tüm yönetim alanlarında olduğu gibi eğitim yönetiminin de önemli bir aşamasıdır. Bir kurumun gelişimi ve değişimi için denetim kaçınılmaz olmaktadır. Eğitim sisteminin en önemli unsurlarından olan öğretmenin de eğitim ve öğretimde verimli ve etkili olabilmesi çağdaş denetim uygulaması ile başarıya ulaşmaktadır. Ulaşılan kaynaklarda Kıbrıs Türk eğitimini denetimi ile ilgili Osmanlı yönetimi (1571-1878) dönemine ait kesin bir bilgiye ulaşılamamıştır. Ancak Osmanlı yönetim anlayışında eğitim kurumları şahıslar ve vakıflara aitti ve okulların doğrudan bağlı olduğu bir mercinin olmadığı görülmektedir. 1826'da Osmanlı devleti'nde "Evkaf-ı Hümayun" nezaretinin kurulması ile eğitim kurumlarının kontrol altına alınması amaçlanmıştır. Ulaşılan kaynaklarda eğitim denetimi ile ilgili bilgiler Kıbrıs'ta Osmanlı yönetiminin sonları, İngiliz yönetimi başlarında karşımıza çıkmaktadır. Osmanlı yönetimi döneminin ardından adanın İngilizlere devredilmesiyle başlayan dönemde de Osmanlı yönetiminin Kıbrıs Türk eğitimi üzerinde etkisinin devam ettiği görülmektedir. Çalışmada Kıbrıs Cumhuriyeti dönemi ve sonrası ile Kuzey Kıbrıs Türk Cumhuriyeti (KKTC) döneminde eğitim denetimi ve uygulamaları tarihsel süreç içinde ele alınarak incelenmiştir. Çalışmada nitel araştırma yöntemlerinden kaynak taraması yapılarak geçmişten bugüne eğitim denetimi ile ilgili bulgular ortaya çıkarılarak denetimin nasıl ve hangi amaç ve ilkelere dayandırılarak yapıldığı ve hangi yöntemlerin kullanılmış olduğu ve geçirdiği süreçler ortaya konmuştur. Denetim uygulamalarıyla ilgili kaynaklardan elde edilen veriler seçilerek anlamlandırılmış ve değerlendirilmiştir. Çalışmada Kıbrıs'ta egemen olan her yönetimin eğitimi etkisi altına alma çabası güttüğü görülmüştür. Bu bağlamda eğitimin daha etkili ve sistemli olması çabası ortaya konarken, bazı dönemlerde de Kıbrıs Türk eğitimini kendi denetimini yapabilmesi için politik olarak da bazı dönemlerde mücadele vermesi gerektiği görülmüştür. Kıbrıs Türk eğitimini başlangıcından bugüne eğitim geldiği nokta ve geçirdiği süreçler kronolojik olarak ortaya konmuştur.

Anahtar Kelimeler: Kıbrıs Türk Eğitimi, Denetim, Müfettiş, Denetmen, Denetim Tarihi

**GELİŞMEKTE OLAN ÜLKELERDE JEVONS PARADOKSU ÜZERİNE BİR
ARAŞTIRMA**

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Özet

Dünya genelinde ekoloji ve iklim uzmanları insanlık-doğa ilişkisinin artık sürdürülemez durumda olduğu ve çevreye verilen zararlar konusunda gelişmiş kapitalist ülkelerin başı çektiği konularında tam bir fikir birliği içerisindeyler. Artık bilim çevreleri arasındaki tartışmalar bir iklim krizini gerçekleştirip gerçekleştirilmeyeceği değil, gerçekleşecek iklim krizinin boyutunun ne olacağı üzerinde yoğunlaşmış durumdadır. Beklenen iklim krizinin en büyük sorumluları olarak gösterilen egemen kapitalist sınıf ise sorunları genellikle görmezden gelmektedirler. Beklenen iklim krizi ile ilgili kapitalist ülkeler tarafından alınan önlemler genellikle teknolojik değişim yoluyla üretim sistemleri üzerine “devrimcileştirmeyi” kapsadığı görülmektedir. Mevcut toplumsal ve ticari ilişkilerin oluşturduğu küresel ekonomik sistemin ise bu devrimlerin dışında kaldığı, ekonomik sistemle ilgili herhangi bir iyileştirme yapılmadığı görülmektedir. “Üretimin devrimcileştirilmesi” terimi ilk kez kapitalist toplumun ayırt edici özelliği olarak Karl Marx tarafından “Komünist Manifesto” isimli eserde kullanılmıştır. Günümüz kapitalist ülkeleri de artık art arda gelen teknolojik buluşların ve klasik iktisadın efsanevi görünmez elinin ihtiyaç duyulduğunda çevre ile ilgili bütün sorunları kendiliğinden çözeceğine inanmayı tercih etmektedirler. Bu görüşün aksine çevre bilimcilerin bir çoğu teknolojik ilerlemenin tek başına iklim krizi felaketine çözüm olmakta yeterli olamayacağını, çağımız üretim yöntemlerinin temelden dönüşümünü hedef alan uzun vadeli sosyal bir devrime ihtiyaç duyulduğunu yüksek sesle dile getirmektedir. Günümüzde enerji üretimindeki etkinlik artışının sonucu olarak enerji tüketiminde fark edilir şekilde bir artış yaşanması (geri tepme etkisi) durumu ekonomi literatüründe Rebound etkisi olarak kendine yer bulmuştur. Rebound etkisi kavramı ilk kez Jevons’un (1866) çalışmasında kullanılmış bir ifade olduğundan Jevons Paradoksu olarak da bilinmektedir. Bu çalışmada başta Türkiye olmak üzere gelişmekte olan ülkelerde enerji üretiminde kullanılan daha verimli teknolojilerin sebep olduğu rebound etkisinin boyutlarının enerji üretim ve tüketim istatistiklerinin yansıtıldığı tablo ve grafikler üzerinden belirlenmesi ve analiz edilmesi amaçlanmıştır.

Anahtar Kelimeler: Jevons Paradoksu, Rebound Etkisi, Enerji Verimliliği

**ENFLASYONUN TÜKETİCİ DAVRANIŞLARI ÜZERİNDEKİ ETKİLERİNİ
ANLAMAK**

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Özet

Ekonomide meydana gelen değişimler tüketicinin yaşamının birçok alanını etkilemektedir. Aynı zamanda tüketicilerin ürün tüketimi ve satın alma ile ilgili tüketici davranışlarını da belirlemektedir. Tüketiciler, özellikle ekonomik durumun dünya çapında dikkate değer değişikliklere uğradığı, enflasyonun arttığı son birkaç yılda, alışveriş davranışlarıyla ilgili farklı davranış değişiklikleri göstermişlerdir (Yurievna, 2022). Enflasyon, tüketici davranışlarını etkileyen ve bir şirketin kâr veya zararını belirleyen temel unsurlardan biridir (Dhar, 2022). Enflasyonun arttığı dönemde tüketiciler, finansal sorunlar nedeniyle satın alma davranışlarını değiştirmekte ve satın almalarını azaltmakta veya sınırlandırmaktadırlar (Sharma & Sonwalkar, 2013). Bir işletme, tüketicilerin davranışlarını tahmin ederek tüketicilerin ihtiyaçlarını anlayabilir ve beklentilerini karşılamaya çalışabilir. Bu, nihayetinde işletmelerin refahlarını korumalarına ve uzun vadeli hedeflerine ulaşmalarına yardımcı olacaktır (Nistorescu ve Puiu, 2009). Bu araştırma; enflasyon bağlamında gençlerin ithal ürünlere olan ilgisini, nitel bir araştırma yaparak teoriğe ve pratiğe katkı sağlamayı amaçlamaktadır. Modern ekonomide, gençlerin kendilerine ait düzenli bir gelirleri olmamasına rağmen çok aktif bir tüketici yaş grubu olduğuna şüphe yoktur (Zollo, 1995). Bu gençlerin gelir kaynağının çoğu ebeveynlerinin parasıdır ve hatta bazılarının aktif bankacılık faaliyetleri ile kendi banka hesapları vardır (Furnham, 1999). Günümüzün genç tüketicileri, kişisel tatmine büyük önem vererek daha bireysel odaklıdır (Newall & Steele, 2002). Ayrıca, gençlerin davranışlarının, kendileriyle sık temas halinde olan yetişkinlerin inançlarından büyük ölçüde etkilendiği kaydedilmiştir (özellikle ebeveynleri ile olan ilişkisi). Buna göre, gençlerin harcama alışkanlıklarının, ebeveynlerinin çok harcama yapmasından veya çok tasarruf etmesinden büyük ölçüde etkilendiği görülmektedir (Furnham & Thomas, 1984a; Furnham, 1999). Bu çalışmada örneklem olarak 17-18 yaş aralığında özel okulda okuyan gençler seçilmiştir. Tüketici davranışlarını ölçebilmek için nitel araştırma yöntemi kullanılmıştır. Odak grup çalışması yapılarak, yarı yapılandırılmış sorular sorulmuştur. Çıkan sonuç OECD'nin verileriyle uyumlu olup mevcut literatürden farklılık göstermektedir. Türkiye'de yaşayan orta-üst grup gelir düzeyine sahip gençler enflasyona rağmen daha fazla ithal mal ve lüks tüketim ürünü satın almakta, fiyatların her geçen gün artacağı konusundaki endişeleri nedeniyle de satın alma davranışlarını ertelemeyip, bir yerine daha fazla alıp, stoklamanın daha iyi olacağı konusunda hemfikirler. Daha fazla almak istemelerinin nedeni aldıkları ürünleri kullansalar bile ileride daha fazla bir fiyata kullanılmış olarak satabilecekleri inancıdır. Bir diğer unsur ise; ileride hiç alamazsam diye şu anki fiyatına bakmadan almaktadırlar. Araştırma sonuçları literatürde beklenen rasyonel tepkilerden farklılık göstermektedir. Geleceğe yönelik araştırmalarda bu farklılıkların altındaki diğer nedenler araştırılabilir, örneklem genişletilebilir ve nitel ile birlikte nicel çalışma da yapılarak literatüre katkı sağlanabilir.

Anahtar Kelimeler: Tüketici davranışları, Enflasyon, İthal ürünler

MEMORIES OF SOCIAL IDENTITY: TIME AND SPACE

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Abstract

This research aims to explore islanders' memory of social identity in relation to time and space with a theoretical approach that positioned in the nexus between reflexive anthropology and social psychology. Islands are perceived as carrying memories of disturbances (LeGoff, 1992). Islands are living entities. They are characterised by sand, iodine smell, mist, rocks, stones, places dominated by nature's forces and usually their liminality is defined by the sea. (Joseph, 2020). This usually makes them physically detached from influences from larger continents, in Cyprus's case the influence of larger continental forces has been significant throughout the history. Islands preserve the feelings of a society as a space of memory. The colonial, and post-colonial influences are memorialised through spaces by formerly traumatised islands. Societies which are condemned by the pressured position between contemporary times and past memories use the space as a constant, reminding, monolithic symbol or representation of memory; or a symbol of transformation. Those physical places enable mourning through symbolic representations or memory becomes more vague as the time passes as a result of socio-physical and cultural transformations. This research explores memories of social identity in North Cyprus, through visual data with an aim to explore the Turkish Cypriots' memory of social identity in time and space.

Keywords: Social Identity, Memories of Social Identity, Islands, Cyprus, Physical Spaces

**KKTC'DE EĞİTİM DENETİMİ ALANINDA SON BEŞ YILDA YAYIMLANAN
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Özet

Eğitim denetimi alanında yapılan çalışmalar, bu alana ilişkin güncel eğilimlerin ortaya konulması ve eksikliklerin tespit edilmesi açısından önemlidir. Mevcut durumun tespiti, ilerleyen dönemlerde hedef koyma ve yapılacak araştırmalara yön verme açısından önemli bir başlangıçtır. Bu doğrultuda hazırlanan araştırma; 2017-2022 yılları arasında Kuzey Kıbrıs Türk Cumhuriyeti'nde yapılan eğitim denetimi alanına ait araştırmaların karşılaştırmalı olarak incelenmesi amacı ile hazırlanmıştır. Araştırmanın literatür kısmını; denetim kavramı, denetim ilke ve modelleri, KKTC denetim sistemi, KKTC denetmen seçim kriterleri oluşturmaktadır. Araştırma kapsamında 2017-2022 yılları arasında yayınlanan 12 makale doküman analizi yolu ile incelenmiş, tablolaştırılmış ve bu makaleler farklı boyutları ele alınarak karşılaştırılmıştır. Araştırmalar incelendiği zaman; araştırmacıların, yoğunluklu olarak eğitim yönetimi üzerine yoğunlaştığı ve eğitimin denetim bacağına ihmal edildiği saptanmıştır. Ülkemizde son beş yılda yapılan bilimsel çalışmaların incelenmesi ile denetimle ilgili 2019 ve 2020 yıllarında araştırmalarda bir artış meydana geldiği fakat bu artışın, 2021 yılında devamının gelmediği söylenebilir. Yapılan araştırmalarda görüşme yöntemine ağırlık verilmiş, daha çok denetmenlere yönelik görüşler araştırılıp denetim sistemlerinin karşılaştırılmasına ve yaşanan sorunların tespitine ağırlık verilmiştir. Yapılan bu çalışma, sadece yayınlanan araştırmalarla sınırlı bir çalışma olması ile birlikte, çalışma sırasında yapılan taramada, Kuzey Kıbrıs'ta yapılan araştırmaların yayınlanması veya bu araştırmalara ulaşılması konusunda zorluk çekildiği görülmüştür. Ülkemizde "Eğitim Yönetimi ve Denetimi" alanında, bir çok üniversite ve kurumda yüksek lisans programı yer almasına rağmen, denetim boyutunda az çalışma yapılmış olması, konu kapsamının bir bacağına eksik kaldığını göstermektedir. Araştırmacıların, sadece eğitim yönetimi değil, eğitim denetimi alanında da çalışmalar yapması gerekliliği ve yapılan çalışmaların yayınlanması aşamasında daha iyi bir veri tabanının oluşturulmasının gerekliliği; bu çalışmayı yapan yazarlar tarafından önerimizdir.

Anahtar Kelimeler: Eğitim denetimi, Eğitim araştırmaları, Doküman incelemesi.

KAYIT DIŐI EKONOMİ VE TÜRKİYE EKONOMİSİNE ETKİLERİ

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Özet

Vergi, bir devletin birincil ve en önemli gelir kaynağıdır. Ekonominin tüm aktörleri, gerçekleştirdikleri ekonomik faaliyetler sonucu ortaya çıkan değer üzerinden güçleri oranında devlete vergi ödemekle yükümlüdürler. Mükellefler tarafından karşılık beklenmeksizin ödenen vergiler, hükümet tarafından ekonomik sistemin sorunsuz işlemesi amacıyla belli bir maliye politikası çerçevesinde kamu harcamaları olarak tekrar ekonomiye dahil edilir. Ülke ekonomisi içerisinde faaliyet gösteren ve bu kamu harcamalarından direkt veya dolaylı şekilde faydalanan bazı mükellefler vergi ödemeyerek veya eksik vergi ödeyerek kayıt dışı gelir sağlama eğiliminde olabilmektedir. Resmi kayıtlarda görülemeyen, kanunlarca belirlenmiş geçerli belgelere dayanmayan, ülkenin reel üretimine dahil olmakla birlikte mevcut ölçüm yöntemleriyle tespiti mümkün olmayan yani ülkenin GSYH hesaplarına dahil edilemeyen tüm ekonomik faaliyetler; kayıt dışı ekonomi şeklinde adlandırılmaktadır. Kayıt dışı ekonomi özellikle gelişmekte olan ülkelerde vergi gelirlerini ve dolayısıyla kamu harcamalarını düşürücü etkisinden dolayı çözüm bekleyen sorunların başında gelmektedir. Keynes'in özellikle gelişmekte olan ülkelere sürdürülebilir bir ekonomik büyüme için sunduğu temel politika olan genişletici maliye politikasının temelinde kamu harcamalarının artırılması yatmaktadır. Kayıt dışı ekonomi kamu harcamalarının en önemli kaynağı olarak görülen vergilerin azalmasına sebep olmakta, kamu harcamalarının yetersiz kalmasına sebep olarak ekonominin tam istihdam seviyesine ulaşma amacının önünde büyük bir engel teşkil etmektedir. Bu bilgiler ışığında kayıt dışı ekonomiyle mücadele için ülkelerin yeni politikalar geliştirmesi ve kararlılık göstermesi ekonomi açısından büyük bir gerekliliktir. Son derece karmaşık bir yapıya sahip olan kayıt dışı ekonomi ile mücadelede hükümetlerce uygulanan mali politikalar büyük önem arz etmektedir. Gelişmiş ülkelerde uygulanan etkin maliye politikaları sayesinde kayıt dışı ekonomi ile mücadelede önemli seviyede başarı sağlanmış fakat gelişmekte olan ülkeler için bu tehdit halen yüksek seviyededir. Kayıt dışı ekonomi, Türkiye ekonomisi için de önemli bir tehdit oluşturmaktadır. Kayıt dışı ekonomi üzerine yapılan çalışmalar incelendiğinde Türkiye'de kayıt dışı ekonominin yüksek seviyelerde olmasının ana sebepleri olarak yüksek vergi oranları, eğitim (halkta vergi bilinci eksikliği), denetimlerin yetersizliği, cezaların caydırıcılıktan uzak olması ve sık uygulanan vergi afları şeklinde sayılmaktadır. Bu çalışmada kayıt dışı ekonominin başta Türkiye ekonomisi olmak üzere dünya ekonomisinde sebep olduğu tahribatlar, mevcut mücadele politikaları ve dünyada kayıt dışı ekonomi ile mücadele konusunda başarıya ulaşmış politikaların Türkiyede uygulanabilirliği tablo ve grafiklerin analiz edilmesi yoluyla okuyucuya sunulmaya çalışılmıştır.

Anahtar Kelimeler: Kayıt dışı Ekonomi, Vergi Politikaları, Vergi Oranları, Vergi Yüğü

GOLAN TEPELERİNİN MEVCUT DURUMU VE GELECEĞİ

Volkan ÇETİNTAŞ

Güvenlik Stratejileri ve Yönetimi Uzmanı

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Özet

Ortadoğu'daki kırılğan yapı tarihsel olaylar kadar dinsel fanatizmin, ekonomi ve stratejilerin de etkili olduğu birçok olaydan etkilenmiştir. Osmanlı Devletinin bölgeden çekilmesi ile her ne kadar meydana gelen hadiselerin hemen hemen hepsi farklı nedenlerden kaynaklanmış olsa da sonuç olarak batılı devletlerin arabuluculuk etmesi ya da dolaylı yollardan olaylara müdahil olmaları ile son bulmuştur. Şii-Sünni, Arap-İsrail ve kısmen de farklı nedenlerden kaynaklı çatışmaların sonucunda şekillenen bu coğrafya, her zaman sahip olduğu yer altı zenginlikleri, konumu ve kültürel mirası münasebetiyle de batılı devletlerin gözünde önemini hep korumuştur. Bu alanlardan bir tanesi de su kaynakları, tarım alanları stratejik konumu ve nüfus barındırma potansiyeli ile ön plana çıkan Golan Tepeleridir. Golan Tepeleri, Suriye, Lübnan, Ürdün, Filistin ve İsrail'in sınırlarının kesiştiği alanda yer almaktadır. Ortadoğu'nun en önemli kentlerinden, Suriye'nin de başkenti olan Şam'a yalnızca 35 km, İsrail'in en önemli kentlerinden ve limanlarından biri olan Hayfa'ya ise yüz kilometreden daha az mesafededir. 1200 km² si İsrail'in, 270 km² si BM'in ve 390 km² si ise Suriye'nin kontrolünde olmak üzere toplamda 1860 km² lik alan kaplamaktadır. Çalışmada öncelikle Arap-İsrail uyuşmazlığının getirmiş olduğu sonuçlar neticesinde Suriye'nin toprağının bir parçası olan Golan Tepelerinin işgalinde rol oynayan etkenler ile alanın mevcut durumu ve statüsü üzerinde durulmuştur. Özellikle İsrail'in Golan Tepelerini işgalinin bölgesel ve ulusal etkileri değerlendirilmiş ve Golan Tepelerinin gelecekteki statüsü ve olası senaryolar tartışılmıştır.

Anahtar Kelimeler: Golan Tepeleri, İsrail, Suriye, Arap-İsrail Savaşları

TURKISH CYPRIOTS SOCIAL IDENTITY PROCESSES AND CATEGORISATION

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Abstract

When people emigrate from one country to another they do not only physically relocate, they also take their own culture with them to a new and unfamiliar environment. When two or more different groups of people come into contact with each other, they may not only adopt each other's beliefs, behaviours but also values and languages (Sam and Berry, 2010). According to Berry (2008), this process begins when individuals with a certain cultural background starts to interact with another group of individuals that come from a different cultural background and such interaction eventually results in cultural and psychological changes in both groups. The transition to the united group identity requires a profound understanding of each group's rationale of what constitutes their sense of belongingness, what constituted their united identity in the first place and shared identity elements before the transition process take place. Adopting Cognitive Developmental Model of Social Identity Integration, a four-stage model which explains the specific processes by which multiple social identities develop intra-individually and become integrated within the self over time (Amiot et al., 2007); this research aims to explore Turkish Cypriot's understanding and opinions on what constitutes their identity and their rationalisation of changes on their identity. It proposes an interdisciplinary lens and aims to capture concept of identity within socio-cultural discourses across time periods and is informed from individual and social psychology, history, sociology and politics. It unfolds at two levels; at micro level, it investigates individual aspects and at macro-level it looks into the social aspects and aim to create an overarching framework combining these.

Keywords: Social Identity, Group Identity Categorisation, Cultural Identity, Social Identity Process

**STUDENTS ASSESSMENT OF ONLINE EDUCATION DURING THE COVID-19
EPIDEMIC**

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Abstract

The purpose of this study was to assess the online instruction given to students during the COVID-19 epidemic. At the four universities of Lahore city that were the center of the study, 650 students pursuing undergraduate, graduate, and doctoral degrees participated. A mixed method was used to design the research using both qualitative and quantitative components. An online survey was employed during the quantitative phase. Online in-depth interviews using a semi-structured interview form were carried out during the qualitative phase. Local Lahore, Pakistan, inhabitants were among the responses. The content analysis led to the identification of 21 categories and three major themes. The following themes were accomplished: "It could have been better!" for their suggestions, "Face-to-face education is better!" for the bad parts of the student's experiences, and "Better than nothing!" for the positive aspects of their experiences. It has been decided that a technology approach should be employed to further expand the distance education curriculum in the four universities that have been selected.

Keywords: Covid-19, Distance Education, Online Education, University Students.

AKDENİZ İKLİMİNE UYGUN KURU BEZELYE ISLAH ARAŞTIRMALARI

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Özet

Bezelye hem taze hem de kuru tane olarak üretilip, tüketilmektedir. Ülkemizde kuru bezelye yetiştiriciliği ve üretimi diğer ülkelere oranla oldukça azdır. Bu çalışma ile amacımız, Akdeniz Bölgesine adapte olabilen, yüksek verimli kuru bezelye çeşitlerini üreticiye kazandırmaktır. Bu amaçlar doğrultusunda araştırma, Doğu Akdeniz Tarımsal Araştırma Enstitüsü Müdürlüğü deneme alanlarında 2019 yılı yetiştirme sezonunda yürütülmüştür. Çalışmada 15 adet bezelye genotipi ve 5 adet bezelye çeşidi kullanılmıştır. Araştırma tesadüf blokları deneme desenine göre, 3 tekrarlamalı olarak kurulmuştur. Islah amaçlarına uygun olarak; çiçeklenme gün sayısı (gün), bakla bağlama gün sayısı (gün), bitki boyu (cm), ilk bakla yüksekliği (cm), 100 tane ağırlığı (g) ve verim(kg/da) gibi özellikler incelenmiştir. Araştırmadan elde edilen analiz sonuçlarına göre en yüksek çiçeklenme gün sayısı değeri 60 gün ile TR-61290 Tekirdağ genotipinden elde edilirken, en düşük değer 45 gün sayısı ile Rondo ve Utrillo çeşitlerinden elde edilmiştir. Bitki boyları bakımından incelediğimizde; TR-61290-Tekirdağ genotipi 161 cm ile en yüksek bitki boyu değerine ulaşırken; Carina çeşidi 70.5 cm ile en düşük bitki boyu değerine sahip olmuştur. Verim değeri sonuçlarına göre ise; en yüksek değerler sırasıyla 338.7 kg/da ve 326.3 kg/da ile Carina çeşidi ve Bursa-20 genotipinden elde edilmiştir.

Anahtar Kelimeler: Islah, kuru bezelye, çeşit,

**UX STUDY ON HANDHELD AUGMENTED REALITY GAMES BY APPLYING
SPRADLEY'S NINE DIMENSIONS DESIGN PRINCIPLE**

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Abstract

The first step in researching augmented reality was making a head-mounted three-dimensional display at the beginning of 1968. The idea behind a three-dimensional display is to show the user a perspective image from a different point of view that changes as the user moves. Since that time, the majority of growth in augmented reality has been driven by technology. The researcher's emphasis on AR's technological aspects, such as its hardware and software, has resulted in very few initiatives directed toward user experience and exploration studies. To address the transition of the notion of augmented reality from research/laboratories to the general user, it is necessary to approach the technology in a more user-friendly, user-centric manner. In this study, we focus on handheld augmented reality (HAR) gaming applications and propose to employ Spradley's nine dimensions to investigate components of handheld augmented reality experience so that designers may comprehend the human-centric design approach. we posted a questionnaire to a diverse sample of 215 individuals. After the questionnaire, we select 35 individuals and provide them with our iPhone11 to play AR Games for direct observation. In the result, we found out 61.9% of users know about HAR games, and 8.1% of users played the AR game without understanding that it is known to handle augmented reality implying that even after utilising augmented reality, many are unaware of it. 28.2% (strongly agree) and 32.5% (agree) on the issue that it is easier to get skilled at AR games. We conclude our research by finding out there are 4 insights related to the HAR games. The detail of these insights is discussed in context with the human-centric design in HAR games.

Keywords: handheld augmented reality (HAR), user-centric, Spradley's nine dimensions, human-centric design

**APPLYING UX PRINCIPLES TO FIND PRE-PATTERNS IN HANDHELD
AUGMENTED REALITY GAMES**

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Abstract

Reality-based interfaces that produce "embodied" game play experiences have recently attracted a lot of attention from the gaming industry and allied research areas. Handheld augmented reality (HAR) is a reality-based interface that superimposes computer-generated imagery (CGI) over a user's view of the actual world. In a HAR environment, players can use their existing physical and social skills to engage with the game system. The application of user experience (UX) design principles to augmented reality (AR) systems has received only a limited amount of research attention. In this study, we look into the potential relevance of such principles to the field of handheld augmented reality game development. The UX design tools such as shadowing, ethnographic research, people and context research, empathy mapping and experience map are used to define the pre-patterns in HAR games. **Participants** - We select a sample of 23 gamers of the gaming society Indian Institute of Technology Kanpur. After the sample of 23 gamers we select diverse sample of 27 individuals to dive deep into the UX research.

Keywords - embodied game, handheld augmented reality (HAR), computer generated imagery (CGI), shadowing, experience map, pre-patterns.

HALAL BEHAVIOR IN MEDIA TECHNOLOGY SYSTEM

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Abstract

The development of this modern era, which has entered society 5.0, makes it easier for humans to use technology easily. The growth of this technology can be profitable for various purposes that can be done quickly. However, there are negative impacts that will occur if humans use technology to be misused. One example of the negative impact that exists is the opening of someone's privacy that can be tracked only by using today's modern technology systems. Therefore, efforts must be made to prevent the technology system from being used for useful things only. With the development of technology, of course, human intelligence also increases, for this reason, digital literacy or ethics is needed in using anything related to public technology. Behavior and traits that are formed can be from environmental factors or oneself. Prioritize teaching from an early age about the correct and wise use of technology through formal education or learning moral ethics from the people around you.

Keywords : halal behavior, teknologi , and information

**STRUCTURE-BASED DRUG REPURPOSING TO INHIBIT THE DNA GYRASE OF
MYCOBACTERIUM TUBERCULOSIS**

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Short Introduction

Drug repurposing is an alternative avenue for identifying new drugs to treat tuberculosis (TB). Although TB can be cured with anti-tubercular drugs, the emergence of multidrug-resistant and extensively drug-resistant strains of *Mycobacterium tuberculosis* H37Rv (Mtb), as well as the significant death toll globally, necessitate the development of effective drugs to treat TB.

Experiments and Key result findings:

In this study, drug repurposing approach was employed to address this drug resistance problem by screening drugbank database to identify novel inhibitors of the Mtb target enzyme, DNA gyrase. The compounds were screened against the ATPase domain of gyrase B subunit (MtbGyrB47), and the docking results showed Echinacoside, Doxorubicin, Epirubicin, and Idarubicin possess high binding affinities against MtbGyrB47. Comprehensive assessment using fluorescence spectroscopy, SPR, and CD titration studies revealed that Echinacoside as a potent binder against MtbGyrB47. Further, ATPase, and DNA supercoiling assays exhibited IC₅₀ values of 2.1-4.7 μ M for Echinacoside, Doxorubicin, Epirubicin, and Idarubicin. Among these compounds, the least MIC₉₀ of 6.3 μ M and 12 μ M were observed for Epirubicin and Echinacoside, respectively. Hence, our findings indicate that Echinacoside and Epirubicin target mycobacterial DNA gyrase, inhibit its catalytic cycle, and retard mycobacterium growth. Further these compounds exhibits potential scaffolds for optimizing novel anti-mycobacterial agents that can act on drug-resistant strains.

THE ROLE OF TRADITIONAL MARKETS IN COMMUNITY ECONOMIC GROWTH

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Abstract

This study aims to determine the extent to which the role of traditional as an economic sector in growing the economy of the surrounding community, whether the community is sufficiently assisted by the presence of traditional markets or not. This study uses qualitative methods, with data collection methods through interviews, field surveys, as well as additional scientific literature from books and scientific journals. The results of this study conclude that the market is a sector that is quite taken into account in administering government. Traditional markets are one of the important sectors that support the community's economy. It contains the interests of the small to medium-sized community in meeting their needs. Traditional markets provide good accommodation for the community, especially traders and buyers because traditional markets can make it easy for people to carry out buying and selling transactions. The existence of traditional markets also provides considerable accommodation in improving the community's economy, because they are able to increase the income of traders while the buyers themselves can meet their daily needs easily and can save expenses so it can be concluded that the community can be said to be prosperous and also helped by the existence of traditional markets. Apart from that, the community's economic conditions have been greatly helped by the presence of traditional markets, but there are still some traders who feel that the daily caretaker fees are still too high and the increased income from the regional budget shows this. it is important for the government to develop traditional markets.

Keywords: The role of traditional markets, economic growth, community economy

**NATURAL MODULATION OF THE GUT MICROBIOTA IN DOGS WITH SPINAL
CORD INJURY**

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Abstract

Background The metabolites produced by microbiota metabolism can modulate gut bacterial composition and brain biochemistry acting as neurotransmitters in the central nervous system. Polyphenols are usually hydrolysed by intestinal enzymes or by gut microbiota. In this form they reach blood, tissues and brain where exert biological activities. The dysbiosis is thought to impair recovery by decreasing the production of short-chain fatty acids which play a role in suppressing inflammation within the central nervous system. The gut microbiota can synthesise neurotransmitters or regulate their levels acting on their precursors. Alteration in the homeostasis of gut-brain axis has been associated also to spinal cord injury. Objective To order to show that polyphenols could increase the levels of neurotransmitters in situations of spinal injury where there is an urgent need to generate new neurons. To arrive at these observations, the authors examined how Polenoplasmin and diet solve paralysis in dogs. Materials and methods Dysbiosis could have significant therapeutic value in the management of spinal cord injury. Results In fact, some polyphenol metabolites can modulate directly neuronal receptors. Metabolites from dietary polyphenols exert neuroprotective effects after reaching the brain by crossing blood-brain barrier. Polyphenols indirect actions involve mechanisms that improve the peripheral cerebrovascular health. Conclusion Dietary polyphenols improve vasodilatory response and increase levels of circulating nitric oxide species that are essential in the control of vascular tone; vasodilation and blood flow in the body and in cerebral circulation. Gut microbiota are able to synthesize neurotransmitters thus microbiota homeostasis can impact on spinal cord injury.

Keywords: gut microbiota, polyphenol metabolites, neurotransmitters, spinal cord injury, Polenoplasmin

**INVESTIGATION OF MINERALS IN FRUIT PEELS POWDER: ULTRASOUND
ASSISTED EXTRACTION FOLLOWED BY FLAME ATOMIC ABSORPTION
SPECTROMETRY**

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Abstract

Osteoporosis is a worldwide disease depicted by the reduced bone mass, an adequate supply of minerals are needed to support bone remodeling and their deficiency causes bone-related diseases, osteoporosis in particular, and have osteo-protective effects. The aim of recent research was to quantify the micro (Mn, Fe, Cu, and Zn) and macro elements (Mg, K, and Ca) in the peels powder of some common fruits (pomegranate, orange, lemon, mango, and grapefruit) by flame atomic absorption spectrometer (FAAS). The extraction of micro and macro elements in peels powder was done by using dilute acids in ultrasonic bath. Apple leaves were used as standard reference material (SRM, NIST 1515) to optimize the ultrasound assisted extraction (UAE) method at varied operating parameters. Maximum response was obtained for extracting of minerals in 500 mg SRM at 60 °C temperature, setting a vortexing time of 5 min. while using 5.0 mL extracting agent HNO₃ (0.5 M)-H₂O₂ (10 %) at 90 % sonication amplitude of ultrasound bath for 6 min. While analyzing the SRM, the percentage recovery was obtained in ranged between 96.8-102.7 % to assure the accuracy whereas repeatability (n = 10) study in terms of % RSD yielding ≤ 2.29 well support the precision of proposed method and limits of quantitation (µg/g) were 0.034, 0.061, 0.065, 0.057, 0.017, 0.175 and 0.053 for Mn, Fe, Cu, Zn, Mg, K and Ca respectively. The proposed UAE method was reliable, efficient, and advantageous over the conventionally employed acid digestion method with regards to less consumption of reagents and short analysis time for the determination of micro and macro elements in fruit peels powder.

Keywords: Bone health, Osteoblasts, Osteoclasts, Ultrasound Extraction, Spectrometry

**FARKLI ÖN UYGULAMALARIN SARIMSAK (*Allium sativum* L.)
TOHUMLARINDA DORMANSİNİN KIRILMASI ÜZERİNE ETKİLERİ**

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Özet

Sarımsak, Amarydaliaceae familyasında soğandan (*Allium cepa* L.) sonra en çok kültürü yapılan önemli bir bitki türüdür. Sarımsak, tohumlarında meydana gelen dormansi nedeni ile tohumla çoğaltım yöntemi kullanılarak üretilmemektedir. Sarımsak üretimi ve çoğaltımı dişler ile yapılmaktadır. Ancak, dişler ile çoğaltım yöntemi pahalı olmasının yanı sıra, işçilik de gerektirmektedir. Sarımsak bitkisinin çoğaltımında sarımsak tohumlarının kullanılabilmesi için sarımsak tohumlarında görülen dormansinin kırılması ve çimlenmenin teşvik edilmesi gerekmektedir. Bu çalışmanın amacı, farklı ön uygulamaların (katlama, giberellik asit, ve giberellik asit + katlama uygulamaları) sarımsak tohumlarında dormansinin kırılması üzerine etkilerinin incelenmesidir. Bu çalışmada, iki farklı genotipteki sarımsak populasyonundan elde edilen tohumlar kullanılmıştır ve tohumlar hasat edildikten hemen sonra uygulamalara başlanmıştır. Katlama uygulamalarında; tohumlar 4°C sıcaklıkta, nemli kum içerisinde farklı süreler ile (0, 2, 4, 6 ve 8 hafta) bekletilmişlerdir. Giberellik asit uygulamalarında, tohumlar 16°C sıcaklıkta 72 saat süre ile farklı konsantrasyonlardaki (250, 500, 1000 ve 1500 ppm) giberellik asit çözeltilerinde bekletilmişlerdir. Katlama+GA₃ uygulamalarında ise, tohumlara katlama uygulamalarını takiben giberellik asit çözeltilerinde bekletilmişlerdir. Uygulamalar sonrasında, tohumlar doğrudan çimlendirme testlerine alınmışlardır. Çimlendirme testleri sonucunda normal çimlenme oranı (%), ortalama çimlenme süresi (gün) ve çimlenme indeksi değerleri hesaplanmıştır. Buna göre her iki genotip için de en iyi sonuçlar, 2 hafta süre ile yapılan katlama +1000 ppm giberellik asit uygulamalarından elde edilmiştir.

Anahtar Kelimeler: *Allium sativum* L., GA₃, normal çimlenme oranı, ortalama çimlenme süresi, tohum dormansisi

SELF-AWARENESS OF THE KHAMR EFFECTS

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Abstract

The purpose of this research is to describe self-awareness of the khamr effects. This research method uses a literature review approach that originates from books, journals and other literary sources related to self-awareness of the khamr effects. The results of this study's literature review concluded that there was a significant relationship between self-awareness and khamr consumption behavior. The higher the level of self-awareness, the lower a person's desire to consume khamr, because they already know the negative effects of consuming khamr. Vice versa, the lower the level of self-awareness, the easier it is for someone to be affected by negative things, including consuming khamr. However, a person's attitude of self-awareness is influenced by factors from the individual himself as well as factors from the surrounding environment. The negative impact of khamr can cause mental disorders and even dangerous health problems. In addition, consuming khamr also causes addiction which can cause death due to the long-term effects of consuming khamr. But many khamr consumers ignore the negative effects of khamr. Everything that happens to a person begins with his own mindset and awareness. Therefore a person must have a strong foundation of life principles that must be adhered to.

Keywords: Self-awareness, Impact, Negative, and Khamr

**PENGARUH PENGELOLAAN SISTEM AKUNTANSI KEUANGAN DAERAH
TERHADAP KUALITAS LAPORAN KEUANGAN KABUPATEN PEKALONGAN**

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Abstract

The purpose of this study is to explain the influence of the management of the regional financial accounting system on the quality of the financial statements of Pekalongan Regency. This study uses a systematic literature review method. The data sources for this research come from books, journals and other literature related to the potential and opportunities for exporting halal cosmetic products in Indonesia. Analysis of research data using VOSviewer - Visualization of scientific landscapes. Specifically, the objective of government financial reports is to provide information useful for decision making and to demonstrate the accountability of the reporting entity for the resources entrusted to it to fulfill these objectives. Government Accounting Standards Government financial reports such as balance sheets, budget realization reports, cash flow reports and notes to financial statements, as discussed above, are prepared in accordance with Government Accounting Standards. This standard regulates, among other things, when assets, liabilities, revenues, expenditures, financing receipts, sales expenditures are recorded in accounting and subsequently reported in the financial statements; how to determine the value of each element of the financial statements; how to disclose it so that the reporting of the elements of the financial statements can be adequately explained. If a centralized system is used, the person responsible for accounting for all financial transactions is assigned to one SKPD (usually the Regional Financial and Asset Management Service) and treats transactions that occur as transactions at the regional government level.

Keywords: financial statements, accountancy, management

**INTRODUCTION OF FINANCIAL ACCOUNTING STANDARDS TO SMA/SMK
STUDENTS IN BATANG DISTRICT**

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Abstract

The purpose of this research is to educate students about what financial accounting standards/SAK are. This study uses qualitative methods, with data collection methods through interviews, field surveys, as well as additional scientific literature from scientific journals. The findings in this study conclude that Financial Accounting Standards (SAK) are Statements of Financial Accounting Standards (PSAK) and Interpretations of Financial Accounting Standards (ISAK) issued by the Standards Board of the Indonesian Institute of Accountants (DSAK IAI) and the Sharia Standards Board of the Indonesian Institute of Accountants (DSAS IAI).) as well as capital market regulatory regulations for entities under its supervision. Objectives of Financial Accounting Standards (SAK): For uniformity, relevant and reliable financial statements, Facilitate the preparation of financial reports due to standard guidelines so as to minimize the bias of preparation, Facilitate auditors in auditing, Facilitate financial statement readers to interpret and compare financial statements of different entities , There are many users of financial statements so that the preparer cannot explain it to each user. There are 4 types of SAK, namely SAK, SAK-ETAP, SAK Syariah, and SAK EMKM. The process for preparing Financial Accounting Standards: The Due Process Procedure for preparing and repealing financial accounting standards/sharia financial accounting standards and the Due Process Procedures for preparing technical bulletins and annual improvements are not required to follow all due process stages regulated as referred to in paragraph.

Keywords: Financial Accounting Standards, financial reports, Indonesian Accounting Association

AN OVERVIEW OF E-WALLET

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Abstract

This study aims to explain the use of e-wallets for students of the Islamic Faculty of Economics and Business UIN K.H. Abdurrahman Wahid Pekalongan. This study uses a descriptive qualitative approach. Researchers obtained data by conducting interviews as primary data and secondary data obtained data from books, journals, other written information that has relevance to the research topic. This research involved fifteen students of the Faculty of Islamic Economics and Business at UIN K.H. Abdurrahman Wahid Pekalongan who uses e-wallets in transactions. This research resulted in the following conclusions: current technological developments affect all activities that were originally done manually, now they can be done instantly. As a result, the needs of consumers in terms of making payments have also changed, where initially the payment system was made with cash, now a non-cash payment system has appeared in the form of an e-wallet. E-wallet is a form of Fintech (Financial Technology) that utilizes internet media and is used as an alternative payment method. In Indonesia there are various e-wallet products, the most popular of which include Dana, ShopeePay, GoPay and Ovo. Advertisements and social environmental factors are the main sources of e-wallet information for students. Students use e-wallets for various needs, such as transportation needs, buying credit, buying food, and shopping for clothes. The three basic reasons are the attractive promos offered, convenience, and ease of payment because they can be made anywhere to make students interested in using them.

Keywords: e-wallet, use value and benefits, cashless and digital payment

CHARACTERISTICS OF THE ISLAMIC ECONOMY

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Abstract

This study aims to explain the Characteristics of Islamic Economics. This study uses a literature review approach that originates from books and journals related to the characteristics of Islamic Economics. This research literature review resulted in the following conclusions: Islamic economics is a decision-making process of production, distribution and consumption activities based on sources of Islamic law, namely the Koran and hadith. The characteristics of Islamic Economics include three main principles. The three of them fundamentally and jointly regulate economic theory in Islam, namely the principles of faith, morality and the principle of law (muamalah). There are several characteristics of Islamic Economics as mentioned in Al Mawsuah Al-ilmiyah wa al-amaliyah al Islamiyah which are summarized as follows: Property Belongs to Allah and Humans Be the Khalifah of wealth; Economy is Bound by Aqidah, Sharia (Law), and Moral; Balance between Spiritual and Material; Islamic Economics creates a balance between individual interests and public interests; Individual Freedom Guaranteed in Islam; The State Is Authorized to Intervene in the Economy; Consumption Guidance; Investment Instructions; Riba Prohibition; Zakat. The relationship between Islamic economics and Islamic faith is evident in many ways, such as the Islamic view of the universe which is subdued (provided) for the benefit of humans. The relationship between Islamic economics and faith and sharia allows economic activity in Islam to become worship. Islam emphasizes the importance of functioning money in its normal field, namely as a transaction facility and a means of valuing goods. Among the factors that divert money from its normal field is interest (usury).

Keywords: Characteristics economics Islam, faith, and morals

**KAHRAMANMARAŞ KOŞULLARINDA BAZI EKMEKLİK BUĞDAY
ÇEŞİTLERİNİN OPTİMUM AZOT İHTİYAÇLARININ BELİRLENMESİ**

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Özet

Bu araştırma, son yıllarda Doğu Akdeniz Tarımsal Araştırma Enstitüsü tarafından tescil ettirilmiş ekmeçlik buğday çeşitlerinin azotlu gübre ihtiyaçlarının Kahramanmaraş bölgesi için belirlenmesi amacıyla yürütülmüştür. Deneme, Doğu Akdeniz Geçit Kuşağı Tarımsal Araştırma Enstitüsü (Kahramanmaraş) arazilerinde, tesadüf bloklarında bölünmüş parseller deneme deseninde üç tekerrürlü olarak kurulmuş, ana parsellerde çeşitler, alt parsellerde ise azot dozları yer almıştır. Araştırmada 4 adet ekmeçlik buğday çeşidi (Gökkan, Yakamoz, Altınöz ve Candaş) tohumluk materyali olarak kullanılmıştır. Ekmeçlik buğday çeşitleri için 5 farklı azot düzeyi (0, 7, 14, 21 ve 28 kg N/da) uygulanmıştır. Ekimle tüm parsellere dekara 8

kg P₂O₅ düşecek şekilde gübreleme yapılacaktır. Araştırma sonucunda, buğday çeşitleri için gerekli optimum saf azot (N) dozları belirlenmiştir. Yapılan araştırmada; tüm çeşitlerde verim ile azot dozu arasında kuadratik ilişki ($Y=a+bx+cx^2$) olduğu tespit edilmiştir. Buna göre azot dozları ile buğday verimleri arasındaki ilişki; Gökkan çeşidi için $Y=237.02+37.92X-0.91X^2$ ve buna göre uygulanabilecek optimum azot miktarı 20.83 kg/da'dır. Yakamoz çeşidi için; $Y=166.58+23.43X-0.55X^2$ ve optimum azot miktarı 21.30 kg/da'dır. Altınöz çeşidi için; $Y=236.56+39.76X-1.07X^2$ ve optimum azot miktarı 18.57 kg/da ve Candaş çeşidi için ise $Y=222.78+36.74X-0.96X^2$ ve optimum azot miktarı 19.13 kg/da olarak belirlenmiştir. Yapılan araştırmada azot dozlarının bazı verim (bitki boyu, metrekarede başak sayısı, 1000 dane ağırlığı, hektolitre ağırlığı) ve kalite (protein, gluten, sedimantasyon) parametreleri üzerine etkileri de araştırılmıştır.

Anahtar kelimeler: Ekmeklik buğday, azot dozu, verim, kalite

TAX FUNCTION FOR THE STATE

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Abstract

This study aims to explain the importance of the tax function for the state. This study uses a descriptive qualitative method based on a literature review approach and analysis sourced from books and journals related to the importance of the tax function for the state. This research literature review resulted in the following conclusions: The largest source of state revenue in Indonesia is taxes. So Tax is an obligation of every citizen which is collected by the government of a country every year through a special agency or agency that handles tax collection matters. The amount of tax that must be paid depends on the amount of income or the object of the tax. Tax is not something foreign to the ears of the general public, almost all groups of people know about taxes. Where taxes are coercive, so do not be surprised if a terrible picture in the minds of the people appears when the word "Tax" is mentioned. So that people who have registered as taxpayers are directly overshadowed by dependents because they have to share the proceeds earned to pay taxes, especially since the benefits cannot be felt immediately. Taxes have two functions, namely taxes as a source of state finance (budgetair) meaning that taxes are a source of government revenue to finance expenditures, and taxes as regulators (regularend) meaning taxes are a tool for regulating or implementing government policies in the social and economic fields, as well as achieving certain non-financial purposes.

Keywords: tax, tax function for the state, tax function

**EFFICIENT VALORIZATION OF POULTRY BY-PRODUCTS VIA METHANE
PRODUCTION OPTIMIZATION**

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Abstract

This investigation concerns the employment of poultry by-products as a substrate for anaerobic digestion and the enhancement of methane production. Experimental trials employing chicken waste as substrate were conducted at a temperature of 38°C in order to explore the influence of various factors, such as ratios of inoculum to the substrate, pH, feather effect, and inoculum type, on anaerobic digestion. The results show that the yield coefficient exhibited a range of variation across the tested values, with the maximum methane production of 275 ml CH₄ obtained under optimal factors including an inoculum-to-substrate ratio of 50%, a pH of 8, chicken waste without feathers, and an inoculum with a basic solution. Moreover, in order to elevate the digestibility of chicken waste, diverse pretreatments were examined, such as dilution pretreatment using different dilution factors of 2, 4, 6, and 8, and the impact of extra alkalinity was evaluated using different volumes of 10, 30, and 50 ml. The combination of these two pretreatments resulted in an increase in methane yield to 550 ml, corresponding to a 107% improvement relative to the yield from untreated poultry by-products.

Keywords: Anaerobic digestion. waste recovery, poultry by-products, Pretreatment. Methane production. Bioenergy.

PILLARS AND TERMS OF SALE AND PURCHASE

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Abstract

This study aims to explain the pillars and conditions of buying and selling. Judging from the type of data, the method used in this study is a qualitative approach. This study resulted in the following conclusions: According to the term pillar, it is defined as something that is formed into the existence of something other than its existence, considering that something exists with the pillars or the elements themselves, not because of their uprightness. As for conditions, according to the terminology of the jurists as formulated by Muhammad Khudlari Bek, is something whose absence obliges and results in the absence of the law itself. Buying and selling is considered valid if the pillars and conditions have been fulfilled. The pillars in question are: First, there is a seller and a buyer, both of them must meet the requirements, namely wise, mature, not extravagant, and no coercion from any party. Second, there are goods to be traded, with the condition that the goods must be present at the time of the transaction, in the form of useful assets, belonging to themselves and can be controlled, and not disgusting items such as carrion and excrement. Finally, there is a sighat or consent sentence, consent granted can be done with the words submission or acceptance, or it can also be in written form, such as invoices, receipts, or notes, and et cetera. The terms of the consent granted are clear and understandable statements, and shows the will of both parties.

Keywords: Pillars, Terms, and Buying and Selling.

**MICRO SMALL MEDIUM ENTERPRISES (MSMEs) PERCEPTION ON THE
IMPORTANCE OF FINANCIAL REPORTS**

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Abstract

This study aims to determine the development of MSME businesses in recording financial reports, so that later they can be used as material for evaluating researchers to socialize recording and reporting of financial reports for MSME business actors. In this study using the literature review method obtained from previous research books and journals related to the Perceptions of MSME Actors on Financial Statements and using a technique in the form of the documentation method. Based on this study, information was obtained that MSME actors often underestimate the recording of financial reports, even considering that financial reports are something complicated. Padahal by recording financial reports in accordance with SAK EMKM standards can increase the credibility of the company and can be used as material for evaluating the company's performance in one period. So far, MSME entrepreneurs only make very simple financial reports, so they are not in accordance with SAK EMKM rules.

Keywords: MSME, financial reports, EMKM

EFFECTIVE TIME MANAGEMENT STRATEGIES FOR COLLEGE STUDENTS

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Abstract

The purpose of this research is to describe an effective time management strategy for university students. This research method uses a literature review approach that originates from books and journals related to effective time management strategies for students. The results of this research literature review concluded that students must have an effective management strategy so that the time they have is not wasted. Effective time management will improve student learning outcomes. By optimizing a good management strategy it will have a major effect on learning outcomes. However, managing time management strategies is not easy for students. Most of the results of student research cannot be consistent with effective time rules. The process of setting a strategy is very important. If it is related to time, the process of forming a strategy in making time management becomes a matter of principle. Time requires a strategy in using it, if students can manage time strategies efficiently it means that students are also able to manage their lives effectively. The management strategy process is characterized by efforts to achieve goals through certain strategies and policies. Thus the first step is goal setting. The second step is determining the strategy to achieve these goals. With a strategy in managing time, it means that students can make the best use of their time so that the time they have is not wasted. With a strategy, students are able to manage time well. Students will not be confused in managing time, because they already have a strategy that has been made.

Keywords: Strategy, time management, effective

**THE EFFECT OF TRINEXAPAC-ETHYL ON PLANT HEIGHT, YIELD AND SOME
AGRICULTURAL TRAITS OF WINTER BREAD WHEAT (*Triticum aestivum* L.)**

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Abstract

This study was carried out at Sakarya Maize Research Institute in the Pamukova district of Sakarya province to investigate the effects of different doses of trinexapac-ethyl on plant height, yield and some agricultural characters in winter wheat in 2021-2022. The experiment was established with four replicates according to the randomized blocks experimental design, and the Alada variety (plant height: 90-105 cm) was used as a plant material. Plant height, grain yield, 1000 grain weight, hectoliter weight, seed size (over 2.5 mm sieve) and number of grains per spike traits were examined in both the trinexapac-ethyl applied plots and the control plots in the experiment. The data of investigated traits were subjected to variance analysis and the mean values were compared using the DUNCAN multiple comparison method. As a result, it was determined that a 10 g/da dose of trinexapac-ethyl significantly shortened the plant height (13-14%) and increased the grain yield of wheat.

Keywords: Wheat, yield, lodging

**THE DECISION TO MARRY WITHOUT HAVING CHILDREN (CHILDFREE)
FROM HUMAN RIGHTS PERSPECTIVE (WOMEN'S REPRODUCTIVE RIGHTS)**

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Abstract

The purpose of this study is to examine the decision to marry without having children or childfree from the perspective of human rights (women's reproductive rights). The research method used is library research which originates from books and journals related to childfreeness in the perspective of Human Rights (HAM). The data analysis technique in this research uses a qualitative descriptive analysis technique. Childfree is a term for people who make the decision not to have children - childfree. The decision to be childfree raises a negative stigma from society. Childfree can be defined as a view of a husband and wife who decide not to have children. Childfree is not a new term, many married couples in big countries have chosen this decision. The decision to choose childfree in household life cannot be separated from the role of husband and wife. This is because it concerns their reproductive rights. Human rights are a form of guaranteed protection in law, especially women's rights, the decision to Childfree is something that does not affect the marriage relationship. It depends on the female body. Therefore, Childfree's decision is a woman's right and a person's personal right that must be supported. Even though there has been a change in the purpose of marriage which is no longer focused on the presence of a child. However, it turns out that the presence of children will always be considered important in marriage. Therefore, the changes that have occurred have enabled society to begin to accept marriage conditions that have so far been considered less than ideal, for example childless marriages.

Keywords: Childfree, Reproduction, Human Rights

THE LATEST DEVELOPMENTS IN THE ISLAMIC ECONOMY IN INDONESIA

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Abstract

This study aims to explain the latest Sharia Economic Development in Indonesia. This study uses a literature review approach sourced from books and journals related to the latest Islamic economic developments in Indonesia. This research study resulted in the conclusion that the development of sharia economy in Indonesia has developed, the proof is the existence of various Islamic financial institutions, the existence of sharia economics study programs, a lot of sharia economic literature, the existence of sharia economic and business consulting companies, the presence of Muslim economists and the emergence of sharia economic movement organizations. The government also participates in the development of the sharia economy in Indonesia, namely by creating regulations to support the development of sharia business.

Keywords: Development, Sharia Economy, and Indonesia.

ETHIC and MORAL PROBLEMS in the PRESENT

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Abstract

In society there are various problems that occur between ethics and morals, such as examples of drug abuse and illegal drugs, drugs are now one of the problems of morality in society, corruption and neoptism are social diseases that hit the world community. Especially in newly developing countries, say Indonesia, this disease is a serious problem and very difficult to eradicate. as for also crossing the street randomly one of the violations that generally occurs on the street is pedestrians, therefore the solution that needs to be needed is awareness from the community because it can endanger the lives of hell, littering even though a place has been provided for the garbage but there are still people who throw it away haphazardly, as we know that in religion there are values of morality and ethics, therefore religious education in the community is very necessary, and also environmental and social factors are one of the factors that cause people to fall into morality problems, as expressed "bad associations destroy good habits" means wherever we are and with whom we associate it will have an impact on our way of life. Therefore, we must be careful. From this problem, it can be concluded that the problem of morality is a problem that continuously becomes our problem. Because like it or not, we as humans live in a diverse socio-cultural environment. Therefore, let's take care of each other and our families so that we don't get into issues of morality and ethics.

Keywords: Problems, Ethics, Morals

**INFLUENCE OF WELFARE PACKAGES ON CONSTRUCTION WORKERS
PRODUCTIVITY IN NIGERIA: A REVIEW**

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Abstract

The economic favourable growth, large profitability, social progress and performance of any organisation is directly depended on the high labour productivity output. Furthermore, in every labour intensive industry, such as the construction industry, project performance is tied to the effectiveness and efficient of its labour productivity. The poor performance of the Nigerian construction industry in terms of project delay, low productivity output, and quality deficiency are caused by inadequate utilisation of welfare facilities and lack of basic amenities for the workers. Based on this, various theories relating to welfare packages and employees productivity were synthesised to bring to the fore through review the welfare packages influence on worker's productivity. The Functional labour welfare theory holds that, employees are more effective, efficient, committed, and productive when their welfare is being taken care of which in turns leads to their mental and physical satisfaction. However, Equity theory to employees welfare assumes that employees should be fairly and sufficiently rewarded according to the amount of effort they put in to perform a particular job. The review revealed that a set of mutually reinforcing, integrated welfare packages have a more substantial influence on workers productivity. Thus, best welfare packages, and policies to improve the construction workers productivity are suggested.

Keywords: Welfare packages, productivity, construction workers, construction industry, Nigeria

**PRODUCTION FACTORS IN THE DEVELOPMENT OF THE ISLAMIC
ECONOMY IN INDONESIA**

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Abstract

The purpose of this study is to explain the basic concepts of the basic principles of Islamic economics namely belief in Allah SWT as the Rabb of the universe, so that this is very closely related to the factors of production. This research method uses a library approach sourced from books and journals that are in accordance with the topic and focus of the research. The findings are that in Islam producing something is not just for self-consumption or selling to the market. These two motivations are not enough, because they are still limited to economic functions. Islam specifically emphasizes that every production activity must also realize a social function. In view of economics can be divided into two parts between economic philosophy and economics. The difference between Islamic economics and conventional economics lies in the economic philosophy, not in economics. Economic philosophy provides a spirit of thought based on Islamic values and sharia limitations, while economics contains tools of economic analysis that can be used. With this framework in mind, the factors of production in the Islamic economy are the same as the factors of production in the conventional economy, which in general can be expressed in terms of the production factor of labor, the factor of production of raw and auxiliary materials, and the factor of capital production. Among the three factors of production, it is the capital production factor that requires special attention because in conventional economics the interest system is applied. The effect of interest on capital turns out to have a widening impact on the level of production efficiency.

Keywords: Development, Factors and Production

**THE IMPORTANCE OF VOCATIONAL COMPETENCE CERTIFICATION FOR
STUDENTS FOR THE NEEDS OF FUTURE LIFE**

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Abstract

The purpose of this study is to explain the importance of vocational competency certification for students for future life needs. This study used a qualitative method, with data collection methods through interviews, field surveys, and using a systematic literature review. The findings in this study conclude that the purpose of qualification certificates for SMK students is basically to prepare experts who are ready to work and produce quality and competent graduates. by the employer. Job seekers consider hiring SMK graduates who have the skills and specialties that suit them. Based on these aspects, qualified SMK graduates have a greater chance of being accepted at a company, of course, in a field of work that is in accordance with the required scope of majors. Large companies are of course also very considerate when looking for workers to work in their companies, especially in the field of internal accounting, because this is related to the smooth preparation of the company's financial reports which have an impact on the survival of the company. Vocational High School qualification certificates do not guarantee 100 percent acceptance to work at companies, but they can increase opportunities to be considered in employee selection. In addition, it is a matter of pride for SMK graduates who have a qualification certificate, because it is proof that knowledge, skills and attitudes have been verified by an independent third party to meet qualification standards.

Keywords: competency certification, company, opportunities

**POSSIBLE REGENERATIVE EFFECT OF BONE MARROW MESENCHYMAL
STEM CELL-DERIVED EXOSOMES IN OLEIC ACID- INDUCED LUNG INJURY
IN RATS**

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Abstract

Acute lung injury and its advanced form, Acute Respiratory Distress Syndrome (ARDS), are important respiratory complications that are difficult to treat and have a high mortality rate. Although ARDS is frequently encountered in intensive care units, no substance or drug has been developed to treat pathological findings such as a neutrophilic alveolitis, hyaline membrane deposition and microthrombus formation. In this project, regeneration results of bone marrow-derived mesenchymal stem cells, which have been known to provide cell and tissue regeneration for years, and stem cells-derived exosomes, which are investigated as a new therapeutic treatment method, in acute lung injury were demonstrated. Oleic acid administered to rats at a dose of 60 mg/kg administered via the tail vein produced significant lung damage as shown in figure 3. When histopathological analysis was performed, oleic acid caused significant bleeding, infiltration, edema and hyperplasia in the lung parenchyma tissue. According to the

scoring of the histopathological image, damage parameters were 3 times more intense in the oleic acid group than in the control. Bone marrow stem cells in 1×10^6 numbers given from the tail vein 2 hours after acute lung injury resulted in a dramatic improvement in the parameters of bleeding, infiltration, edema and hyperplasia caused by oleic acid application. Serum total antioxidant capacity levels were evaluated by administering 1×10^6 number of exosomes released from bone marrow mesenchymal stem cells in acute lung injury induced by oleic acid (60 mg/kg) in rats. While oleic acid suppressed total antioxidant capacity as expected, exosome administration did not reverse this suppression. ANOVA was used for statistical analysis and Dunn-Sidak multiple comparison test was used for post-hoc test. The marrow stem cell group was found to be significant compared to the MSC-exosome group.

Keywords: Acute Respiratory Distress Syndrome, Acute lung injury, Exosome, Mesenchymal stem cell, Regenerative medicine

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THE ROLE OF FINANCIAL LITERACY IN FINANCIAL MANAGEMENT

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Abstract

The purpose of this research is to describe the role of financial literacy in financial management. This research method uses a literature review approach that originates from books and journals related to the role of financial literacy in financial management. The results of this research literature review concluded that financial literacy greatly influences the way financial management in adolescents and has a negative effect on student consumptive behavior. Students who have low ability in financial literacy will make wrong decisions in consuming, because in consuming they do not take into account priority needs. Students who have good financial literacy will be selective in consumption, they will prioritize buying what they need, and set aside what they want. Student financial literacy is measured using 5 (five) indicators, namely an understanding of needs, an understanding of scarcity, an understanding of economic principles, an understanding of economic motives, and an understanding of economic activity. Knowledge of the economy has an important role in shaping a person's consumption behavior. Individuals with a better level of financial literacy are expected to be able and more selective in determining which product to consume and prioritizing their needs first and adapting it to the abilities of each individual. The importance of financial literacy will minimize students' consumptive behavior in consuming if students apply economic theories in everyday life. However, students who have good financial literacy are not necessarily able to minimize consumptive behavior. This is influenced by various factors, for example student personality, lifestyle, and self-control.

Keywords: Financial Literacy, Financial Management, and Students.

THE IMPORTANCE OF PRIVATE FINANCE MANAGEMENT

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Abstract

This study aims to explain the importance of personal financial management. This study uses a literature study approach sourced from books and journals associated with the relevance of personal finance management. The study literature results in the following conclusion: financial management is a person's responsibility for his or her finances. So finance management is important to regulate the daily balance because every need is never separate from finance. College needs are getting longer and longer and more and therefore need to be managed well, that is, by regulating spending- spending that is tailored to his/her income. Personal financial management in it there is a lifestyle that has priority. It can also be called the power of priority and influence the level of discipline of a person when managing the money he or she makes every day. Money management is done because it is an individual responsibility in daily life. "Money is not everything"

Keywords: Emergency, Management, and Personal Finance Management

PENTINGNYA BAHASA INDONESIA YANG BAIK DAN BENAR

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Abstract

The purpose of this research is to describe the importance of good and correct Indonesian from a subjective perspective. This research method uses a literature review approach that originates from books and journals related to the importance of the Indonesian language. The results of this research literature review concluded that the importance of the Indonesian language has several advantages, namely facilitating communication. Good and correct Indonesian can facilitate communication between individuals or groups with different backgrounds and cultures. Clear and structured language will help messages to be conveyed more easily understood and interpreted. Increasing the credibility of using Indonesian properly and correctly will increase one's credibility in speaking or writing. People who use proper Indonesian will be seen as more intelligent, educated, and trustworthy. Improving the ability to think Indonesian is good and right to help improve the ability to think logically. Strengthening national identity Indonesian is the national language that strengthens Indonesian national identity. Good and correct language helps maintain the purity of the Indonesian language, thereby strengthening national unity and pride. Increasing career opportunities in good and correct Indonesian is an important requirement in the world of work. The use of appropriate and regular language will increase one's chances of getting a job or achieving a successful career. Improving foreign language skills in good and correct Indonesian can help improve foreign language skills. When a person masters Indonesian well, it will be easier for him to learn a foreign language because he has a strong foundation in using the language. Preserving the Indonesian language is good and correct, helping to preserve the Indonesian language.

Keywords: Language, structure, and Indonesia.

**INVESTIGATION OF THE ANTI-CANCER EFFECTS OF PHOTODYNAMIC
THERAPY BY USING THE SCHIFF-BASE LIGAND COMPLEX AS
PHOTOSENSITIZERS ON HUMAN BREAST CANCER CELL LINE**

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Abstract

Breast cancer is a malignant disease with high morbidity and mortality rates. Chemotherapeutic agents used in breast cancer have serious side effects. For this reason, Photodynamic Therapy (PDT), which has photoactive agents, offers an alternative treatment in this regard as a method that can treat cancer by combining a photosensitizer and light of a certain wavelength in the presence of oxygen. The purpose of the present study was to uncover possible antitumor activity and mechanism of action of the newly designed Palladium (Pd)-conjugated Schiff-base Ligand (SBL)-mediated PDT on MCF-7 cells by comparing it with Cisplatin. LED light source was used in the study. Newly synthesized Pd-conjugated SBL (complex-1, complex-2) agents with

cisplatin were applied to MCF-7 cells. MCF-7 cells were incubated with agents for 4, 8, and 12 hours for cellular uptake analysis. In MTT analysis, the toxic effects of the agents on MCF-7 cells were determined after 48 and 72 hours of incubation. After the optimization experiments, light (Control, Cisplatin, Complex-1, Complex-2) and non-light (Control, Cisplatin, Complex-1, Complex-2) cells groups were formed. Cell death was examined by flow cytometry. The level of ROS was evaluated with the DCFDA Kit. In our results, the cellular uptake rate of MCF-7 cells to which the agents were applied was found to be at the highest level at the 12th hour. It was determined that the light-exposed cisplatin, complex-1 and complex-2 groups increased cytotoxicity after 72 hours of incubation. In addition, it was observed that ROS levels increased in cisplatin, complex-1 and complex-2 groups with and without light. Also, apoptotic and necrotic cell death was observed in these groups. However, cell death weren't detected in the light and non-illuminated complex-2 groups. In conclusion, complex-1 agent had potential as a candidate anticancer agent in FDT on MCF-7 cells, but complex-2-mediated PDT hadn't anticancer activity.

Keywords: Photodynamic therapy, cell death, MCF-7; reactive oxygen species, schiff base, palladium

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**THE ROLE OF PARENTS IN OVERCOMING TEEN FANATICISM TOWARDS
ONLINE GAMES**

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Abstract

The purpose of this study is to analyze the role of parents in overcoming the impact of adolescent fanaticism on online games. This research method uses a literature review approach that originates from books and journals related to adolescent fanaticism towards online games. The results of this research literature review concluded that fanaticism can be interpreted as belief in a fanatical object which is often associated with something or excessive enjoyment of an object, where this fanatical attitude is usually shown through enthusiasm for extreme objects, emotions, excessive interest in a long time, and often assume what they believe is the most correct thing. Teen fanaticism towards online games can be a serious problem because it can interfere with their daily life and make them lose interest in other things. In reducing fanaticism, it is necessary to have the role of parents in minimizing the addictive level of playing online games in their children, so that in the future they can live their lives in harmony without causing negative effects from unexpected problems. Some of the roles of parents in overcoming adolescent fanaticism for online games include limiting the time to play games, namely parents can help control teenage fanaticism by managing the time to play online games. They can set a daily time limit for playing games and ensure that teens do not exceed the allotted time. In addition, parents can also encourage other activities, establish communication, limit children's pocket money and snacks and get professional help.

Keywords: Teens, Online Games. and Fanaticism

FACTORS TRIGGERING TEEN FANATICISM TOWARDS ONLINE GAMES

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Abstract

The purpose of this study was to analyze the factors that trigger adolescent fanaticism towards online games. This research method uses a literature review approach that originates from books and journals related to adolescent fanaticism for online games. The results of this research literature review concluded that fanaticism can be interpreted as a belief in fanatical objects that are often associated with something or excessive pleasure in an object, where this fanatical attitude is usually shown through enthusiasm for extreme objects, emotions, excessive interest in time for a long time, and often assume what they believe is the most correct thing. Fanaticism in online games in adolescents can be triggered by an attitude of dependence on games. Teenagers who play online games too often and for too long can become addicted to these games and consider them an important part of their lives. Playing games with great frequency and intensity can have side effects of addiction and dependency. As for the consequences that arise, the individual will continue to pursue it. This can cause them to become fanatical and obsessed with the game. Then other triggering factors are fanatical gaming communities, influence of friends or groups, opportunities to escape from problems, lack of understanding of healthy boundaries in playing games, influence of social media, and inadequate education. All of these factors can predispose adolescents to become fanatical and obsessed with certain online games, which can be detrimental to their mental and social health.

Keywords: Teens, Online Games. and Fanaticism

THE INFLUENCE OF SOCIAL MEDIA ON BUSINESS ACTIVITIES

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Abstract

The purpose of this study was to determine the effect of social media on business activities. This research method uses a literature study approach that originates from previously existing journals and is relevant to the purpose of this study. The results of this literature study conclude that social media is very influential on today's business activities. Social media is now used as a medium for buying and selling online. Compared to traditional buying and selling activities or having to meet directly between sellers and buyers, online buying and selling activities have many advantages. The existence of social media is the easiest marketing and promotion media and through social media is also more efficient. Promotion using social media has also increased business activities, especially due to easy marketing, production activities have also increased. For example, if previously handmade handicraft sellers in Indonesia themselves lacked interest, by using social media handmade handicraft sellers could market their products abroad where they have an interest in handmade handicraft products. This shows that social media is very influential on business activities.

Keywords: Social media, business activities, influence

**ADLI GENETİKTE KİMLİKLENDİRMEDE STR'LERİN YERİNİ SNP'LER
ALACAK MI**

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Özet

Suç olaylarının aydınlatılmasında adli kimliklendirme amacıyla kullanılan STR lokuslarının kullanımı standart bir yöntem haline gelmiştir. Yirmi yılı aşkın bir süredir, 300-400 baz çifti uzunluğundaki STR bölgeleri adli genetikte kimliklendirmeye katkı sağlamaktadır. Olay yerinden toplanan biyolojik örneklerin, sıcaklık, nem, vb çevresel etkenlere maruz kalması nedeniyle DNA yapısında degradasyon meydana gelebilmektedir. Bu durumda STR lokusları ile 100 bp den küçük, analiz edilemeyen degrade DNA örneklerinin, SNP (Tek Nükleotid Polimorfizmi) analiz yöntemi ile incelenmesi mümkün hale gelmektedir. Bireylere fenotipik ve genotipik özellikler kazandıran DNA'nın polimorfik gen bölgelerinin özelliklerinden dolayı SNP'ler, günümüzde adli kimliklendirmede soy tahmini, fenotip tahmini, biyocoğrafik kimliklendirme gibi çalışmalarda kullanılmaktadır. Şüpheli bir durumda, STR profili ile bir eşleşme olmadığında, olay yerinden toplanan biyolojik örneğin kime ait olduğunun belirlenmesine yardımcı olabilecek herhangi bir bilgi çok değerli olacaktır. Bu nedenle adli genetikte, analizi güç olan biyolojik örneklerin ait olduğu kimliğin teşhis edilmesinde, adli DNA fenotipleme ile mağdur/maktül/şüpheli'nin yaşı, saç ve göz rengi gibi fiziksel görünümü hakkında ek bilgilerin çıkarılmasında, SNP'lerin kullanımı tercih edilmektedir. Şüpheli bir şahıs ile olay yerinden gelen DNA örneklerinin aynı kaynaktan gelip gelmediğini tespit etmek için, miras, annelik-babalık davalarında akrabalık ilişkilerinin belirlenmesinde, antropolojik çalışmalarda, felaket kurbanlarının kimliklendirilmesinde ve kayıp kişilerin belirlenmesinde SNP'ler kullanılmaktadır. Ancak bu uygulamalarda bazı çözümlenebilir engeller bulunmaktadır. Bunlar, adli alanda uygulamanın gerçekleşmesi sırasında meydana gelen etik hususlardır. Bir diğer husus ise; SNP'lerin Türkiye'de adli alanda uygulanmasıyla ilgili veri tabanının mevcut olmamasıdır. Ancak SNP'lerin kimliklendirmede kullanımının hız kazanmasıyla adli veritabanı oluşabilecek, dolayısıyla SNP'ler adli olayların çözümlenmesinde rutin olarak kullanılabilir nitelik kazanabilecektir. 1990'lı yıllardan bu yana STR çalışan laboratuvarlar tarafından özellikle CODIS verileri ile ilgili büyük bir veritabanı oluşmuştur. SNP'lerin kullanımıyla bu verilerin göz ardı edilmesi mümkün değildir. Mali yönden de değerlendirilecek olunursa; STR ile analizi mümkün olmayan ve degrade olan DNA örneklerinde SNP kullanımı mümkün görünmektedir. Bu düşünceden yola çıkarak, Jandarma ve Sahil Güvenlik Akademisi, Adli Bilimler Bölüm Başkanlığı, Adli Doğa Bilimleri Bölüm Başkanlığı'nda "SNP'leri kullanarak göz rengi ve saç rengi tahmininin adli kimliklendirmede optimizasyonu" başlıklı bir proje gerçekleştirerek, çalışmalarımızla veritabanına ve de suç olaylarının çözümlenmesine katkı sağlamayı planlamaktayız.

Anahtar Kelimeler: DNA, STR, SNP, Adli kimliklendirme, Fenotipleme

WILL SNPs REPLACE STRs IN FORENSIC IDENTIFICATION

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Abstract

The use of STR loci for forensic identification in the investigation of criminal cases has become a standard method. For over two decades, STR regions of 300-400 base pairs in length have contributed to identification in forensic genetics. The DNA structure of biological samples collected from crime scenes may be degraded due to exposure to environmental factors such as temperature and humidity. In this case, it becomes possible to examine degraded DNA samples smaller than 100 bp, which cannot be analyzed with STR loci, by the SNP (Single Nucleotide Polymorphism) analysis method. Therefore, SNPs are preferred in forensic genetics to identify the identity of difficult-to-analyze biological samples and to extract additional information about the physical appearance of the victim/suspect, such as age, hair and eye color, through forensic DNA phenotyping. SNPs are used in cases involving inheritance, maternity, and paternity, as well as in studies such as ancestry estimation, phenotype estimation, and biogeographic identification in forensic identification. SNPs have also been used to determine whether DNA samples from a suspicious person and DNA samples from the crime scene come from the same source, and to identify disaster victims. However, there are ethical issues that arise during the realization of the application in the forensic field, and a database on the application of SNPs in the forensic field is currently lacking in Turkey. With the increasing use of SNPs in identification, it is possible that a forensic database will be established, allowing for routine use of SNPs in solving forensic cases. From a financial point of view, it seems possible to use SNPs in degraded DNA samples that cannot be analyzed by STR. Since the 1990s, STR laboratories have built up a large database, particularly of CODIS data. It is not possible to ignore this data with the use of SNPs. We have been planning to carry out a project titled "Optimization of Eye Color and Hair Color Estimation Using SNPs in Forensic Identification" at the Gendarmerie and Coast Guard Academy, Department of Forensic Sciences, Department of Forensic Natural Sciences, and contribute to the database and the analysis of criminal cases with our studies.

Keywords: DNA, STR, SNP, Forensic identification, Phenotyping

ADVANCES OF TiCN CVD COATINGS FOR ENHANCED CUTTING TOOL PERFORMANCE

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Abstract

TiCN (titanium carbonitride) coatings deposited using chemical vapor deposition (CVD) have become increasingly popular for cutting tool applications due to their excellent mechanical and tribological properties. The development of TiCN coatings has been driven by the need for improved tool life, increased cutting speeds, and better surface finishes in various metal machining applications. This paper summarizes the recent advancements in TiCN CVD coatings for cutting tool applications. Also, the present paper focuss on the CVD process and the various parameters that can affect the deposition of TiCN coatings, including precursor selection, deposition temperature, gas flow rate, and pressure. Next, the mechanical and tribological properties of TiCN coatings are examined, including hardness, wear resistance, and coefficient of friction. The effect of coating thickness and substrate material on the properties of TiCN coatings is also discussed. The paper then discusses the recent advancements in TiCN CVD coatings, including the incorporation of elements such as aluminum and silicon to improve the properties of the coatings. Additionally, the use of new precursors and the development of novel deposition techniques, such as pulsed-CVD and plasma-enhanced CVD, are explored. The review also covers the surface modification of TiCN coatings using various techniques, such as laser treatment to improve their performance. Finally, the paper summarizes the current state of TiCN CVD coatings for cutting tool applications and highlights the future research directions. The paper concludes that TiCN CVD coatings have shown great potential for cutting tool applications, with the recent advancements in the deposition process and surface modification techniques improving the performance of these coatings. The review also suggests that further research is needed to optimize the deposition process and to develop new techniques to further improve the properties of TiCN CVD coatings for cutting tool applications.

Keywords: Chemical Vapor Deposition, TiCN Coatings, Cutting Tools, Wear Resistance, Hardness, Film Properties, Advancements, XRD; AFM; TEM; Coating-structure and microstructures.

**IS DEPRESSION EFFECTIVE ON EATING ATTITUDES AND BEHAVIORS? A
CROSS-SECTIONAL RESEARCH**

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Abstract

Eating disorders are defined as the deterioration of eating behaviors and the negative effects of body weight due to this deterioration. Depression, on the other hand, is known as an emotional state that manifests itself with loss of interest and pleasure in ordinary activities, great sadness, feelings of guilt and worthlessness, loss of appetite, sleep loss and loss of sexual desire. The aim of this study is to evaluate the relationship between depression and eating attitudes and behaviors in adults. The research was carried out on a total of 288 individuals, 103 (35.8%) male and 185 (64.2%) female, aged between 18-70 years. The data were collected with a questionnaire and the questionnaire included questions about the descriptive information of individuals, Eating Attitude Test-26 (EAT-26) and Beck Depression Inventory. It was determined that 28.6% of women and 9.7% of men had the risk of depression ($p<0.05$). Dieting, bulimic behavior scores, and total EAT-26 scores of individuals at risk of depression were found to be higher than those without ($p<0.05$). Statistically significant correlations were obtained between body mass index and oral control score and between BDI score and dieting, bulimic behavior, oral control subscale and total EAT-26 score ($p<0,05$). As a result, eating behaviors may differ according to depression status. However, studies should be conducted with different sample groups and larger samples in which depression and eating behaviors are evaluated together.

Keywords: depression, eating behavior, dieting, oral control behavior, bulimic behavior

IMPROVING THE ACADEMIC PERFORMANCE OF STUDENTS

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Abstract

This research was carried out to find out the causes of low performance in students with the view to using activity-based methods in helping students to improve upon their academic performances. The study took place at New Abirem Senior High School in the Birim North District of the Eastern Region in Ghana. Some students were used as a sample and the accessible population. Class exercises and observation were the technique used to collect data on the low performance of the students under study in the academic year 2021-2022. This study is based on qualitative research method. As a result, it was obvious that teachers are not aided in the provision of teaching-learning materials and that was hindering their effectiveness in teaching.

Keywords: Academic, performance, improve

BANK MUAMALAT INDONESIA INFORMATION

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Abstract

This study aims to analyze the information of Bank Muamalat Indonesia. This study uses a literature review approach. This literature research concludes that the Company is the first bank in Indonesia to use the concept of Sharia banking. The company was founded based on the Deed of Establishment No. 1 November 1 1991 AD or 24 Rabiul Akhir 1412 Hijriah, made before Yudo Paripurno, SH, Notary, in Jakarta. The establishment deed was approved by the Minister of Justice of the Republic of Indonesia in Decree No. C2-2413.HT.01.01 of 1992 dated March 21, 1992 and was registered at the Central Jakarta District Court office on March 30, 1992 under No. 970/1992 and announced in the State Gazette of the Republic of Indonesia No. 34 dated 28 April 1992 Supplement No. 1919A.

Keywords: Company, Bank muamalat, and Indonesia

**E-COMMERCE PRACTICES IN INDONESIA IN A SHARIA ECONOMIC REVIEW
IMPLEMENTATION TOLERATED HAPPILY**

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Abstract

This research aims to describe the Implementation of Happy Tolerance. This research uses the library research method. The main data sources in this study come from books, journals and other manuscripts that are relevant and related to the Implementation of Tolerance with Joy. This research literature review concluded that radicalism in educational institutions is a religious phenomenon in society. Various data and findings show that campuses and schools are exposed to radicalism. The problem of radicalism and intolerance in educational institutions also shows a hidden character of intolerance. Many students are reluctant or do not need to give Christmas greetings to Christians. This case both shows the narrative that tolerance is important. Both of them tend to see tolerance as limited to respecting and appreciating different religions but forget to carry out tolerance internally (to their own religion). The potential to be different is huge. This difference results in the birth of different legal results, because it is influenced by the social conditions in which this proposition lives. Religion is a matter of interpretation, and fiqh is a matter of definition. We want to hold a single definition or truth about who is tolerant and who is intolerant, between who is radical and who is not. Efforts to tolerance are rarely seen and built from within, fellow religions. Like, how do we understand, realize, tolerate various thoughts, understandings, regarding differences in Islamic law (fiqh) or differences in the interpretation of religious texts, and so on.

Keywords: tolerated, happily

IN VITRO TECHNIQUES FOR PREDICTION OF NUTRITIONAL QUALITY OF RUMINANT FEEDS

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Abstract

The milk yield and growth of ruminant animals are largely dependent on the quality of the feed. Especially seen as low voluntary intake and digestibility. Determining the in vivo intake and digestibility of feedstuffs is time consuming, laborious and expensive. It is also not suitable for large scale feed evaluations as it requires large quantities of feed. Therefore, many attempts have been made to estimate intake and digestibility using in vitro techniques. For these purpose a lot of methods have been developed, evaluated and modified. In vitro methods can give more accurate and reliable results. Because in vivo microorganisms and enzymes are more sensitive to undetectable factors affecting the rate and level of digestion. To be effective, in vitro methods must be reproducible and have a good correlation with in vivo parameters. In vitro methods are cheaper and less time consuming, while maintaining experimental conditions more precisely than in vivo experiments. Developed by Menke et al., (1979) gas test method is very simple to apply and does not require advanced equipment. In this review, the advantages and disadvantages of in vitro techniques used for feed evaluation were described.

Keywords: Feed evaluation, in vivo, in vitro, digestibility

**THE URGENCY OF EDUCATION AND RESEARCH TECHNOLOGY IN LAUNCHING AN
INDEPENDENT CURRICULUM**

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Abstract

The purpose of this research is to describe the urgency of MENDIKBUDRISTEK in launching the independent curriculum. This study uses the method of literature review. The main sources of data in this study come from books, journals and other manuscripts that are relevant and related to the Urgency of the Ministry of Education and Culture in launching the independent curriculum. This research literature review concluded that the Minister of Education, Culture, Research and Technology (Mendikbudristek), launched the Independent Curriculum on 11 February 2022 online. The Merdeka curriculum is much more concise, simpler and more flexible to be able to support learning loss recovery due to the Covid-19 pandemic. Apart from that, through the Independent Curriculum it is also to catch up with Indonesian Education from other countries. At the start of the pandemic, the Ministry of Education and Culture launched the Emergency Curriculum, as the first step of the Independent Curriculum. In the Emergency Curriculum, the government drastically reduced the amount of material. So that students and teachers can focus on exploring the most essential topics. There is no compulsion in this choice because the government offers it to schools. They can then see if the Emergency Curriculum is much simpler, so teachers can focus. In addition, the Merdeka Curriculum can also be adapted to the online system. So teachers and students are not burdened with a lot of material. The Minister of Education and Culture also emphasized the Independent Curriculum as an option without coercion for educational units. Because schools that are not comfortable implementing the Independent Curriculum are still allowed to choose the first option, namely the 2013 Curriculum. The Independent Curriculum is part of the teachers at school. According to him, teachers must be able to adjust to changes. Because the implementation of the Independent Curriculum cannot be separated from the role of the teacher.

Keywords : MENDIKBUDRISTEK, Independent curriculum

**ELECTRONIC AND STRUCTURAL PROPERTIES OF NOVEL SERIES OF
HETEROCYCLIC OF COUMARIN AND QUANTITATIVE STRUCTURE ACTIVITY
RELATIONSHIP (QSAR) STUDIES AND GOLBRAIKH AND TROPSHA'S CRITERIA OF
VALIDATION**

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Abstract

Drug discovery and design are inextricably linked to various branches of chemistry, particularly organic chemistry. Many aspects of chemistry must be involved in order to translate knowledge of the molecular, genetic, and cellular bases of cancer into effective therapies. Thus, the goal of this research is to identify promising active compounds for coumarin as CK2 protein kinase inhibitors using a QSAR model and drug similarity analysis. CK2 is a ubiquitous Ser/Thr-specific protein kinase that is required for cell cycle viability and progression. CK2 levels are particularly high in proliferating, normal, or transformed tissues, and transgenic mice expressing its catalytic subunit are responsible for lymphomas. The work began with the optimization of the equilibrium structures of the basic coumarin in order to select the most reliable forecasting approach compared to experimentation and at the lowest computational cost. Following our research, we conduct a multiple linear regression (MLR) analysis to generate QSAR models. An external validation research was done because the results show that the QSAR model of CK2 inhibitory activity is robust and has extremely strong prediction capacity, as indicated by R² values of 0.951 and 0.927, respectively, following linear regression analysis. The investigation using QSAR models is successful in screening 34 candidate chemicals. Following that, the compounds under consideration were evaluated for drug-likeness and reactivity (ADME, golden triangle, lipophilicity indices). The results reveal that when supplied orally, the majority of the substances have no bioavailability issues. The data also aid in determining which chemicals do not have clearance issues, as well as which are the most stable and reactive among those examined. The anticipated findings of this study may aid in the development of novel coumarins with significant CK2 inhibitor activity.

Keywords: coumarine, CK2, QSAR, MLR.

**DEVELOPMENT OF A MACHINE LEARNING-BASED SELLER RANKING ALGORITHM
FOR E-COMMERCE MARKETPLACES**

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Abstract

On e-commerce marketplace websites and mobile applications, multiple sellers can sell the same product. When a seller wants to add a new product to the store, the system first checks if the product is available on the marketplace. If the product is available, it is added as a new seller under the existing product code without creating a new product code. This screen, where the same product is displayed with different seller options, is called "Buybox". The order in which sellers are listed on the "Buybox" screen is very important. This is because most product sales are made by the seller who is in the first place. At the same time, the higher a seller is in the ranking, the more likely he/she is to make a sale. In this study, a sorting algorithm based on Extreme Gradient Boosting (XGBoost) has been developed to rank sellers on the Buybox screen. A dataset of 57690 rows consisting of 8 attributes of products sold on Trendyol.com has been created. The sorting algorithm has been tested on 4 different product categories including electronics, fast-moving consumer goods (FMCG), textiles and default. The default category includes all electronics, FMCG and textile products. The performance of the developed algorithm has been evaluated using Mean Absolute Error (MAE). The MAE's obtained for the electronics, FMCG, textile and default categories are 2.49, 0.91, 0.31 and 1.54, respectively. In general, the performance of the ranking algorithm has been found to be high for all categories.

Keywords: Ranking Algorithm, Machine Learning, E-commerce Marketplace

**PENGARUH PENGELOLAAN SISTEM AKUNTANSI KEUANGAN DAERAH TERHADAP
KUALITAS LAPORAN KEUANGAN KABUPATEN PEKALONGAN**

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Abstract

The purpose of this study is to explain the influence of the management of the regional financial accounting system on the quality of the financial statements of Pekalongan Regency. This study uses a systematic literature review method. The data sources for this research come from books, journals and other literature related to the potential and opportunities for exporting halal cosmetic products in Indonesia. Analysis of research data using VOSviewer-Visualization of scientific landscapes. Specifically, the objective of government financial reports is to provide information useful for decision making and to demonstrate the accountability of the reporting entity for the resources entrusted to it to fulfill these objectives. Government Accounting Standards Government financial reports such as balance sheets, budget realization reports, cash flow reports and notes to financial statements, as discussed above, are prepared in accordance with Government Accounting Standards. This standard regulates, among other things, when assets, liabilities, revenues, expenditures, financing receipts, sales expenditures are recorded in accounting and subsequently reported in the financial statements; how to determine the value of each element of the financial statements; how to disclose it so that the reporting of the elements of the financial statements can be adequately explained. If a centralized system is used, the person responsible for accounting for all financial transactions is assigned to one SKPD (usually the Regional Financial and Asset Management Service) and treats transactions that occur as transactions at the regional government level.

Keywords: financial statements, accountancy, management

REMOVING AQUEOUS WASTE WITH COST-EFFECTIVE BIOADSORBENTS

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Abstract

This study's goal was to synthesize and construct biomaterials of the cationic and anionic types. These substances were utilized as adsorbents in waters that had been contaminated by various adsorbates that were probably prevalent in the environment. In order to describe the various materials, various approaches (IRTF, DRX, MEB, BET, and ATG/DTA) will be used. Studies on the adsorption by these substances will be conducted while changing a number of variables, including pH, mass, concentration, and temperature. Removal of effluents in aqueous media, particularly the adsorption technique, which appears to be well suited to remove pollutants due to its shown efficacy as well as for financial reasons, using inexpensive adsorbents such agricultural and industrial wastes.

Keywords: Characterization; Different materials; Water treatment; Bio adsorbents; adsorption

ISLAMIC ECONOMIC REVIEW ABOUT E-MONEY

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Abstract

This study aims to analyze the Islamic economic review of e-money. This research uses research literature study data obtained indirectly. Sources of data needed in this research are books, journals and documents relevant to this research. The results of the study concluded that E-money in the perspective of Islamic Economics has now become part of technological advances in society, so it is lawful and has fulfilled the principles of Islamic law as a means of transaction and muamalah. This halalness is based on the rules and the existence of demands for human needs for electronic money, and consideration of the many benefits that exist in it, both for the benefits to the users of the electronic money themselves and the parties concerned. In addition, with electronic money, people can get security and comfort in carrying money. If it is associated with gharar and maysir, it is clear that this electronic money does not contain gharar or maysir aspects. This is because the nominal value that can be used is exactly the same as that deposited. As for administration fees, in this context, it is a service that is permissible because of the services that are obtained by the holder of the electronic money. Regarding the cost of making a card and administrative costs, this is actually an optional value. Not the value stated on the card. In addition, organizers must be based on retail payment needs which demand faster and more efficient transactions to avoid maysir.

Keyword: E-Money, Transactions, and Islamic Economics

GEBE BİR KÖPEKTE KRONİK DİYAFRAM FITIĞININ TEDAVİSİ

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Özet

Diyafram, plevral ve peritoneal boşluklar arasında fiziksel bir bariyer görevi görür. Ventilasyona ve lenfatik sıvının hareketine yardımcı olma işlevi gören tendon-kas yapısına sahip bir septumdur. Abdominal içeriğin diyaframdan herniasyonu doğuştan veya travmatik bir olayın sonucu olabilir. Konjenital veya plöroperitoneal herniler köpeklerde ve kedilerde nadir olarak görülür. Diyafram, glottis açıkken karın üzerine kuvvetli bir darbe ile yırtılır ve akciğerler, diyaframın kraniyal olarak hareket etmesine izin vererek kollabe olabilir. Diyafram fitiğinin varlığını belirlemek ve rüptür yerini lokalize etmek için radyografi yapılır. Radyografiler, diyafragmatik silüetin bir kısmının veya tamamının kaybını, kalbin normal kaudal silüetinin bir kısmının veya tamamının yokluğunu ve ayrıca yer değiştirmiş iç organların ve sekonder plevral sıvının varlığına bağlı olarak toraksta artan doku yoğunluğunu gösterebilir. Karaciğer, dalak, hava veya sindirimle dolu mide, hava veya sindirimle dolu duodenum, hava veya sindirimle dolu jejunum veya hava veya dışkıyla dolu kolon olduğundan, abdominal organların pozisyonundaki bir değişiklik tanıya yardımcı olur. Bu organların tamamı veya bir kısmı kraniyal yönde göğüs boşluğuna doğru yer değiştirebilir. Abdominal organların pozisyonundaki bu kraniyal kayma sadece karın içinde olabilir veya göğüs boşluğuna kadar uzanabilir. Her iki durumda da, hem göğüs boşluğunun hem de karın boşluğunun radyografik görünümü normalden belirgin şekilde farklıdır. Midenin göğüs boşluğu içinde kalması ve pilorus geçişinin engellenmesi durumunda midede genişleme meydana gelebilir. Göğüs boşluğu içinde gizlenmiş gastrointestinal segmentlerin varlığını göstermek veya karın içinde pilor antrumunun ve duodenumun fıtıklaştığını belirlemek için bir indirekt radyografi yöntemi olan baryum sülfat takip çalışması yapılabilir. Böylece göğüs boşluğu içerisine fıtıklaşmış mide, ince bağırsaklar ve kolon radyografide opasitesi artmış olarak görüntülenebilir ve seyri takip edilebilir.

Anahtar kelimeler: Cerrahi, diyafram, göğüs, köpek

ASSESSMENT OF THE DIELECTRIC PROPERTIES OF BARIUM TITANATE/POLYMER COMPOSITES: EFFECTS OF THE POLYMER MATRIX STRUCTURE

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Abstract

The electricity consumption and generation can be regarded as a stringent problem that needs urgent solving. It is paramount to preserve the balance in the electricity grids for ensuring an adequate supply to the home or industrial consumers. The developments in the area of devices working on alternative energy resources imposed the stabilisation of the unsteadiness among the demand and supply by storing the excess of electricity. In this context, the scientists were determined to find suitable materials that allow the storage of electric energy. For instance, the main component of a capacitor is the dielectric medium, which must exhibit an improved permittivity and a high dielectric breakdown field. Relying on the depicted background, this work is aiming to estimate the dielectric characteristics of some polymers loaded with distinct amounts of barium titanate. Several polymer structures were chosen as matrix, namely poly(methyl methacrylate), polyimide, cellulose acetate butyrate, polystyrene, polybenzoxazine and poly-4-vinylpyridine. The electrical properties of the matrix materials were determined by group contribution theory. Since the excellent dielectric features of barium titanate are widely recognized, their involvement in improving the effective permittivity of the studied polymers is analyzed. This was done by employing specific mixing rules. It was found that in all multiphase systems the addition of the ceramic particles conducted to the augmentation of the dielectric constant. Also, the molecular polarizability of each polymer was shown to influence the electrical performance of the composite. The differences given by the mixing relations are also discussed here. Another addressed aspect was the

impact of the dielectric characteristics of the ceramic filler in the tetragonal, orthorhombic, or cubic phase on the overall properties of the samples. All the aforementioned aspects are crucial for producing polymer composites with suitable electrical parameters that are matching the demands for manufacturing the dielectric parts, which can be implemented in capacitors or other related devices.

Keywords: flexible polymer, ceramic filler, dielectric properties.

Acknowledgement: This work was supported by a grant of the bilateral scientific cooperation between the Romanian Academy and Consiglio Nazionale delle Ricerche CNR-Italy, project number P2-AR-CNR-2023-2025.

**ABSORPTION EDGES AND MORPHOLOGY OF REINFORCED POLYVINYL ALCOHOL
WITH VARIABLE AMOUNTS OF PRISTINE/MODIFIED CARBON-BASED FILLER**

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Abstract

In the context of the fast evolution in the area of the polymer-based materials, many technologies have registered a tremendous progress. The synergism of the concepts derived from nanotechnology and polymer processing have led to a new category of materials, namely polymer nanocomposites. Considering the above premises, this work presents studies on the preparation and characterization of some composites containing a hydrosoluble matrix which was loaded with two sorts of carbon –based fillers. Thus, in polyvinyl alcohol matrix were incorporated variable quantities of pristine or modified carbon nanotubes. The mentioned filler was selected owing to its widely known excellent electrical and mechanical properties. Furthermore, for generating a better interaction with the polymer matrix having lots of hydroxyl functional groups, the carbon nanotubes were chemically modified by hydroxylation reaction. This procedure renders functional moieties on the filler walls that lead to better wettability with polyvinyl alcohol. The level of the filler dispersion in the matrix was studied by means of optical microscopy, showing good homogeneity of the samples. In order to understand how the filler affects the electronic structure of the polyvinyl alcohol, UV-VIS spectra were obtained. From these data, it was possible to further determine the dependence of the absorption coefficient and from its variation with the photon energy, the Urbach energy – depicting the structural disorder in the samples – was evaluated. Next, the Tauc theory was applied to the spectral data and the optical band gap energy was estimated as

a function of the filler amount in the composite. The results were also discussed by considering the sorts of the filler introduced in the polyvinyl alcohol matrix. The influence of the functionalization on the calculated optical parameters was analyzed. The presented data in this work is very important for applications which are involving polymer-based materials, characterized by flexibility, enhanced electrical properties and mechanical resistance. Such films are of great interest for introducing them in electronic devices.

Keywords: polymer composite, carbon-based filler, morphology, absorption edges.

**SOL ANTEBRACHIUMDA OSTEOSARCOMA MEYDANA GELEN BİR KÖPEKTE
TÜMÖRLÜ DOKUNUN OSTEOTOMİ YÖNTEMİ İLE UZAKLAŞTIRILMASI**

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Özet

Osteosarkom (OSA), köpeklerde en sık görülen kemik tümörüdür (malign kemik tümörlerinin %80'inden fazlası). OSA'lı köpeklerin %80'i akciğer metastazı nedeniyle ölmektedir. OSA'nın etiyopatogenezi bilinmemektedir, ancak çeşitli predispozan faktörler (cinsiyet, vücut ağırlığı) gelişimine yol açabilir. Vücut ağırlığı 40 kg'ın üzerinde olan köpekler, daha küçük köpeklere göre daha yatkındır. Çalışmaların çoğu, bu neoplazmanın erkekleri dişilerden daha sık etkileme eğiliminde olduğunu göstermektedir. Bir neoplazmanın yeri, metastaz ve ölüm riskini artırır. Distal radiusta lokalize olan tümörler daha düşük metastaz riski ile ilişkilendirilirken, proksimal humerus ve distal femur veya proksimal tibia lokalize tümörler yüksek metastaz kabiliyetine sahiptir ve bu da mortalitede önemli bir artışa neden olur. Klinik belirtiler primer tümörlerin konumuna bağlıdır. Apendiküler OSA'da tipik klinik belirtiler şunlardır: topallık (belirgin bir ağrı olsun ya da olmasın) ve tümör bölgesinde genellikle tümörün çevredeki yumuşak dokulara yayılmasının bir sonucu olan lokal şişlik. Esas olarak Rottweiler, Alman Çoban Köpeği, Boxer, Doberman Pinscher, Setter). En sık orta yaş köpeklerde (6 ila 10 yaşları arasında) görülür. Topografik konum apandiküler iskelet (vakaların %64'ü), eksenel iskelet (%28, 5) (kaburgalar ve kafatası) ve ekstraskeletal kaslar (%7, 5). Apendiküler OSA ön ayaklarda arka ayaklara göre daha sık görülürken, ekstraskeletal OSA öncelikle viseral organlarda (adrenal bez, göz, mide bağı, ileum, böbrek, karaciğer, dalak, testis ve vajina) gelişir.

Gereç ve Yöntem

Melez ırkı 10 yaşlı köpekte sağ antebrachiumun distalin de gelişen osteosarkomun tedavisi için planlama yapıldı muayene aşamaları tamamlandıktan sonra çekilen X-ray görüntüleme işlemi sonrası bilgisayarlı tomografi (GE HiSpeed 2 kesit) çekildi. Tomografi işlemiyle belirlenen sağlıklı kemik doku sınırları belirlendi. Operasyon yapılan plan çerçevesinde gerçekleştirildi.

Anahtar kelimeler: Cerrahi, köpek, kemik, kanser, operasyon

**EVALUATION OF THE DIELECTRIC PERFORMANCE OF A MODIFIED
CELLULOSE MATRIX CONTAINING DIFFERENT METAL-BASED FILLERS**

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Abstract

The dielectric characteristics of the polymer-based layers have been presenting huge interest for the fabrication of flexible components implemented in energy storage devices, especially in capacitors. The performance of the materials can be modulated by combining the benefits of the polymers and filling particles. It is widely acquainted that inorganic reinforcement agents, such as metal oxides, are exhibiting tremendous applicative potential since they are able to improve the electrical properties of polymers. In this work, a theoretical evaluation of certain parameters of some polymer composites designed for energy storage purposes, are investigated. For this goal, hydroxypropyl methylcellulose (HPMC) was chosen as matrix due to its remarkable biodegradability, water solubility, easy of processing, mechanical stability and flexibility features. This polymer was further loaded with fillers, like manganese-doped zinc oxide (ZnMnO), titanium dioxide (TiO₂), hafnium oxide (HfO₂) and tantalum pentoxide (Ta₂O₅). The dielectric constant of this cellulosic matrix was ascertained by employing a method that accounts on its structural characteristics, which are quantified through connectivity indices. Then, the effects created by the different quantities of the metallic particles introduced in the matrix on the dielectric properties of the composites were predicted by using certain mixing rules. Furthermore, the critical analysis of the data acquired with these models was done. The next step involved the evaluation of the dielectric breakdown and electric energy density for all the proposed composite systems. These electrical parameters together with the dielectric constant are essential factors in describing the multicomponent material suitability of storing electrical energy. This reported approach is providing a facile and quick tool for designing polymer composites with optimal targeted electrical properties without expensive consuming of the raw substances used in synthesis stage. In this way, it is possible to appraise the best composition and association of polymer and filler to acquire the desired performance of dielectric layers utilizable for energy-related applications.

Keywords: cellulose ester, composite, bio-filler, dielectric constant.

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**4-AZIDO-2-(4-İKAMELİFENİL)-5-(3-NİTROFENİL)-2H-1,2,3-TRİAZOLLERİN
SENTEZİ**

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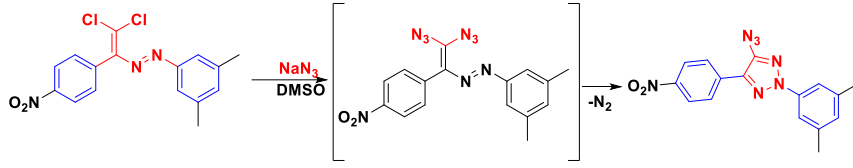
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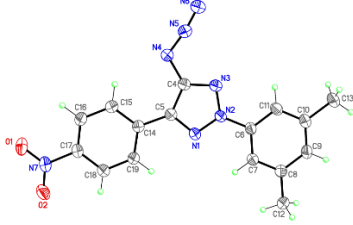
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Özet

Önceki çalışmalarda 2-nitrobenzaldehit bazında sentezlenen diklorodiazadienlerin NaN_3 ile reaksiyonundan 4-azido-2H-1,2,3-triazoller sentezlenmişti. Reaksiyon sırasında azit anyonunun çift bağındaki heminal klor atomlarının yer değiştirmesi sonucu devamsız bis-azidlerin oluştuğu belirlendi. Daha sonra azot molekulunun ayrılması ve molekül içi siklizasyon reaksiyonu sonucunda karşılık gelen 1,2,3-triazoller elde edildi. Azit grubunun organik sentezdeki yer değiştirme reaksiyonlarına kolayca dahil olması onların geniş bir uygulama alanına sahip olmalarının önünü açmaktadır. Özellikle birçok tıbbi maddelerin sentezinde kullanmak mümkündür. Bu yöntem, biyolojik olarak aktif 4-azido-2H-1,2,3-triazollerin elde edilmesi için çok etkili bir sentez yöntemi olarak kabul edilebilir. Bu doğrultuda 3-nitrobenzaldenitten sentezlenen diklorodiazadienler üzerinde araştırmalara devam edilmiş ve 1,2,3-triazoller sentezlenmiştir.



Sentezlenen bileşiklerin yapısı, NMR ile birlikte RQA araştırma yöntemi ile doğrulanmıştır.



Anahtar kelime: triazol, diklorodiazadien, fizyolojik olarak aktif madde

(E)-1-(1-(4-(TERT-BÜTİL)FENİL)-2,2-DİKLORVINİL)-2-(P-İKAMELİ)DİAZENLERİN
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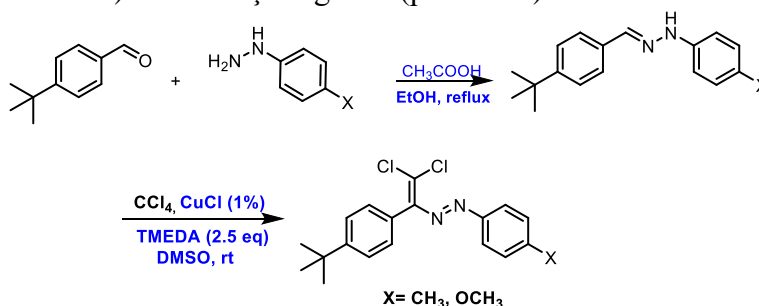
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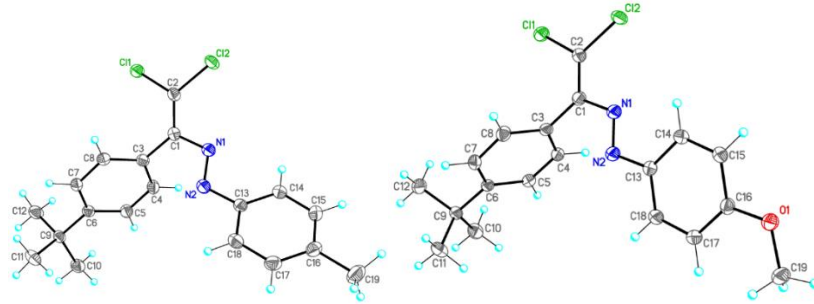
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Özet

Aromatik aldehytlerin fenilhidrazinler ile reaksiyonundan N-ikameli fenilhidrazonların ve onların polihaloalkanlar (CCl₄, CBr₄ ile) ile reaksiyonundan dihalodiazadienler sentezlendiği tarafımızdan belirlendi. Polihalojen bileşikleri organik çözücülerde iyi çözünür olmaları nedeniyle onların yararlı sentonlar, ilaçlar, boyalar vb. çeşitli uygulama alanlarında kullanılabileceğini gösterir. Bu nedenle, tert-bütül benzaldehytin çeşitli hidrazinlerle reaksiyonlarından fenilhidrazonlar sentezlendi ve CuCl katalizörü varlığında CCl₄ ile reaksiyondan (E)-1-(1-(4-(tert-bütül)fenil)-2,2-diklorovinil)-2- ile karşılık gelen. (p-ikameli) diazenler elde edildi.



Elde edilen bileşiklerin yapısı, RQA yönteminin yanı sıra NMR yöntemiyle de doğrulandı.



Anahtar kelimeler: diklorodiazadien, fenilhidrazonlar, X-ışını çalışmaları

METİL(E)-4-(2,2-DİKLOR-1-(FENİLDİAZENİL)VİNİL)BENZOAT TÜREVLERİNİN
SENTEZİ

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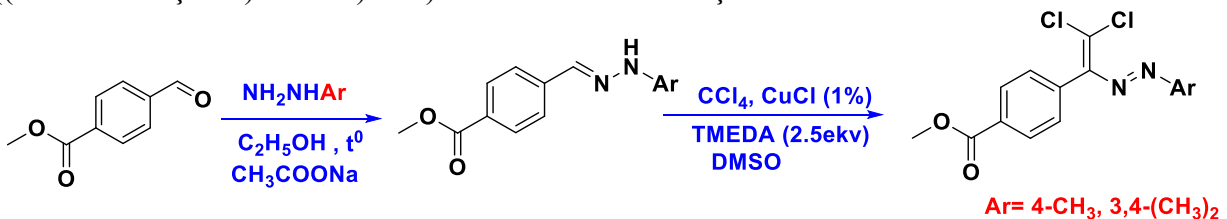
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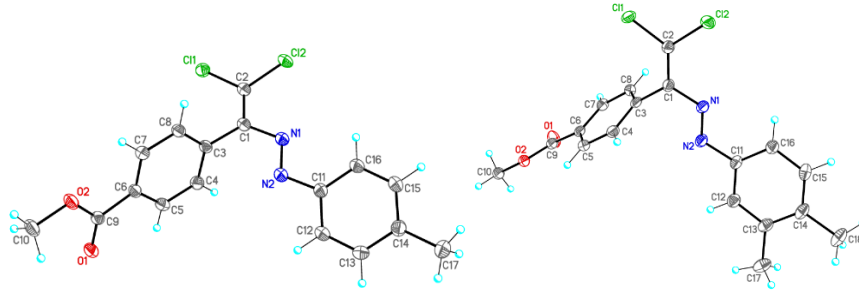
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Özet

Daha önceki çalışmalarda dihalogendiazadienlerin sentezi birçok aldehite dayalı katalitik olefinasyon reaksiyonu koşulları altında, bunların bazı dönüşüm reaksiyonlarından ise triazollerin ve α -ketoasitlerin aril-hidrozo türevlerinin sentezi gerçekleştirilmiştir. Bunlar dikkate alınarak araştırmalara ilk kez eter grubu içeren benzaldehit ile devam edilmiştir. Bunun için metil 4-formülbenzoatın ilgili fenilhidrazinler ile reaksiyonundan fenilhidrazonlar elde edilmiştir ve onun da CCl_4 ile reaksiyonundan metil (E)-4-(2,2-dikloro-1-((ikameedilmişfenil)diazenil)vinil)benzoat sentez edilmiştir.



Elde edilen bileşiklerin yapısı, RQA yönteminin yanı sıra NMR yöntemiyle de doğrulandı.



Anahtar kelimeler: diklorodiazadien, fenilhidrazonlar, X-ışını çalışmaları

APOPTOTIC EFFECT OF CYNARIN ON CANCER CELLS

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Abstract

Most epidemiological studies show that a diet rich in vegetables and fruits in particular has cancer-preventive properties. The beneficial effects of this diet can be attributed to polyphenols, bioactive compounds with anticancer properties. One of the foods containing these polyphenols is artichoke. Artichoke (*Cynara scolymus* L.) is a perennial plant that has been used as food from the past to the present, especially in the Mediterranean diet. This plant is rich in phenolic acids and flavonoids. It is also an important medicinal plant for therapeutic purposes or as a supportive treatment. Polyphenols from the edible part of artichoke have been shown to be a potential chemopreventive on various cancer cells. Cynarin has been identified as the most important polyphenol in artichoke. Cynarin (1,3-O-dicaffeoylquinic acid), found in plants of the *Astraceae* family, is a derivative of dicaffeoylquinic acid. Cynarin is found mostly in the head and leaf parts of this plant. However, the plant contains Cynarin in very low amounts. This component, which enhances the effects of artichoke, has many health benefits. The potential health effects of Cynarin can be summarized as anti-carcinogenic, hepatoprotective, choleric, cholesterol-lowering, diuretic, anti-atherosclerotic, antioxidative, antibacterial, anti-diabetic and immunomodulatory activity. Polyphenol compounds show antiproliferative and apoptosis-inducing effects in cancer cells. They also have the ability to regulate cell differentiation and cell cycle. These compounds can stimulate apoptosis in cancer cells as prooxidants as well as repairing and healing cells as antioxidants. Polyphenols in artichoke have been shown to activate the apoptotic mechanism of cancer cells via mitochondrial pathway or death-receptor pathway at high doses. There are studies showing that low doses induce aging in cancer cells through epigenetic and ROS-mediated mechanisms. In support of the studies, high doses of Cynarin applied to some cancer cells are reported to have tumor suppressor effects by stimulating apoptosis. However, it was found that low doses did not have any effect on apoptosis. In conclusion, Cynarin may be a promising compound in cancer chemoprevention or treatment. For this reason, it is thought that more *in vitro* and *in vivo* studies should be conducted to further clarify the apoptotic effects of Cynarin.

Keywords: Cynarin, Polyphenol, Cancer cells, Apoptosis

**EVALUATION OF SOYBEAN BREEDING LINES FOR CULTIVAR DEVELOPMENT
IN MEDITERRANEAN REGION AS A MAIN CROP CONDITIONS**

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Abstract

The objective of this study was to evaluation the agronomic and quality traits of soybean breeding lines in the main crop growing season for Mediterranean region. This study was conducted in the Eastern Mediterranean Agricultural Research Institute experimental area in 2019. The experimental design was randomized complete block design with three replications. Seventeen soybean breeding lines and three varieties, Mona, Lider, Sa88, were used as plant material. In the study, days to maturity, plant height, number of pods, 1000 seed weight, seed yield, protein ratio, fat ratio and fatty acid compositions were investigated. According to the research findings, seed yield values varied between 223.7-558.4 kg/da. In the experiment, the average of control varieties was determined as 451.7 kg/da and seven soybean breeding lines performed above trial standard averages. The highest fat content was obtained from Mona (24.5 %) and the highest protein content was obtained from the DA-12-14-(1-3) breeding line (40.9%).

Keywords: Agronomic traits, soybean, yield, quality, main crops

**HISTOCHEMICAL ANALYSIS OF THE SYMPATHETIC NERVOUS STRUCTURES
IN THE WALL OF THE INTERNAL ILIAC ARTERIES**

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Introduction

The study of the nervous apparatus in the walls of blood vessels in various areas in some vertebrates adds to the information about the features of the sympathetic innervation of the blood vessels. The study of the nervous apparatus of the vessels provides information on their various functional activities. Functional changes in the nervous structures in the walls of blood vessels have recently been encountered frequently.

Purpose of the study

The aim of the study was to investigate sympathetic nerve structures in the wall of the internal iliac arteries of white rats.

Material and methods

The material for the study was pieces of the wall of the internal iliac arteries taken from 15 female white rats weighing 250–400 grams. Sympathetic nerve fibers and structure were identified using the technique of V.N. Shvaley and N.I. Zhuchkova.

Results

The study showed the presence of a clearly visible sympathetic innervation in the walls of the internal iliac arteries of white rats, which is represented by a plexus of sympathetic fibers. In addition, individual bundles of sympathetic fibers, which are located in parallel, were also detected on the obtained histochemical preparations. Identified sympathetic nerve fibers are represented by different diameters. In the composition of the walls of the internal iliac arteries, nerve fibers of large and medium caliber are mainly detected. As part of the wall of the internal iliac arteries, the density of the sympathetic nerve fibers increases in the proximo-distal direction. In the walls of the internal iliac arteries, thickenings were also found, such as in the adventitia and the subendothelial layer.

Conclusion

The sympathetic nerve fibers' density increases in the proximal to distal direction in the wall of the internal iliac arteries.

**THE INFLUENCE OF THERMAL RADIATION AND CHEMICAL REACTION ON
MHD MICROPOLAR FLUID IN THE PRESENCE OF HEAT GENERATION/
ABSORPTION**

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Abstract

Numerical and theoretical analysis of mixed convection flow of MHD micropolar fluid with stretching capillary in the presence of thermal radiation, chemical reaction, viscous dissipation and heat generation/ absorption have been studied. The governing non linear partial differential equations of momentum, angular velocity, energy and concentration are converted into ordinary differential equations using similarity transformations which can be solved numerically. The dimensionless governing equations are solved by using Runge Kutta fourth fifth order along with shooting method. The effect of physical parameters viz., micropolar parameter, unsteadiness parameter, thermal buoyancy parameter, concentration buoyancy parameter, Hartmann number, spin gradient viscosity parameter, microinertial density parameter, thermal radiation parameter, Prandtl number, Eckert number, heat generation or absorption parameter, Schmidt number and chemical reaction parameter on flow variables viz., velocity of micropolar fluid, microrotation, temperature and concentration has been analyzed and discussed graphically. MATLAB code is used to analyze numerical and theoretical facts. From the simulation study it can be concluded that an increment of micropolar parameter, Hartmann number, unsteadiness parameter, thermal and concentration buoyancy parameter results in decrement of velocity flow of micropolar fluid; microrotation of micropolar fluid decreases with an increment of micropolar parameter, unsteadiness parameter, microinertial density parameter and spin gradient viscosity parameter; temperature profile of micropolar fluid decreases with an increment of thermal radiation parameter, Prandtl number, micropolar parameter, unsteadiness parameter, heat absorption and viscous dissipation parameter; concentration of micropolar fluid decreases as unsteadiness parameter, Schmidt number and chemical reaction parameter increases. Furthermore, computational values of local skin friction coefficient, local wall coupled coefficient, local Nusselt number and local Sherwood number for different values of parameters have been investigated.

Keywords: Thermal radiation, chemical reaction, viscous dissipation, heat absorption/ generation, similarity transformation.

AVIFAUNA OF THE PROVINCE (AIMAK) DORNOGOV IN MONGOLIA

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Abstract

Dornogov aimag - the total area is 109472 km². Aimak is subdivided into 14 soums. Our route was through 8 somon. Features of the territory The aimak is subdivided from north to south into 4 physical-geographical regions: the Middle Khalkha holly steppe, the Northern Gobi, the East Gobi depression and the East Gobi (Dzamyin-Uda) peneplain. In the Dornogov aimag, 79 species of birds belonging to 13 orders, 27 families and 57 genera are recorded. According to the nature of their stay, 25 resident species and 54 migrant species are noted. The ecological group in the avifauna of Dornogov aimag is dominated by open habitats (steppes, semi-deserts), 35 species of campophiles (44.3%) are noted. In trees and shrubs, the share of which is 27 species (34.2%). There are 17 limnophiles (21.5%) in the wetlands. The taxonomical classification of avifauna of the Dornogovi aimak is the following: Galliformes - 1, Anseriformes - 4, Falconiformes - 8, Gruiformes - 1, Charadriiformes - 9, Columbiformes - 4, Cuculiformes - 1, Strigiformes - 2, Apodiformes - 1, Upupiformes - 1, Piciformes - 1, passeriformes - 46 species. According to B.K. Shtegman (1938) in the study area, representatives of 9 types of fauna were noted by widespread species of middle latitudes: Mongolian – 22, Transpalearctic - 17, European - 12, Siberian - 11, Chinese - 6, Arctic and Mediterranean - 4, Tibetan - 1 and it is not clear origin - 2 species.

**INVOLVEMENT OF POLYIMIDE STRUCTURE ON THE OPTICAL PROPERTIES OF
THE CORRESPONDING AZOCHROMOPHORE SYSTEMS**

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Abstract

The progress in the research regarding polymer systems was principally focused on the improvement of their balance of properties. This led to the multiplication of the categories of this sort of materials as a function of their main group of functionalities. A peculiar interest was directed towards introduction of photosensitive features to polymers by chemical modification or by mixing them with molecules that are responding to light action. Among these, azochromophores are very interesting because the azo-moiety can suffer numerous conversions from one isomeric state to another when exposed to radiations of precise energy. This work is aiming to prepare some photosensitive layers by using several polyimide precursor structures in association with an azo dye having cyano as terminal group. In order to make flexible layers, the polymers were synthesized by using a carefully selected pair of aromatic dianhydride and diamine containing ether bridges among the phenyl units. The dianhydride also presents the isopropylidene groups, while the diamine has a cyano group substituted on the benzene ring in meta or ortho position. To accomplish the targeted supramolecular systems, in the solution of the polyimide precursor was inserted the azo-component, namely 4-[(4-cyanophenyl)diazanyl]phenol (AzoCN). The photosensitive counterpart was incorporated in the polymer in several mixing ratios and subsequently the resulted samples were deposited onto clean glass slides. To finalize the film drying and cyclization of the polyimide precursor, a thermal treatment was applied. This approach led to supramolecular polyimide systems and their properties can be controlled via the inserted amount of AzoCN. Its influence on the optical properties was first tested by means of colorimetry. The data indicated important differences in the film's aspect as a function of both polyimide structure and azochromophore quantity. Another analysis involved the evaluation of the refractive index by applying the group theory method. It was found that the light velocity through the samples is modified as a result of photo-responsive component presence in the polymer. The data are

relevant for further selecting the best conditions of surface texturing via laser to make flexible components for electronics.

Keywords: flexible polyimide, azo dye, optical properties.

Acknowledgement: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number TE 25/9.05.2022 within PNCDI III (code PN-III-P1-1.1-TE-2021-1044).

**POLYPHENOL POWDERS OF WHITE GRAPE–THE POTENTIAL
BIOACCESSIBILITY AND BIOAVAILABILITY OF POLYPHENOLIC COMPOUNDS
AND BIOLOGICAL ACTIVITIES**

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Abstract

The present study aimed to identify the nutrients (UPLC-PDA-ESI-MS/MS method) and biological activity (the activity of antioxidants as the power of metal-chelating, antiradical ability ABTS•+, activity of removing hydroxyl radicals, capability to inhibit the activity of catalase, anti-inflammatory to inhibit the activity of lipoxygenase) of polyphenolic powder of white grape ('Solaris' cultivar). The study was also to determine the potential bioaccessibility and bioavailability in the *in vitro* model of simulated gastrointestinal digestion. Phytochemical profiling of polyphenolic powder revealed 18 compounds, including 3 phenolic acids, 7 flavonols, and 8 flavan-3-ols. Highly bioaccessible during *in vitro* conditions were dimer procyanidin and caffeoyl-tartaric acid. The polyphenolic extract showed high bioaccessibility of metal-chelating power, the activity of removing hydroxyl radicals and inhibiting the activity of catalase. While extract of polyphenolic white grape powder was highly bioavailability. Thus, the white grape polyphenolic powder can be used in designing functional foods tailored to individual needs and diet-related disorders and/or in designing symbiotics. This research was funded as a whole by National Science Centre, Poland [grant no. 2020/39/D/NZ9/01810].

Keywords: bioactive compounds, simulated gastrointestinal digestion, antioxidant activity, anti-inflammatory activity.

SOME TRANSFORMATIONS OF ETHYL CYANOACETATE

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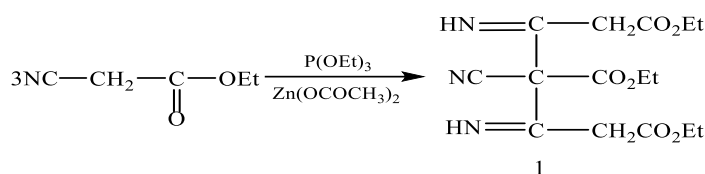
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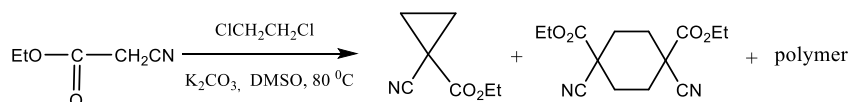
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Abstract

It has been found that ethyl cyanoacetate (1) in the presence of triethyl phosphite and zinc acetate participates in self-condensation reaction with the formation of diimine derivative (2), the formation of which should be considered as a product of the addition of the CH₂ fragment of compound (1) to the nitrile groups of two molecules of compound (1) according to the scheme:



Alkylation of compound (1) with 1,2-dichloroethane in DMSO in the presence of potash at 80°C for 3 hours gives three products: C,C-intramolecular dialkylation with the formation of cyclopropane derivative (3), an intermolecular product of C,C,C ,C-tetraalkylation with the participation of two moles of the reagent and two moles of the substrate - bis 1,4-(cyanoethoxycarbonyl)cyclohexane (4) and a polymeric product



Alkylation of compound (1) with 1,2,3-trichloropropane is more complicated and 2 mol of a substrate (1) and 3 mol of trichloropropane are involved in the condensation reaction. Along with alkylation, dehydrochlorination also occurs. Under the reaction conditions, the primary alkylation product undergoes partial hydrolysis and decarboxylation, as well as complete hydrolysis and decarboxylation to form products 5 and 6, respectively.

Keywords: alkylation, cyanoacetate, 1,2-dichloroethane, 1,2,3-trichloropropane, condensation

DESTRUCTIVE FUNGAL DISEASES OF TURFGRASS

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Abstract

Turfgrass absorbs atmospheric pollutants such as carbon monoxide, sulfur dioxide, ozone, nitrogen dioxide, ammonia and volatile organic compounds. Turfgrass quality is very important in green areas and keeping it healthy is more important than growing it. There are many factors that limit the development of turfgrass and spoil its color. Since turfgrass does not have a strong stem, it is more sensitive to abiotic factors such as environmental stress factors and biotic factors than other plants. The risk of disease transmission increases, especially since the leaves in the golf and football fields that are open to continuous use are more worn out. Anthracnose (*Colletotrichum graminicola*), Bipolaris Leaf Spot (*Bipolaris sorokoiniana*), Brown Patch (*Rhizoctonia solani* and *R. zae*), Copper Spot (*Gloeocercospora sorghi*), Dollar Spotting (*Sclerotinia homoeocarpa*), Fusarium Leaf Spot and Root Rot (*Fusarium culmorum*, *F. tricinctum*), Gray Leaf Spot (*Pyricularia grisea*), Helminthosporium Leaf Spot (*Drechslera poae*), Powdery Mildew (*Blumeria graminis*), Rust (*Puccinia* spp), Fairy Rings, Pythium Leaf Blight and Root Rot (*Pythium ultimum*, *P. aphanidermatum*) and Summer Patch (*Magnaporthe poae*) are the most common fungal diseases. These diseases cause plant death in very large turfgrass areas. This review was aimed to provide an overview of the turfgrass diagnosis and highlight prospects for disease detection.

Keywords: Turfgrass, pathogen, fungi, disease, symptom

**PROMOTING A STUDY ON THE IMPORTANCE OF MAINTAINING ADEQUATE
NUTRITION AND HEALTH DIET FOR CHILDREN WITH CEREBRAL PALSY IN
MODERN SOCIETY**

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Abstract

The contemporary study on the importance of maintaining adequate nutrition and a healthy diet for children with cerebral palsy (CwCP) in modern society. Undernutrition is more likely in children with severe CP, especially those with oropharynx dysfunction. Several factors and approaches go into figuring out if someone need nutritional assistance. Children who do best on an oral diet often get immediate benefits from supplementation. Enteral tube feeding might be explored for malnourished children if poor weight gain persists despite oral nutritional supplements and the child develops oropharynx dysphagia and an unsafe swallow. Making educated guesses about calorie and protein needs isn't enough to prevent overfeeding or underfeeding. Children with CP should be fed in a way that promotes good growth and development for their health, quality of life, comfort, and happiness. The risk of malnutrition can be mitigated by providing parents and caregivers of children with CP, who often have a significant disability, with nutrition education. Caretakers and children with mild to moderate CP should be taught classes on preparing and eating a balanced diet, focusing on receiving appropriate vitamins to fight obesity. The cognitive, neurological, muscular, and skeletal involvement in children with cerebral palsy can be as varied as in adults. The greater a child's need for medical care, the higher the risk of being malnourished. Medical complications later in life can be mitigated if feeding and nutritional issues are identified and treated early on by a multidisciplinary team of care professionals. Caregivers and family members play an essential part in the team regarding the day-to-day logistics of feeding and nutrition. This paper provides an impression of CP, its consequences on a child's health diet and development, and the various treatment and rehabilitation options available to families with a child with the disorder. Many health diet issues pursuing children with CP have to do with their development and nutrition. Stunted development and malnutrition pose major threats to the health, quality of life, social relationships, motor skills, and even mortality of children with cerebral palsy. Many methods for treating developmental delays have been developed since they were first identified. The contemporary era's greater focus on malnutrition as a cause of stunting has resulted in better rehabilitation treatments and higher survival rates. Advances in treatment for children with CP have resulted from a better understanding of the neurological, metabolic, and environmental factors contributing to its development in modern society.

Keywords: Promoting, Importance, Maintaining, Adequate, Nutrition, Health Diet, Children with Cerebral Palsy, and modern Society

AKDENİZ BÖLGESİNDE NOHUT (*Cicer aritinum* L.) HAT VE ÇEŞİTLERİNİN
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Özet

Akdeniz ekolojik koşullarında bazı nohut (*Cicer aritinum* L.) genotiplerinin verim ve tarımsal özelliklerinin belirlenmesi ve çeşit ıslahı amacıyla bu araştırma yürütülmüştür. Tarla denemesi 2017 yılında Doğu Akdeniz Tarımsal Araştırma Enstitüsü Doğankent lokasyonu deneme arazisinde, 20 genotip ile kışlık olarak ekilerek yürütülmüştür. Bu çalışmada ülkesel ve ICARDA orjinli genotipler kullanılmış ve tesadüf blokları deneme deseninde ekimler yapılmıştır. Ekimlerde, sıra arası 45 cm, sıra üzeri 8 cm olacak şekilde, 5 m uzunluğundaki 4 sraya 9 m²'lik parsellere ekimler yapılmıştır. Ekim öncesi dekara 2-3 kg N, 5-6 kg P₂O₅ gelecek şekilde gübreleme uygulanmıştır. Araştırmada, Çukurova koşullarında nohut verim ve verimle ilgili bazı özellikler arasındaki ilişkilerin tespiti ve çeşit geliştirmeye yönelik, nohut genotiplerinden kışlık ekime yönelik seleksiyon ve değerlendirmeleri yapılmıştır. Araştırmanın yürütüldüğü yılda kışlık ekimlerden elde edilen en yüksek ve en düşük tane verim değeri 212,50 kg/da olarak FLIP 09-186C ve 97,83kg/da ile ENA 144-10 nohut genotiplerinden elde edilmiştir. 100 tane ağırlığı bakımından 47,33 -34,27gr arasında değerler elde edilirken; çeşit ve hatlarda, erkencilik özelliği için de çiçeklenmede 88,00-73,67 gün değerleri arasında ve bakla bağlamada 99,00-94,00gün değerleri arasında olarak tespit edilmiştir. Makinalı hasata uygunluk bakımından bitki boyları 74,40-59,40cm ve ilk bakla yükseklikleri 35,53-27,10cm değerleri elde edilmiş ve öncelikli olarak incelenmiştir. Bu sonuçlar yapılan ıslah çalışmalarında belirleyici olmaktadır. Çeşit ve hatlar bölge koşulları içinde değerlendirilerek çeşit tesciline yönelik çalışmalar sürdürülmektedir.

Anahtar kelimeler: nohut, verim, tarımsal özellikler ve çeşit ıslahı

**YAPAY ZEKA VE OTOMASYONUN İŞGÜCÜ PİYASASINA ENTEGRASYON
SORUNLARI**

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Özet

Yapay zeka ve otomasyonun hızlı gelişimi, birçok işin yerini yapay zeka uygulamalarının alacağı anlamına geliyor. Yapay zekanın hakim olacak birçok alanda uygulanması sonucunda mevcut meslekler işlevini yitirdiği için iş kayıpları ortaya çıkıyor. İnovasyonun bir sonucu olarak üretim maliyetlerindeki düşüş, robotların üretim, paketleme, inşaat, bakım ve tarım gibi yeni alanlarda giderek artan sayıda manuel görevleri üstlenmesini sağlıyor. Bu nedenle teknolojik gelişmenin her dalgasında işçiler işsizlikle karşı karşıya kalmaktadır.

Anahtar kelimeler: yapay zeka, yasal düzenleme, ücretli emek, işçi, işveren, meslek, robot, iş gücü, data mining (veri madenciliği).

EFFECTS OF PASTURE AND CONCENTRATE-BASED FEEDING ON MILK AND DAIRY PRODUCTS

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Abstract

Pasture-fed dairy products has recently increased the interest of consumers. Although there are many studies describing the effect of different feeding strategies on the composition of milk in our country and in the world, there are few studies that compared pasture-based and concentrate-based nutrition. Milk obtained from different feeding strategies have effects on products, such as yield amount, color, effect of spreadability, melting temperature, change in gel firmness. Changes in milk composition have also been effects on milk and dairy product workability, functionality and sensory properties. Methods have been found to determine traceability of dairy products or to verify marketing claims such as "pasture fed". Availability of forage and forage quality are quite variable depending on climatic and seasonal factors. Consumption of grasses which mature later in the growing season has been shown to significantly increase milk protein yield and milk protein concentration. The practice of seasonal, pasture-based feeding systems is largely determined by economic and environmental factors, but evidence for potential nutritional benefits associated with dairy commodities produced therefrom could also provide valuable considerations in this regard. This study will investigate the effects of feed types on milk composition and quality and the ultimate impact of dietary changes on milk and dairy product functionality, with special emphasis on pasture and concentrate-based feeding systems in Turkey and around the world.

Keywords: Grasses, marketing, milk protein, seasons, temperature

THE EFFECT OF COMBINATION OF CHICKEN MANURE EXTRACT WITH AB-MIX NUTRITION ON THE GROWTH AND YIELD OF MUSTARD GREENS IN HYDROPONIC SYSTEM

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Abstract

The demand for mustard greens continues to increase in line with the growing population, so efforts need to be made to increase mustard green production. Hydroponic cultivation is one of the efforts to increase mustard green production on limited land. This study aims to determine the effect of substituting chicken manure extract and to determine the appropriate concentration combination on AB-mix nutrition on the growth and yield of mustard greens (*Brassica juncea* L.) using NFT hydroponic system. This study was conducted in Bandar Lampung, in November-December 2022. The treatments were arranged in a Completely Randomized Design (CRD) with 4 single treatments and 6 replications. Each treatment consisted of four levels, namely 100% AB-mix, 100% chicken manure extract, AB mix 50% + chicken manure extract 50%, and AB mix 75% + chicken manure extract 25%. The results showed that the growth and yield of mustard greens in the AB-mix 75% + chicken manure extract 25% treatment were significantly higher than in the 100% AB-mix treatment, as evidenced by the variables of plant height, stem length, leaf dry weight, leaf count, stomatal count, and the amount of weight of three plant heads but equivalent or not significantly different for the leaf greenness, root length, and harvest index variables. The best composition of chicken manure extract substituted with AB-mix nutrition was AB-mix 75% + chicken manure extract 25%.

Keywords: NFT Hydroponic system, growth performance, yield enhancement, nutrient substitution

**WORKPLACE CONTEXT, MANAGEMENT PRACTICES AND YOUNG EMPLOYEE
RETENTION: THE CASE OF HOSPITALITY AND TOURISM IN LEBANON**

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Abstract

This research study investigates the relationship between management practices and young employee retention in the hospitality and tourism industry in Lebanon. Besides, it examines the moderating role of the workplace context in the relationship between management practices and employment retention in the industry. Non-probability purposive sampling method was used to collect 421 questionnaires through a survey of young employees. Exploratory factor analysis (EFA) and Cronbach's alpha test are conducted to test the construct validity, reliability, and internal consistency of collected data. Descriptive statistics are used to interpret the data. Zero-order correlations, multiple regression analysis and Fisher's Z-test are applied to assess the interrelations of the various groups of variables and the determinants of young employee retention. The findings show that management practices tested in this study have significant relationships with young employee retention in the hospitality and tourism industry in Lebanon. Further, the findings reveal that the workplace context moderates the relationship between three management practices (participation in decision-making, training, and performance recognition) and young employee retention. Further, the findings suggest that managers in hospitality and tourism businesses must improve their management practices and promote a positive workplace context to retain young employees. Finally, this study is the only one that tests the moderating role of the workplace context in the relationship between five selected management practices (participation in decision-making, training, performance recognition, remuneration and job continuity) and young employee retention. Previous studies used fewer variables.

Keywords: Workplace context, management practices, young employee retention, hospitality, tourism, lebanon

**MEDIATING ROLE OF PUBLIC SERVICE MOTIVATION BETWEEN
MANAGEMENT PRACTICES AND TAKING CHARGE BEHAVIOR: A MULTI-
MEDIATION MODEL**

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Abstract

This study concentrates on extra-role behaviors that contribute to continuous improvement of the individuals who work on the frontline *i.e.*, take-charge behavior (TCB). This study investigates the impact of management practices on TCB and the mediating role of four dimensions of public service motivation (attraction to policymaking, commitment to the public interest, compassion, and self-sacrifice) between management practices and TCB. This multi-mediation study is conducted on street-level bureaucrats (police). The data (N = 451) were collected from the employees working in the police department, in Punjab, Pakistan. The data were examined through SPSS-23 for descriptive statistics and partial least square structural equation modeling (PLS-SEM) for inferential statistical analysis. Smart PLS-3 was used for data analyses. The results confirm that management practices have a direct effect on TCB. However, public service motivation partially mediates the relationship between management practices and TCB. The study implications, limitations, and future research directions are presented in the last section of the study.

Keywords: Extra Role Behavior; Street-Level Bureaucrats; Public Service Motivation; Public Sector; Management Practices

**ŞEHİRLERİN PAZARLANMASI VE MARKA ŞEHİR BAĞLAMINDA EDİRNE: BİR
SWOT ANALİZİ**

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Özet

Şehirler, gerek coğrafi konumları, gerek kültürel zenginlikleri ve sosyal dokularıyla içinde yaşayanların yaşam kültürlerini belirleyen önemli unsurlardandır. Şehirlerin markalaşması, özünde tüm diğer ticari ya da ticari olmayan ürün ve hizmetlerin markalaşmalarından farklı değildir. Hepsinde de, hedef kitlesinin gözünde benzerlerinden farklılaşma, bu farklılık sayesinde konumlanabilme, kendine özgü nitelikleriyle öne çıkma, bilinirlik ve çekiciliklerini yükseltme hedefleri vardır. Ancak bu hedefler gerçekleştirildiğinde başarılı bir markalamadan söz edilebilir. Bu çalışmada marka şehir olma yolunda Edirne şehri incelenmiş, onu marka şehir yapan/yapabilecek özellikleri Swot analiziyle değerlendirilmiştir. Durum Analizi ismiyle de anılan Swot Analizi, bilindiği üzere araştırmaya tabi tutulan konu, unsur ya da fenomenin üstün ve zayıf yönlerinin incelendiği, bununla birlikte fırsat ve tehditlerin değerlendirildiği bir analizdir. Üstün ve zayıf yönler iç çevresel özelliklerin bir getirisi olmakla birlikte, fırsat ve tehditler daha ziyade dış çevresel faktörlerden doğan “potansiyel” özellikleri olarak değerlendirilmektedir. Bu bağlamda Edirne iline ait analizin temel çıktıları şöyledir,

Üstün yönler:

- 1) Sahip olunan tarihi ve kültürel miras,
- 2) Türkiye'nin en büyük metropolüne fiziki yakınlık ve şehrin Avrupa'ya sınır komşusu olması
- 3) Kırkpınar Güreşleri ve Kakava Şenlikleri'nin marka kent olma yolunda önemli bir unsur olan Unesco Kültür Mirası listelerindeki yeri
- 4) Tarıma elverişli arazi ve iklim yapısı

Zayıf yönler:

- 1) Otel, motel, misafirhane gibi konaklama tesislerinin yetersizliği
- 2) Eğlence ve gece hayatı kültürünün zayıf olması
- 3) Şehrin turistik öğelerinin pazarlanmasındaki eksiklikler
- 4) Başta imalat sanayi olmak üzere sanayisinin gelişmemiş olması

Fırsatlar:

- 1) İstanbul-Edirne arası yapımı tamamlanmakta olan hızlı tren projesiyle iki il arası geliş-gidişlerin kolaylaşması
- 2) Başta Bulgar ve Yunan turistlerin şehrin ekonomisine katkısı
- 3) Çeşitli kültürel etkinliklerin yıllar içinde profesyonelleşmesi ve çevre illerden ve ülkelerden bu etkinliklere olan katılımın artması
- 4) İstanbul'un Edirne'ye doğru büyümesi ve zaman içinde kentin, İstanbullular için bir uğrak yeri haline gelmesi

Tehditler:

- 1) Doğal su kaynakları ve topraktaki kirlenme, kuraklık, yanlış tarım politikaları gibi sebeplerle tarımsal faaliyetlerin azalması,
- 2) Kurumlararası çatışmalardan doğan koordinasyon ve iletişim eksikliği, verimli ortak çalışmaların yürütülememesi,
- 3) Nitelikli iş gücünün yakınındaki büyük şehir olan İstanbul'a göçü ve şehirdeki girişimci eksikliği.
- 4) Son yıllarda artan plansız şehirleşme faaliyetleri, dere yatağına yapılan evler, kurulan mahalleler.

Anahtar Kelimeler: Marka, şehir, Edirne, swot analizi.

**FRAMEWORK FOR HEALTHCARE ORGANIZATION GOVERNANCE- A SYSTEM
THINKING APPROACH AUTHOR**

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Abstract

The healthcare industry across the globe is facing a value crisis, which is a situation where the cost of healthcare services is not commensurate with the outcome. Traditionally, the primary goal of healthcare organizations has been to maximize shareholder profits. However, in recent years, there has been a growing recognition that this approach may not be the best way to ensure the long-term success and sustainability of the healthcare industry. This paper stresses the need of thinking beyond this narrow approach of shareholder profit maximization and focus on stakeholder value maximization. This study uses system thinking approaches such as a causal loop diagram and iceberg model to understand the pitfall of the narrow approach of shareholder profit maximization in healthcare organizations. The study further performs stakeholder analysis to identify the interests, needs, and expectations of each stakeholder, as well as their level of influence and power over the health systems and policy. The study further uses graph theory and matrix approach (GTMA) to analyze and represent complex healthcare systems and propose an approach for value maximization in such systems. Thinking beyond shareholder profit maximization, healthcare organizations can prioritize patient-centered care, social responsibility, and innovation, ultimately leading to better outcomes for patients and society. This paper provides a descriptive and prescriptive framework in this direction. The findings of this study are useful for healthcare organization owners and health policymakers.

Keywords: Healthcare Organization, Shareholder Profit Maximization, Shareholder Value Maximization, Shareholder Analysis, Graph Theory, and Matrix Approach (GTMA)

**SELÜLOZİK MAMULLERİN TEK BANYODA ÖN İŞLEM VE REAKTİF
BOYARMADDELER İLE BOYANABİLİRLİĞİNİN ARAŞTIRILMASI**

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Özet

Günümüzde tekstil ürünlerinde en çok tercih edilen doğal liflerin başında selülozik esaslı pamuk lifi gelmektedir. Rahat kullanım hissi, ısı yalıtımı sağlaması ve yüksek nem tutma kapasitesine sahip olması nedeniyle diğer liflere göre daha çok tercih edilmektedir. Pamuk yapısal olarak sarımtırak renge sahip olup içerisinde birçok safsızlık (pektin, mumsu yapılar vb.) barındırmaktadır. Pamuğun bu safsızlıklardan arındırılması ve boyamaya hazır hale gelebilmesi için ön işlem prosesi uygulanmaktadır. Pamuğun ön işlem proseleri genellikle haşıl sökme, yıkama ve ağartma işlemlerinden oluşmaktadır. Ağartma prosesi sonrası pamuk lifinin renklendirmesi için boyama işlemi uygulanır. Selülozik esaslı tekstil mamullerinin boyanmasında genellikle reaktif boyarmaddeler tercih edilmektedir. Reaktif boyarmaddeler, selülozik mamulleri bazik ortamda tuz ve boya yardımcı kimyasalları ile boyayabilmektedir. Ön terbiye ve boyama proseslerinde fazla miktarda tüketilen su ve kimyasallar, çevre ve insan sağlığını tehdit etmektedir. Selülozik mamullerin ön terbiye prosesinde tüketilen su, enerji ve kimyasal miktarının azaltılması, yeni proses ve kimyasalların geliştirilmesi ile mümkün olacaktır. Bu kapsamda pamuklu mamullerin ön işlem proseslerinde yaygın olarak enzimler kullanılmaktadır. Bu prosesler incelendiğinde ise genellikle bir ön işlem yapıldıktan sonra banyonun döküldüğü ve boyama işlemine geçildiği gözlenmiştir. Yapılan bu projede ise ön işlem sonrası banyo çözeltisi dökülmemektedir. Boya ve yardımcı kimyasallar aynı banyo çözeltisi içerisine ilave edilmektedir. Yapılan çalışmada ise geliştirilen ticari kimyasal ile ön işlem prosesi ortadan kaldırılarak, ham iplik ve kumaşların tek banyoda boyanması üzerine çalışılmıştır. Tek banyoda boyama prosesinde belirlenen renkler geleneksel boyama prosesinde elde edilen renkler ile karşılaştırılmıştır. Karşılaştırmalar için spektrofotometre cihazı kullanılmıştır. Her iki boyama prosesi sonrası elde

edilen numunelerin renk farklılıkları (ΔE), hidrofilite deęerleri, yıkama ve srtme haslıkları deęerlendirilmiřtir. Sonular incelendięinde birbirine benzer renk farklılıkları (ΔE) elde edilmiř fakat hidrofilite deęerlerinin geleneksel boyama yntemine gre daha dřk olduęu tespit edilmiřtir. zellikle sellozik havlı kumařların boyanmasında kullanılan tek banyoda boyama prosesi iin hidrofilite alıřmaları yapılmaktadır. Farklı ıslatıcı ile havlı kumařların hidrofilite deęerlerinin iyileřmesi iin alıřmalar devam etmektedir. Bu alıřma sayesinde bir n iřlem ve boyama prosesi iin %79,87 kimyasal, %83,06 doęalgaz, %69,83 elektrik, %59,38 su ve %68,07 zamandan tasarruf saęlanmıřtır. Geliřtirilen proses ile reaktif boyamada daha az enerji, su ve kimyasal kullanılarak, tekstil sektrne evreci bir boyama prosesi kazandırılmıřtır.

Anahtar Kelimeler: Pamuk boyama, n iřlem, tek banyo

DOKUMA TEZGÂHLARINDA LAMEL AYIRICI SİSTEM GELİŞTİRİLMESİ

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Özet

Özellikle ev tekstili sektöründe önemli bir yere sahip olan havlu kumaşlar, genellikle iki çözü ve bir atkı ipliği sistemi kullanılarak dokunmaktadır. Havlu dokuma makineleri, hav çözü salma sistemi ve hav oluşturma mekanizmaları açısından diğer dokuma makinelerinden farklılık gösterir ve sadece havlu yapı dokuyacak şekilde tasarlanarak üretilmektedir. Üretilmek istenen ürün ebadına göre tezgâh üzerinde dokuma ayarları yapılmaktadır. Bu ayarlamalardan bir tanesi de lamel ayarıdır. Lamel, her bir çözü ipliğine takılan ve çözü iplik yoklayıcısı olarak da bilinen, çözü ipliği koptuğunda ya da gevşediğinde aşağı düşerek elektrik devresini kapatan ve makinenin durmasını sağlayan sistem elemanıdır. Lamel ayar işlemi, her bir ipliğin geçeceği tel sayısı ve ihtiyaç duyulan lamel adedinin belirlenmesiyle gerçekleştirilmektedir. Mevcut durumda ihtiyaç duyulan lamel adedi tezgâh üzerinde bulunan lamel adedinden fazla ise tezgâha lamel eklenmesi gerekmektedir. İhtiyaç duyulan lamel adedi tezgâh üzerinde bulunan lamel adedinden eksik ise tezgâh üzerinde bulunan lameller tezgâh dışarısına alınmaktadır. Yapılan lamel ekleme ve çıkarma işlemi manuel olarak gerçekleşmektedir. Bu durum zaman ve iş gücü kayıplarının oluşmasına sebep olmaktadır. Çalışma kapsamında geliştirilen sistem ile lamel ekleme ve çıkarma işleminin otomatik gerçekleşmesi hedeflenmektedir. Çalışmada lamellerin kayar bir kızak üzerinde hareket eden araba ve arabaya montaj edilen ayarlanabilir lamel ayırıcı aparat geliştirilmiştir. Bu ayırıcı aparat sayesinde lamellerin, tezgâh üzerinde sabit kalması sağlanmıştır. Bu sayede lamellere ekleme veya çıkarma işlemine gerek duyulmadan iş gücü ve zaman kayıplarının önüne geçilmiştir. Tasarlanan lamel ayırıcı aparat ile yarı otomatik olarak gerçekleştirilen işlemin, devam eden tasarımlar ile otomatik olarak gerçekleştirilmesi planlanmaktadır.

Anahtar Kelimeler: Dokuma tezgâhı, lamel, çözü ipliği

CLINICAL, HISTOPATHOLOGICAL, AND ULTRASTRUCTURAL STUDIES ON THE EFFECTS OF *Chlorella vulgaris* SUPPLEMENTATION IN PROTECTING HEALTHY TISSUE FROM TOXICITY BROUGHT ON BY THE THERAPEUTIC REGIMEN OF CISPLATIN

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Abstract

A common chemotherapy drug used to treat several cancers is cisplatin. The primary drawback of cisplatin therapy is that it induces organ toxicity, which compromises its clinical efficacy. Although significant progress has been made in understanding the mechanisms underlying cisplatin-induced toxicity, protective strategy development has not kept pace. The animals were divided into four groups, each group contained 5 rats. Animals in the control group received intraperitoneal injections of saline (NaCl). Cisplatin group: For three months, the animals received 134 mg/kg of cisplatin intraperitoneally, which is the same dose that was used in the human treatment protocol. Animals in the chlorella group received 150 mg/kg of chlorella orally every day for three months. Cisplatin/Chlorella group: Over the course of three months, the animals received 134 mg/kg of cisplatin intraperitoneally once per week and 150 mg/kg of chlorella orally daily. The obtained results showed that cisplatin increased levels of lipid peroxidation, tumor necrosis factor alpha (TNF-alpha), nitric oxide (NO), interleukin 12 (IL-12), and interleukin 6. (IL-6). Cisplatin, however, reduced antioxidant capacity. The chlorella treatment, on the other hand, reverted this change to values that were closest to the control values. After cisplatin treatment, it was observed that the liver and kidney function markers were elevated. Chlorella supplementation has the potential to significantly reduce these functional marker levels. Additionally, light and transmission ultrastructure microscopy analysis revealed that chlorella supplementation prevented abnormalities from occurring after cisplatin treatment caused liver, kidney, and spleen injury. Nuclear factor erythroid 2-like 2 (Nrf2) expression was significantly increased in the liver and kidney after treatment with cisplatin, whereas it was significantly decreased in the chlorella/cisplatin group. Additionally, it has been demonstrated that taking supplements of chlorella vulgaris can guard against the toxic effects of cisplatin on various body organs. The use of *Chlorella vulgaris* supplementation makes cisplatin therapy safer.

Keywords: cisplatin; *Chlorella vulgaris*; liver; kidney; spleen

**TÜKETİCİLERİN BAL VE KATMA DEĞERİ YÜKSEK DİĞER ARI ÜRÜNLERİNİN
SATINALMA TERCİHİ: SİİRT İLİ MERKEZ İLÇESİ**

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Özet

Bu araştırmada, Siirt ili Merkez ilçesinde bulunan tüketicilerin balın yanı sıra diğer arı ürünlerine olan satın alma tercihlerini ve bu tercihlerin arkasındaki nedenleri incelenmesi amaçlanmıştır. Araştırmada kullanılan veriler 2022 yılına ilişkin olup, toplam 107 tüketiciden anket yoluyla elde edilmiştir. Araştırmada, tüketicilerin ne sıklıkla arı ürünlerini satın aldıklarını, hangi arı ürünlerinin daha fazla talep gördüğünü, hangi özelliklerin tüketiciler için önemli olduğunu ve bu ürünleri neden tercih ettikleri araştırılmıştır. Verilerin analizinde ortalama, yüzde, standart sapma gibi tanımlayıcı istatistikler kullanılmıştır. Sonuçlara göre, tüketicilerin %31,78'i aylık bal ve diğer arı ürünlerini satın almak için 81TL'den daha fazla para harcadıkları ortaya çıkmıştır. Arı ürünleri içerisinde baldan sonra sırasıyla polen, arı sütü ve propolis tüketiciler tarafından daha fazla bilinen ürünler olarak tespit edilmiştir. Ayrıca, tüketicilerin bu ürünleri satın alırken fiyat faktörüne birinci sırada önem verdikleri ortaya çıkmıştır.

Anahtar Kelimeler: Arı ürünleri, Arıcılık, Tüketici tercihi

**REFERANS DERLEMLERİNİN ÇEVİRİYE DESTEK AMAÇLI KULLANIMI:
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Abstract

Çeviri teknolojileri çok ileri bir noktaya ulaşmış ve makine çevirisi yöntemleri de günümüzde çok gelişmiş hale gelmiştir. Buna rağmen, iyi eğitilmiş çevirmenlerin çeviri alanındaki rolü yadsınmaz. Dilbilgisi ile ilgili yazılı kaynaklar ve sözlükler genellikle çeviri sürecinde referans kaynağı olarak kullanılır, ancak referans kaynağı olarak ayrıca verimli olduğu düşünülen bir kaynak bir bütüncelerdir. Bugün, bütüncelerin çevrimiçi ve ücretsiz kaynaklar olması, onları kolayca erişilebilir hale getirmiştir ve birçok araştırmacı dil araştırması için bütüncelere başvurmaktadır. Bütünce kullanımı, çeviri alanındaki araştırma ve uygulamalarda da yaygınlaşmıştır. Bu nedenle bu çalışmada bir bütüncenin çeviri düzeltmesinde ne kadar etkili olabileceği üzerinde çalışılacaktır. Bu araştırmanın amacı, çeviride meydana gelen farklı kategorilerdeki hataların bir referans bütüncesi kullanılarak ne ölçüde azaltılabileceğini ve ne tür farklılıklar doğuracağını araştırmaktır. Araştırmada hem nicel hem de nitel yöntemler kullanıldı. Kontrol ve deney grupları olarak iki gönüllü öğrenci grubu oluşturuldu. Her iki gruptan da "Küçük Prens" kitabından bir bölümü çevirmeleri istendi ve öğrenci çevirileriyle küçük bir çeviri bütüncesi oluşturuldu. Daha sonra çeviriler farklı sözcüksel ve dilbilgisi kategorilerindeki hatalar için kodlandı. Hatalar tespit edildikten sonra deney grubuna bütünce kullanımı konusunda eğitim verilmiştir. Eğitimden sonra öğrenci çeviri bütüncesinden örnek cümleler seçilerek cümle tamamlama testi ve çoktan seçmeli alıştırmalar hazırlandı. Kontrol grubu, görev sırasında referans olarak sözlüklere ve dilbilgisi kitaplarına başvurdu; deney grubu ise bir referans bütüncesine başvurdu. Çalışmanın sonuçları, bir referans bütüncesinin çeviriye destek amaçlı olarak verimli kullanımına ışık tutmaktadır.

Anahtar Kelimeler: Çeviride düzeltme, çeviri araçları, bütünce, bütünce eğitimi

THE SITUATION OF MIGRATION IN INTERNATIONAL POLITICAL ECONOMY

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Abstract

Migration concerns the agenda of international political economy in some main categories such as human rights, security and economy. In the context of human rights-security at the global level, the United Nations High Commissioner for Refugees (UNHCR) deals with migration and has special concepts for them such as refugees and asylum seekers. According to UNHCR records, 89.3 million people worldwide have been displaced by violence disrupting public order. Of these, 27.1 million are refugees, 53.2 million are displaced within the borders of the country, and 4.6 million are asylum seekers. In terms of economical references like sustainable development, especially the United Nations International Organization for Migration (IOM) stands out. IOM defines the phenomenon of migration in a broader framework and as an umbrella concept. It refers to persons who have moved away from their habitual residence, either temporarily or permanently, or for various reasons, within a country or internationally. In this sense, illegal migrants and international students are also in this status. In this presentation, the focus is on the importance of remittances for financing development at the national level. According to IOM data, as of 2020, there are 281 million migrants in the world and they constitute 3.6 percent of the global population. Again, 164 million of them are active workforce. As of 2020, the amount of remittances sent by migrants and diaspora is 702 billion USD. As of 2020, the top 10 countries with the most remittances are India, China, Mexico, Philippines, Egypt, Pakistan, France, Bangladesh, Germany and Nigeria. In this presentation, the limit is international political economy and workers' remittances. In terms of the results, the following can be stated: The amount of remittances for migrants/workers is an important amount at the global level and in the light of current data, it is seen that these moneys are directed especially from high-income countries to low and middle-income countries. In this sense, remittances continue to be important in financing the development of low and middle-income countries.

Keywords: Migration, Migrants, International Political Economy, Financing for Development, Remittances.

**EVALUATION OF APOLIPOPROTEINA-1, APOLIPOPROTEIN B AND GLUCOSE
LEVELS OF THE ELDERLY, ACTIVELY EXERCISING AND NON-EXERCISING
INDIVIDUALS IN NNEWI**

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Abstract

Background: Cardio vascular disease remains the leading cause of death and disability. It has been linked to the role demonstrated in certain structural proteins such as the Apolipoprotein A-1 and Apolipoprotein B and the relationship with physical activities. **Objectives:** The serum levels of Apo A-1, Apo B and glucose were evaluated in the elderly, actively exercising and non-actively exercising individuals in Nnewi. **Materials and methods:** Ninety subjects recruited for the study were grouped into; Group A- Non-actively exercising , Group B Actively Exercising aged , and Group C- Elderly Individuals aged between 55 years and above. Blood sample was collected from all the participants after 10-12hours overnight fast. Apolipoprotein A-1, Apolipoprotein B and Glucose levels were determined spectrophotometrically. Their systemic (SBP), and diastolic blood pressures (DBP) including the Heights, and weights were also measured. Questionnaire was used to obtain their socio-demographic information. Data was analyzed using ANOVA, Bonferroni Post Hoc Test, and Pearson r correlation. **Result:** There was no significant difference in the mean serum value of Apolipoprotein A-1 and Apolipoprotein B in elderly and actively exercising compared with the Non-exercising ($p>0.05$). A significant higher difference existed in the mean serum value of glucose in the Elderly (6.60 ± 1.50) and actively exercising (5.89 ± 0.82) compared with the Non-exercising (5.40 ± 0.48) ($p<0.05$). A significant higher difference was seen in the mean

systolic, diastolic, and BMI levels of the Elderly compared with the non-exercising ($p \leq 0.05$). However there was significantly lower mean systolic and diastolic blood pressure value, and BMI value in the actively exercising compared with the Non-exercising group ($p \leq 0.05$). A strong positive correlation was observed between Apo B vs Apo A-1 in the actively exercising, and Non-exercising groups, while a weak negative correlation existed between BMI and Apo A-1 in the actively exercising. **Conclusion:** The significant differences observed in the parameters measured were not clinically significant.

Keywords: Apolipoprotein A-1, Apolipoprotein B, Glucose.

FORECASTING THE RELIABILITY OF MOBILE ROPEWAYS BASED ON SELF-PROPELLED WHEELED CHASSIS

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Abstract

Mobile ropeways based on two self-propelled wheeled chassis with high load capacity and cross-country capability coupled with a single rope system are a promising type of transport and transshipment equipment for use in remote areas and areas of natural or man-made disasters. Therefore, increased requirements are imposed on the reliability of this transport equipment, since it is operated far from the locations of repair and restoration enterprises. Within the framework of grant No. 22-29-00798 of the Russian Science Foundation, a set of studies was carried out on the creation of mathematical models and computer methods for modeling the reliability indicators kinetics of mobile ropeways at the design stage. Mathematical models are based on an approach using systems of ordinary differential equations of the first order of Kolmogorov-Chapman. This approach allows us to take into account all possible (from the point of view of reliability theory) states in which the equipment of a mobile ropeways can be located, as well as possible transitions between them. The positive effect of carrying out scheduled maintenance and repairs of equipment in the interval between the intervals of ropeways operation was taken into account by adjusting the probability of failure-free operation of those key structural elements that were undergoing schedule repair. The developed methodology for predicting changes in the time of operation of quantitative indicators of reliability of mobile ropeway equipment was implemented in the form of a computer program. The use of the developed models and methods in the practice of designing mobile ropeways has shown that it is advisable to use them for planning repairs of complex technological equipment: to determine the timing of repair operations of key structural elements, the volume and cost of repairs, the number of spare parts.

Keywords: Mobile Ropeway, Wheeled Chassis, Reliability, Design.

**EXPLORING FAITH-BASED INTERVENTIONS IN FOOD INSECURITY IN
NIGERIA: A PHENOMENOLOGICAL APPROACH**

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Abstract

This study explores food insecurity in Nigeria, especially from 2015 to 2023. Although, the issue of food insecurity has received attention from the scholarly community, literature has yet to isolate the reason for persisting food insecurity in Nigeria and what faith groups could do to stem the tide. Staple foods such as garri, corn, rice, yam, beans, millet, potatoes, and others have all jerked up with prices above the common man's pocket. With the rising food inflation, it is not uncommon that some households could have been forced to eat at a ratio of 0.0.1 or 0.1.0 for their daily meals. Nearly 25 million Nigerians are at risk of facing hunger between June and August 2023, if urgent action is not taken. Data was gotten from personal observations and relevant literature. Content analysis was used to analyse the data. Findings indicate that food insecurity is caused by climate change, faith-based insecurity, and rural-urban migration, among others. Unfortunately, the impact of faith-based organisations on food insecurity in Nigeria has been negligible. There is a need for faith based groups to begin climate preservation campaigns in rural and urban centres in Nigeria. This can also be done in churches and mosques. Faith-based interventions can also focus on sensitising their members to be tolerant when it comes to religious issues, this will reduce insecurity drastically. Recommendations are discussed.

Keywords: FBO's, Food insecurity, Climate Change, Migration, Hunger, Nigeria

**ENERGY DEVICES BASED ON PLASTE WASTE MATERIALS AND IONIC LIQUID
DOPED POLYMER ELECTROLYTE**

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Abstract

We have tried to develop plastic waste-based Carbon as electrodes and environmentally safe ionic liquid doped polymer electrolyte. High conducting electrolyte developed are based on ionic liquid (IL) doped solid Polyethers. Porous Carbon materials has been developed using plastic bottle throne within campus of Sharda University while veriety of low viscosity ionic liquids doped polyether's have been prepared using solution cast technique and characterized by impedance spectroscopy, optical microscopy (OM), differential scanning calorimetry, x-ray diffraction (XRD), and fourier transform infrared spectroscopy (FTIR). Finally we have tested these Carbon based electrodes and IL doped high conducting solid polymer electrolyte films in energy devices namely supercapacitors/dye sensitized solar cell.

Keywords: Low viscosity Ionic Liquid, Polymer electrolyte, Supercapacitor, Dye sensitized solar cell

**ROLE OF CREATIVE HUBS AND PRODUCING NEW MEDIA PRODUCTS
TOWARDS THE SDGS, AS A TOOL FOR ACHIEVING THE GOAL OF
SUSTAINABLE CITIES SDG 11.**

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Abstract

The article discusses the structure of modern creative industries and the interrelation of the concept with media and innovative mass media technologies. The role of creative hubs in creating new media products is examined, as well as how they are one of the main tools in achieving the goals of the Concept for the Development of Creative Industries in the Republic of Kazakhstan for 2021-2025, and as one of the methods for achieving the goal of developing cities, as set out in the UN Sustainable Development Goals until 2030. The aim of the research is to identify methods for developing this topic using content analysis and desk research. The literature, the Resolution of the Government of the Republic of Kazakhstan on the implementation of the strategy for the development of the creative sector and the achievement of growth indicators and expected results, and the Voluntary National Review on the implementation of the Agenda for Sustainable Development until 2030 are considered. It is noted that media resources play a significant role in popularizing the strategically important tasks of this industry. They are designed to transmit truly scientific knowledge and the importance of the development of creative industries to society as the main booster of the country's economic development and one of the solutions to ensure sustainable development of Kazakhstani society. However, to date, scientific research in the field of social sciences and the topic of the connection between the media as an important component of creative industries and the hypothesis of its development from the involvement of the media are poorly studied. As successful and confident development of the creative sector is important to support not only materially but also to create a favorable and efficient information environment. The author describes the possibilities of digital journalism, which should be used to promote scientific knowledge in society and attract the attention of government agencies to the activities of Kazakhstani scientists in the field of communications. The scientific significance of the article is an attempt to outline a completely new view on popularizing scientific knowledge in society; to offer new methods of developing creative industries, to determine the relationship between creators of creative content, business representatives, and the state as one of the methods contributing to the growth of the country's economy and the share of creative industries. In addition, the author, using examples of existing programs and projects in the field of innovative technologies, reveals the work already done in this direction in the country, gives an independent research assessment based on the existing project "Digital and Creative Laboratory" of the Nazarbayev University Innovation Cluster as an example of providing state support to entrepreneurship entities to stimulate the creative industries of the Republic of Kazakhstan, and actively promotes the implementation of the main UN Agenda for Sustainable Development.

Keywords: Creative industries, new media, digital journalism, innovation, sustainable development, media business, incubation, cultural economy, media production, information environment.

**INTENSE LASER FIELD EFFECT ON THE ELECTRONIC AND OPTICAL
CHARACTERISTICS OF HARMONIC AND ANHARMONIC OSCILLATORS WITHIN
AN INGAN/GAN HETEROSTRUCTURE**

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Abstract

Harmonic and anharmonic oscillators are fundamental concepts in materials science as they play a crucial role in understanding the electronic and vibrational properties of materials, including semiconductors and insulators. These oscillators provide a theoretical framework for the analysis of the behavior of atoms and molecules in material and their interaction with electromagnetic fields, making them a vital tool for the development of new materials and technologies. This paper explores the significance of harmonic and anharmonic oscillators in InGaN/GaN heterostructure by analyzing their electronic and optical properties under the impact of a nonresonant intense laser field, including higher-order anharmonic terms. The research employs effective-mass and parabolic band approximations, along with the finite element method to determine the eigenvalues and eigenvectors of the electron confined within the harmonic and anharmonic oscillator potentials. By utilizing the density matrix expansion approach, the paper derives analytical expressions of the linear and third-order nonlinear optical absorption coefficients for a two-level system. The findings suggest that the electronic and optical properties of nanostructured semiconductors can be adjusted to fit specific responses for particular applications or goals by manipulating the structural parameters such as the width, depth of either HO or AHO potential, and applied laser intensity. Furthermore, the integration of ILF results in a decrease in the amplitude of the resonance peaks of the OACs and a shift of these peaks towards higher energy ranges. The study also concludes that the impact of the incident electromagnetic intensity is more prominent in the absence of the ILF than when it is present, for both HO and AHO potentials.

Keywords: Absorption spectrum; ILF; Harmonic; Anharmonic-oscillator.

**EXPLORING THE PERSISTENCE OF HYPERTENSION DESPITE MEDICATION:
IMPLICATIONS FOR ADVANCING TREATMENT AND POLICY PERSPECTIVES IN
INDIA**

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Abstract

Background & objectives: Hypertension, a silent yet pernicious ailment, afflicts a significant proportion of the Indian populace. Tragically, only one-third of those suffering from hypertension are cognizant of their condition, and an even tinier percentage are able to effectively regulate it through medication. It is imperative that we comprehend the underlying characteristics and behaviours of patients treated for hypertension, in order to generate evidence for improved management strategies. This study endeavours to investigate the key factors associated with uncontrolled blood pressure levels among patients receiving medication for hypertension. **Methods:** Data from the LASI survey (2017-18) is analysed to study hypertension control among 12,353 individuals aged 45+ who were diagnosed and on medication. Blood pressure levels were used to classify respondents into 4 categories of hypertension control. Logistic regression analysis is used to examine the association between hypertension control and demographic, socio-economic and behavioural characteristics. **Results:** A critical proportion of respondents is having uncontrolled hypertension of grade 1 (31 per cent), grade 2 (15 per cent) and grade 3 (2 per cent), despite taking medication for the same. As compared to their remaining counterparts the risk of uncontrolled hypertension is high in rural areas (OR=1.37, 95% CI, P<0.01), old adults living alone (OR=1.63, 95% CI, P < 0.05), patients having no schooling (OR=1.18, 95% CI, P < 0.05), patients with obesity (OR=1.2, 95% CI, P<0.05), Moderate alcohol drinkers (OR=2.1, 95% CI, P<0.01), Abusive alcohol drinkers (OR=1.6, 95% CI, P<0.01). **Interpretation & Conclusions:** Poor control over blood pressure levels among patients from rural areas, the poorest and most vulnerable sections support the governmental efforts initiated since 2018 to expand community-level screening and provisioning of NCDs, including hypertension. In addition, concrete efforts for health promotion within patients under medication for hypertension to are essential for better management of this condition.

Keywords: Hypertension, Medication, NCD

**EVALUATION OF SYMPTOMS OF DYSPHAGIA IN INDIVIDUALS WITH DIABETIC
FOOT ULCER**

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Abstract

Diabetic Foot Ulcer (DFU) are lesions associated with autonomic, sensory and motor neuropathy due to Diabetes Mellitus (DM). In addition to the well-known complications of DM such as retinopathy, nephropathy, neuropathy and cardiovascular disease, oral complications such as burning mouth syndrome, dry mouth sensation, gingival recession and tooth loss associated with neuropathy can also be expected. Our aim in the study was to examine the oral complications and oropharyngeal dysphagia symptoms that can be seen in patients with DFU in detail using the Eating Assessment Tool (EAT-10). 35 individuals with a diagnosis of Type 2 Diabetes Mellitus and having foot ulcers were included in the study. Burning mouth syndrome, presence of intraoral lesion, gingival recession and tooth loss were recorded as oral complications of the participants. The EAT-10 scale was used to evaluate the symptoms and severity of oropharyngeal dysphagia. 16 (45.7%) of the individuals included in the study were female, mean age was 61.40 ± 8.83 , and mean diabetes duration was 17.71 ± 7.25 years. Burning mouth syndrome was recorded in 45.7% of the participants, intraoral lesion in 57.1%, gingival recession in 71.4% and tooth loss in 91.4% of the participants. A total score of 3 or above in the EAT-10 scale, which evaluates the symptom and severity of oropharyngeal dysphagia, indicates that there is a swallowing problem. In our study, the total mean scale score of individuals with DFU was 13.71 ± 8.99 . Participants were mostly respectively; they stated that they experienced intense complaints of difficulty in swallowing solid foods, food stuck in the throat while swallowing, difficulty swallowing pills, coughing while eating, and pain during swallowing (Table 1). In our findings, we found that individuals with DFU had swallowing problems according to the EAT-10 scale. As a result, oropharyngeal swallowing problems may be seen in individuals with DFU due to oral complications related to diabetes. Paying attention to eating and swallowing problems in the evaluation and treatment stages of individuals with DFU can increase the effectiveness of rehabilitation.

Keywords: Diyabetes Mellitus, Dysphagia, Eating Assessment Tool

Table 1. EAT-10 assessment data of individuals

Questions		0 =no problem, 4=severe problem					Total Score X±SD
		0	1	2	3	4	
		N (%)					
	My swallowing problem has caused me to lose weight.	14(%40)	12(%34,3)	8(%22,9)	1(%2,9)	0	0,88±0,86
	My swallowing problem interferes with my ability to go out for meals.	13(%37,1)	14(%40)	6(%17,1)	2(%5,7)	0	0,91±0,88
	Swallowing liquids takes extra effort.	7(%20)	13(%37,1)	10(%28,6)	5(%14,3)	0	1,37±0,97
	Swallowing solids takes extra effort.	5(%14,3)	13(%37,1)	6(%17,1)	9(%25,7)	2(%5,7)	1,71±1,17
	Swallowing pills takes extra effort.	6(%17,1)	11(%31,4)	10(%28,6)	6(%17,1)	2(%5,7)	1,62±1,13
	Swallowing is painful.	8(%22,9)	11(%31,4)	9(%25,7)	6(%17,1)	1(%2,9)	1,45±1,12
	The pleasure of eating is affected by my swallowing.	8(%22,9)	14(%40)	7(%20)	4(%11,4)	2(%5,7)	1,37±1,13
	When I swallow food sticks in my throat.	5(%14,3)	12(%34,3)	11(%31,4)	4(%11,4)	3(%8,6)	1,65±1,13
	I cough when I eat.	6(%17,1)	15 (%42,9)	6(%17,1)	5(%14,3)	3(%8,6)	1,54±1,19
	Swallowing is stressful.	7(%20)	17(%48,6)	5(%14,3)	3(%8,6)	3(%8,6)	1,37±1,16

**OPTIMIZATION AND PREDICTION OF NITRITE AND SULPHATE REMOVALS
FROM WASTEWATER BY IRON OXIDE NANOADSORBENT USING DIFFERENT
MODELING APPROACHES**

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Abstract

The treatment of milk processing industry wastewater (MPIW) with an abundance concentration of hazardous organic contaminants is desirable for the sustainability of food processing industries, but it is challenging. This study aimed to develop a novel green synthesized iron-oxide nano-adsorbent (GSIO-NA) using an eco-friendly, ultrasonic-assisted extract of the *Catharanthus roseus* flower to achieve desirable sulfate and nitrate adsorption in real and synthetic MPIW. Quality characteristics of MPIW determined and found huge effluent loads, including sulfate and nitrates. The GSIO-NA characterization revealed stable, non-spherical particles with a grooved surface and a face-centered cubic phase with a typical hematite spinal structure. Strong H-bonding interactions and phytochemicals were found to be responsible for reducing ferric chloride hexahydrate into iron-oxide nanoparticles. These were used as an adsorbent for MPIW treatment. The percent reduction efficiency (%RE) of nitrate and sulfate with GSIO-NA was determined with a focus on the initial concentration of pollutants, pH, adsorbent dosage, and contact time. Predictions of process responses were made by artificial neural networks coupled with response surface methodology-based soft-computing technique. In a batch study, 88.08 and 86.36 %RE of sulfate and nitrate were absorbed on GSIO-NA at optimized adsorption process parameters. Pseudo-second-order, Freundlich, and intra-particle-diffusion models were the best fit to predict the adsorption capacity of a developed adsorbent. Most MPIW characteristics fell below the permissible limits of effluent standards, especially sulfate, and nitrate, resulting in 98.21 and 92.30 %RE upon using GSIO-NA. Hence, this novel green technology could be used in the milk processing industry for cleaner production and recycling wastewater.

Keywords: Milk processing, Wastewater treatment, *Catharanthus roseus*, Iron oxide, Nanoadsorbent

BEING CREATIVE THROUGH EMOTIONAL STABILITY IN CHOOSING COPING STRATEGIES

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Abstract

This research was conducted by conducting a survey of SME business owners in Banyumas Regency. This study has a goal including to provide views and empirical evidence on how the level of emotional intelligence can affect creativity by considering a person's personality as moderation and coping strategies as mediation when facing the aftermath of the pandemic, namely the COVID-19 endemic which can affect the owner's decision making on life. his company. The population used in this study were SME business owners who were then taken through a purposive sampling method with several criteria so that 76 respondents were collected. Using PLS (Partial Least Square) as an analytical tool shows that: (1) Emotional intelligence has a positive effect on coping strategies (2) Emotional intelligence has a positive effect on creativity (3) The personality trait of neuroticism has a negative influence on the relationship between emotional intelligence and coping strategies while conscientiousness and openness to experience have no significant relationship to the two variables (4) Coping strategies can mediate the relationship between emotional intelligence and creativity. The implications and suggestions concluded from this research are that it is important to remember the importance of the government, institutions, and communities engaged in the economy to realize that business owners have the desire to continue to survive despite the perceived impact of the pandemic so that more attention is needed by providing direction, training, and guidance so that business owners can continue to develop their businesses creatively. This study provides a further empirical view of how the relationship between emotional intelligence, coping strategies, and creativity that is still limited. Future research could investigate further how the relationship between the three variables can help the economic sector, especially small business owners.

Keywords: Emotional Intelligence, Coping Strategies, Personality Traits, Big Five Personalities, Creativity, SME

**THE IMPORTANCE OF MANAGEMENT FUNCTIONS IN NATURAL DISASTERS:
EVALUATION OF KAHRAMANMARAŞ-CENTERED EARTHQUAKES**

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Abstract

Management; It is the whole of efforts to direct a group of people towards determined goals and to ensure coordination with cooperation between them. The concept of management evokes; “To make decisions that will enable to use human resources, financial resources, fixtures, tools-equipment, raw materials and auxiliary materials, and finally the time factor in a harmonious and effective manner in order to achieve the goals, and to enforce them”. To operate through others and to achieve predetermined goals; Some processes are required. That is, management requires a series of activities. These activities, which are constantly repeated in mutual interaction, are called "management functions". This process consists of “planning, organising, executing, coordinating and controlling” functions. Management functions interact with each level (strategic, coordinative, operational) in the management pyramid. Businesses, public institutions, non-governmental organizations and every non-profit organization management must know these functions. This fact is also valid for any institution or person struggling with natural disasters. Natural disasters are events that negatively affect human life. In some cases, they may develop gradually. Sometimes, they can affect our lives suddenly. Among these, the following can be listed: “Earthquakes, storms, tornadoes, floods, floods, volcanoes, forest fires, severe cold, landslides, rock falls, avalanches, droughts and famines”. Some disasters may be man-made. These are generally: “Nuclear-biological-chemical accidents, transport accidents, industrial accidents, accidents caused by overcrowding, immigrants and displaced, etc.”. The deterioration of the ecological structure increases the destructive effect of natural disasters day by day. This study has been prepared on the importance of management functions in natural disasters. The study focuses on natural disasters in general and destructive earthquakes in particular. In this study, firstly, literature information is explained. First of all, management, management functions, natural disasters and the importance of management functions in natural disasters are explained. Then, the results of Kahramanmaraş-centered earthquakes are given. Methodology department; It is about the problem, purpose and importance of the research, as well as the research method and scope. In the title of findings and discussion, the importance of management functions in particular for Kahramanmaraş-centered earthquakes has been discussed. The study is concluded with conclusions and recommendations.

Keywords: Management Functions, Natural Disasters, Importance of Management Functions in Natural Disasters, Kahramanmaraş-Centered Earthquakes

LIE AND NOETHER SYMMETRIES OF SECOND-ORDER PARTIAL DIFFERENTIAL EQUATIONS

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Abstract

Second-order partial differential equations (PDEs) mostly appear in physics, mechanics, chemical engineering, and other fields of science. Any second-order PDE is equivalent to the Euler-Lagrange equation. Each Euler Lagrange equation has Lagrangian or in fact, an infinite number of Lagrangians. The Lagrangian of dynamical system is the difference between the kinetic and potential energies. The main goal of this study is to find the Lagrangians of the considered PDEs (Euler Lagrange equations). Then use the Noether symmetry equation to find all the Noether symmetries of the obtained Lagrangians. Compare the Lie and Noether symmetries for each PDE and then use the Noether theorem to find all the conservation laws hold in the given dynamical system.

Keywords: Lagrangians, Noether symmetries, conservation laws

**INCREASING THE QUALITY OF SERVICES PROVIDED IN THE HOTEL
INDUSTRY THROUGH A QUALITY MANAGEMENT SYSTEM**

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Abstract

For the survival of tourism industry, the quality of the provided services is perceived as a survival strategy, especially in the post-pandemic period. Quality became an important tool for competitiveness at the market. Modern trends confirm the constantly growing demands for quality. At the same time, more emphasis is placed on strong and meaningful experiences. In effective planning and quality management, it is important to realize not only the influence of enormous market competition, but also to know the characteristics of decision-making processes, as well as the psychological aspects of tourism participants. Quality is currently an integral part of international competitiveness at the national level and at the corporate level. It is certainly an indisputable attribute of economic success and prosperity. Information about a high-quality service provided will reach five other potential customers, while the rumor about a bad, low-quality service will reach at least 15 people. According to the conducted research, it has been shown that the cost of acquiring new customers is much higher than the cost of keeping old customers. For this reason, keeping satisfied and loyal customers remains a fundamental business principle in this industry. Some researchers have noted that in the service industry, competitive advantage is focused on exceptional quality services that bring customer satisfaction and loyalty. The paper specifies the perception of quality management in tourism enterprises. The aim of the research was to find out the differences in the rate of registration of complaints from customers in the context of the application of the quality management system in accommodation facilities. The research sample was hotels in the countries of the Vyšehrad Four. By means of the questionnaire method, the state of improvement of visitors' satisfaction during the introduction of the system of quality was determined. Managers of accommodation facilities were questioned. Obtained data were verified through Pearson's chi-square and other tests. The results show that the introduction of a quality management system in accommodation facilities has a positive effect on reducing the level of complaints and increasing the satisfaction of the accommodated guests. In conclusion, it follows that the quality management system is a useful tool for strengthening quality due to the immediate possible response to potential deficiencies. Its application is beneficial for the management of individual businesses as well as a tool contributing to increasing competitiveness at the tourism market in the post-pandemic period.

Keywords: Quality. Hospitality. System of quality management. Tourism business competitiveness.

SWITCH MODE POWER SUPPLY-BASED MULTIFUNCTIONAL EMULATOR

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Abstract

In this paper, a DC-to-DC buck converter-based multifunctional emulator is presented. The proposed system aims to build a novel module-based flexible power electronics circuit architecture capable of simulating multiple renewable energy sources and batteries with a single device. Due to the fixed circuit topology and control system used in the current market's various energy source emulators, each emulator device can only emulate a single energy source. The proposed approach enables the use, integration, and flexible transformation of power electronics circuit successfully for a variety of converter topologies. Several single-phase DC/DC buck converters, a multiple-phase interleaved DC/DC buck converter, and a three-phase converter can be cited as easily applicable examples of the proposed system. Thus, multiple renewable energy sources and batteries or a single high current energy source can be emulated easily and spontaneously with the developed power electronics circuits in the module. Additionally, providing a cost-effective (less implementation cost) approach for developing advanced power conditioning devices (PCUs), higher efficiency and reduction in the level of complexity, being easily adaptable and feasible to function under variable environmental conditions and frequent load changes can be considered as the significant advantages of the proposed system. The performance of the proposed topology will be validated experimentally with the implementation of MATLAB/Simulink/Stateflow on dSPACE Real-time-interface (RTI) 1007 processor, DS2004 High-Speed A/D and CP4002 Timing and Digital I/O boards in the near future.

Keywords: Switch Mode Power Supply-based Emulator, DC-DC Buck Converter, Multiphase-Converter Topology, Power Electronics Circuit Architecture, Renewable Energy Sources and Battery Emulators

DESCARTES'TAN HABERMAS'A MODERN ÖZNEİN SERÜVENİ

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Özet

Descartes, yöntemsel kuşku anlayışıyla özneyi doğrunun tek ölçütü olarak tanımlamış ve bu bağlamda geçmişe ait bilgisel birikimi de şüpheli olarak betimlemiştir. Descartes için bütün kuşkulardan kurtulabilmenin yegâne sarsılmaz dayanağı insânî öznenin bizatihi kendisidir. Kant ise modern sübjektivite metafiziği bağlamında, Kartezyen bireysel özne ya da Hume tarzı ampirik özne anlayışları yerine, transandantal özne, sonrasında ise ahlâkî özne anlayışlarını ikâme etmiştir. Hegel'le birlikte başlayan özne-nesne ikiliğini aşma arayışları Nietzsche'de modern öznenin parçalanıp bölünmesi yoluyla doruğuna ulaşmış, Heidegger ortaya koyduğu Dasein anlayışıyla öznenin varlıktan ayrı düşünülemeyeceğini ortaya koymuştur. Foucault gibi kimi çağdaş düşünürler ise, bilhassa Nietzsche'nin açtığı yoldan giderek modern özneye alternatif öznellik imkânlarına yönelmişlerdir. Frankfurt Okulu'nun yaşayan son temsilcisi olan Habermas, aklı ön plana alan iletişimsel özneyi inşa ederek modernitenin içine düştüğü akıl ve özne krizini aşma derindedir. Modern öznenin gelişimi ve eleştirisi yönündeki tartışmalar günümüze kadar devam etmiştir. Bildiride modern öznenin serüveni genel hatlarıyla ortaya konulduktan sonra modern sübjektivite metafiziğinin en son geldiği noktaya dair özgün değerlendirmeler ortaya konulacaktır.

Anahtar Sözcükler: Descartes, modernizm, öznellik, özne, Hume, Kant, Hegel, Nietzsche, Habermas

COMBINATORIAL PROPERTIES OF POWER GRAPHS OVER GYROGROUPS

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Abstract

Algebraic graph theory connects algebra (both abstract and linear) and graph theory. Many algebra concepts have been facilitated through the construction of graphs as tools used in computer science. Conversely, graph theory has also helped to characterize certain algebraic properties of any algebraic structures. The power graph $P(G_1)$, a group G_1 is a simple graph with the vertex set G_1 such that two distinct vertices $w, u \in G_1$ are adjacent in $P(G_1)$ if and only if one is an integral power of the other. In this work, we determine the degree of all the nodes and the lambda number of power graphs over gyrogroups. Moreover, we find certain polynomials and the Hosoya index for the same algebraic graphs and also find a link between gyroautomorphisms and the group of auto morphisms of the power graph of gyro group. The gyro group G_l is basically the union of $W(l)$ and $H(l)$, where $W(l) = \{0, 1, 2, \dots, 2^{l-1} - 1\}$ and $H(l) = \{2^{l-1}, 2^{l-1} + 1, \dots, 2^l - 1\}$ is used to explain the structure of $P(G_l)$ of G_l . Since W is a cyclic subgroup of order 2^{l-1} , so it is $P(G_l)$ is isomorphic to K_l graph $K_{2^{l-1}}$, and each element of $H(l)$ is connected only towards identity e . Therefore, the structure of the power graph of $G(l)$ is given below:

$$P(G_l) = K_1 \vee (K_{2^{l-1}} \cup K_l)$$

Keywords: Power Graph, Gyro group, Gyroautomorphisms.

CERTAIN TOPOLOGICAL PROPERTIES OF COMMUTING GRAPHS OVER SEMI-DIHEDRAL GROUPS

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Abstract

A topological descriptor is a numeric value derived from a molecular structure that reflects significant structural characteristics of the suggested molecule. Various physical properties, chemical reactivity, and biological activity are correlated with the chemical composition based on its algebraic value. This work examines algebraic graphs. Algebraic graph theory basically explores the link between abstract and linear algebra and graph theory. Let G be a group and X be a nonempty subset of G . The commuting graph $C(G, X)$ of G has X as the vertex set, where two elements in X are adjacent if $xy = yx$. This work discusses several degree-based and distance-based topological descriptors of commuting graphs of semi-dihedral groups. Furthermore, the atom-bond connectivity index and its fourth version, the Wiener index and its reciprocal, the geometric-arithmetic index and its fifth version, Schultz molecular topological index, harmonic index, Harary index, Sankruti Index, Hosoya polynomial, Reciprocal status Hosoya polynomial, Randić index and the general Randić index will be calculated using the two proposition of Semi-dihedral group.

Proposition 1. $\Gamma(SD_{8n}) = K_4 \vee (nK_4 \cup K_{4n-4})$ for odd n .

Proposition 2. $\Gamma(SD_{8n}) = K_2 \vee (2nK_2 \cup K_{4n-2})$ for even n .

Keywords: Topological Indices, Semi-dihedral group, Commuting graphs.

**CONTEMPORARY MANAGEMENT FUNCTIONS IN THE TOURIST AGENCY
SANN-FLY**

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Abstract

Contemporary management finds place everywhere in contemporary literature. The most important management functions are: planning, organizing, leading and controlling. The application of contemporary management is very important in the tourism industry, which is also used in tourist agencies. Management is one of the most important activities since the beginning of mankind when people needed to fulfill their goals and objectives. Now management has become essential even in the field of business where decision-making in complex organizations becomes simpler by relying on human groups who constantly manage or direct the work that must be done successfully and properly from the planning stage to at the control, which is the final stage where it shows the result of the work, is it going well or does it need improvements. Given the competition, quality services and modern management techniques, help you to be one step ahead and be as close and open as possible to customers.

The purpose of this paper is to understand the contemporary management functions used in the tourist agency and the quality of the service. To define and describe what are the contemporary management techniques that this company uses. The qualitative method was used for the methodology of this study. The instrument used for data collection is the interview with the person in charge of the tourist agency Sann Fly in Ferizaj. This study aims to present the functions of contemporary business management and how Sann Fly tourist agency applies contemporary techniques. SANN FLY offers all services to its passengers with the most modern online methods and at affordable prices. This business also provides its own services online, where the booking of tickets and other services is done electronically.

Keywords: management, contemporary management, tourist agency, contemporary management techniques

**THE INFLUENCE OF URBAN ENVIRONMENT ON HUMAN PSYCHO-
EMOTIONAL STATE**

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Abstract

Different physical environments cause the human brain to respond to it and affect the body in different ways. Some environments are perceived as risky and activate the sympathetic nervous system, while others lead to relaxation by affecting the parasympathetic nervous system. The fundamental component of the environment is the landscape. In a natural environment people experience fewer negative emotions; and by visiting city parks and green areas city dwellers can reduce anxiety, tension and stress. A visual connection with nature, even through a window, has a positive effect on restoring attention and general well-being. The view out of the window on a poorly maintained facade, an offset composition can lead to a reaction of anxiety, disgust and depressive feelings. The answer is the transformation of the landscape into a hybrid version, where natural elements (for example, planted trees) are present along with the artificial buildings. Some of the modern cities are full of chaotic construction with high-rise buildings. Residents of apartments on high floors testify to the fear of being trapped by a fire or an earthquake, terrorist attacks, falling from windows or balconies, acquiring infectious diseases by sharing buttons, etc. Humans are biologically inclined to want to be in places where there is some complexity and variety. Long monotonous fences, identical entrances, houses and entire yards force the nervous system to overextend, causing psychological discomfort. Different textures, colors and materials, awnings, arches or other architectural details, see-through doors and windows lead to an improvement in the mood of the city people. The general aesthetics of the city is also essential. The harmonious appearance of the street has a good effect on the mood, promotes good health. On the other hand, anti-aesthetics, which includes damaged houses, garbage and graffiti, has a negative effect on the human psyche.

Keywords: urban environment, landscape, psychological stress, façade, aesthetics, psycho-emotional state

PERSISTENT TRIGEMINAL ARTER VE KLİNİK ÖNEMİ: OLGU SUNUMU

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Abstract

During the embryological development period, there are anastomoses between the internal carotid artery, which will feed the brain, and the basilar artery formed by the vertebral arteries. These anastomoses are the trigeminal, otic, hypoglossal and proatlantal arteries, named according to the structures they are adjacent to. These 4 pairs of primitive arteries are called presegmental arteries. Presegmental arteries disappear at about the 5th week of the embryo after the communicating arteries have developed. However, although rare, some of them can survive into adulthood. Persistent trigeminal artery (PTA) is the most common vertebrobasilar variation. Although it is seen with a frequency between 0.1% and 0.6% in the population, it constitutes 85-87% of carotid-basilar artery anastomoses. PTA is an asymptomatic variation that is usually seen incidentally during radiological imaging. However, there are studies reporting that it may be associated with various vascular anomalies and disorders, including aneurysm, arteriovenous malformation, and symptoms such as trigeminal neuralgia, vertigo, ataxia, paralysis, migraine, and headache. A 72-year-old female patient was admitted to the neurology clinic with complaints of dizziness and blurred vision. Digital subtraction angiography (DSA) was planned for endovascular treatment when a stenosis was detected in the origin of the right vertebral artery in the Doppler ultrasonography. In DSA, the presence of PTA originating from the cavernous segment of the left internal carotid artery was detected. PTA, which did not differ in terms of sex, was first described by Richard Quinn in 1844 at autopsy and by Sutton in 1950 for angiography. There are different classifications according to the regions fed by the PTA, the vessels or the place of attachment to the basilar artery. Saltzman divided the PTA into 2 groups, Weon divided it into 5 groups and Komiyama into 3 groups. Tasdemir et al., on the other hand, added a new one to all these classifications by presenting a case of PTA that alone forms basilar artery, where vertebral artery is not connected. It has been reported that PTA may cause some symptoms and clinical problems. It should be considered that the posterior circulation is provided by the carotid interna, and the risk of posterior ischemic stroke in the presence of atherosclerotic plaques in this vessel will increase. At the same time, there may be a risk of developing cerebellar ischemia due to the presence of hypoplastic vertebral artery and insufficient filling of the PICA originating from this artery. Tyagi et al. reported in their retrospective study that PTA may cause vascular malformations and aneurysms with altered hemodynamics. In terms of its anatomical course, the association of aneurysms, trigeminal neuralgia and transsellar PTA during transsphenoidal surgery is of particular importance for neurosurgeons. Preoperative recognition and correct interpretation of these variations are important to avoid complications during intracranial operations.

Keywords: PTA, Variation, DSA

**FRANSIZCA ÖĞRETİM YÖNTEMLERİNDE DERS KİTABI ETKİNLİKLERİNİN
EVRİMİ**

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Özet

Bu çalışmanın amacı, çok ögeli bir dizge arz eden Fransızca öğretiminde ders kitabı etkinliklerinin geçirdiği evrimi irdelemektir. Bahsi geçen evrimi irdelerken ilk olarak yabancı dil öğretiminin, özellikle dilbilim ve ruhbilim gibi rehber teşkil eden alanlardan etkilenerek geçirdiği tarihsel dönüşüm dikkate alınmalıdır; bu bağlamda dil odaklı, bildirişim yetisi odaklı ve güncel olarak da daha seçmeci bir özellik gösteren yöntem sonrası aşamalar gözlemlenmektedir (Puren, 1988/2012; Germain, 1993; Kumaravadivelu, 2003, 2006; Cuq & Gruca, 2017). Öte yandan, yabancı dil öğretiminin değerler dizisinde kuram ile uygulama arasında köprü görevi gören yöntem olgusunun iki önemli alt bileşeni vardır: öğretmenin sınıf içi edimleri (Cicurel, 2011) ve ders kitapları. Dolayısıyla, bu çalışmada ders kitaplarında önerilen etkinliklerin geçirdiği dönüşüm, yukarıda anlatılan aşamalarla ilintilendirilecektir; başka bir deyişle, Fransızca öğretiminde kırılma noktaları oluşturan Dilbilgisi-Çeviri, Doğal, Sözel-İşitsel, Görsel-İşitsel, Bildirişim ve Eylem-Etkinlik gibi yöntemlere ya da yaklaşımlara bağlı oluşturulmuş Fransızca öğretimi kitaplarındaki dilsel-bildirişimsel etkinliklerin, dinleme-okuma-konuşma-yazma yetileri kapsamında (Conseil de l'Europe, 2005; Bertocchi & Costanzo, 2008) nasıl tasarlandığı; yani, etkinliklerin içeriği, oluşturulacak çözümlene çerçevesi aracılığıyla nitel olarak (Merriam, 2009) araştırılacaktır. Burada dikkat edilecek öncül öğeler dilsel odaklılık, bildirişimsel odaklılık, dil yetisi türü, etkinliklerin gerçek ya da kurgusal özelliği, etkinlikte kullanılan belgelerin özgünlüğü vb. olacaktır; ancak araştırma sürecinde bu öğeler değişiklik gösterebilecektir. Sonuç olarak, bu araştırmanın bulgularının Fransızca ders kitaplarındaki etkinliklerin geçirdiği evrime ve gelecekteki olası seyrine ışık tutması hedeflenmektedir.

Anahtar Sözcükler: Fransız dili, yöntem, ders kitabı, bildirişimsel yaklaşım, eylem-etkinlik yaklaşımı

**TO WHAT EXTENT IS ACADEMIC BURNOUT INFLUENCED BY POSITIVE
THINKING EDUCATION**

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Abstract

Academic burnout is defined as a sense of fatigue due to the demands and requirements of education, a pessimistic sense of the subject and poor personal progress in education (self-efficacy). Positive thinking as a new approach in psychology involves training skills to change negative attitudes and pessimism and skills to create a positive and effective lifestyle that can help students to prevent and cope with academic burnout. This study aimed to analyze the effect of positivity training on reducing academic burnout among students of Sepidan Higher Education Center. The present research is a semi-experimental study on 154 students majoring in public health and nutrition, using the pre/post-test design. Maslach questionnaire was used to evaluate the effect of positive thinking on the reduction of burnout and compare it before and after the intervention. The data were analyzed using the SPSS software. In this study, 31.2% of the participants were male and 68.8% were female. 12.3% of them had a bachelore degree, 72.1% were undergraduate, and 15.6% had postgraduate and higher degrees. Their minimum age was 18 and the maximum age was 52 years old; their mean age was 28.25 years. Their mean burnout score before the intervention was 50.85 and reached 49.25 after the intervention. The mean scores at the post-test stage shows 1.6 units compared to the pre-test. The results showed that there was a significant difference between the pre- and post- tests. The results also showed that positive thinking training effectively reduced the rate of academic burnout and its components (academic burnout, doubt, pessimism, and academic self-efficacy).

Keywords: Positive thinking, academic fatigue, educational burnout, educational apathy, educational self-efficacy.

**READINESS FOR E-LEARNING FROM THE UNIVERSITY STUDENTS AND
PROFESSORS' PERSPECTIVES**

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Abstract

The aim of this study was to evaluate the cognitive, psychomotor, and attitudinal readiness of faculty members and students of Shiraz University of Medical Sciences for using e-learning in 2019 in order to move toward the desired future of e-learning in medical education, promote the benefits of e-learning in the country, and provide training to each of the research groups, if needed. This is a cross-sectional study conducted in Shiraz University of Medical Sciences, Iran, in 2019. The study population consisted of 379 students and 281 professors selected through the systematic random sampling in Shiraz University of Medical Sciences. The e-learning readiness questionnaire developed by Zarif Sanaei et al. was used to evaluate the students' and teachers' viewpoints. The results showed that the average level of skill, knowledge, and attitude among students and teachers was positive and higher than the mean ($P < 0.05$). It had only a significant relationship in the level of education of the teachers and the marital status of the participants. There was also a significant interaction between skill, knowledge, and attitude. There is a need for successful implementation of e-learning by creating appropriate infrastructure, applying the required standards, as well as taking measures to reduce the existing resistance in this regard, which can be achieved through training workshops. The experience of successful universities in the country and abroad can also be used to implement e-learning.

Keywords: E-learning, learning, preparedness, professors, students

**MULTIMODAL DISCOURSE ANALYSIS OF SEXISM AND GENDER
STEREOTYPING POPULAR NIGERIAN ONLINE COMIC SKITS**

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Abstract

This study examined sexism and gender stereotyping in two popular online comic skits using multimodal discourse analysis as theoretical framework. aspect which accounts for the grammar used in the skits. The study appraised the verbal and the visual choices of the characters and attempted to establish patterns of sexism in both. It was discovered that while focusing on the goal of entertainment, the skits portrayed evidence of sexist use of English in the linguistic choices of the characters. The study also found that through the instrumentality of both verbal and visual choices, the skits portrayed gender-based prejudices. Based on these findings, the study concluded that these Nigerian online comedy skits primarily present characters as stereotypes and uses sexist language. However, both the stereotypes and the sexism target females more than the target males and this reflects the sociocultural context of patriarchy. It recommended that content creators should adopt a more inclusive language and avoid sexism in online comedy skits.

Keywords: Sexism in entertainment, multimodality, gender stereotyping in skits, media and language, semiotics, Nigerian comedy, linguistic sexism, and visual grammar.

**PYRIMIDINE-BASED COMPOUNDS AS INNOVATIVE PROTEIN-PROTEIN
INTERACTION INHIBITORS IN CANCER TREATMENT**

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Abstract

In neuroblastoma, Aurora Kinase A (AURKA), independently of its kinase activity, binds to the oncoprotein N-Myc, preventing its degradation and contributing to the progression of neuroblastoma since it interferes with the cell-cycle exit of neuroblasts. While intense efforts have been made to develop AURKA inhibitors, the very low druggability of N-Myc has prevented any successful strategy for chemotherapeutic intervention. However, recent studies demonstrating the interaction between AURKA and N-Myc have provided an innovative therapeutic approach. These findings have prompted the identification of new compounds able to disrupt the AURKA/N-Myc complex, in order to promote N-Myc degradation. New studies indicated that **RPM1722**, a promising orthosteric bis-anilinopyrimidine AURKA inhibitor, was capable of blocking this protein-protein interaction [1]. **RPM1722** bromine atom is thought to be responsible for induced-dipole forces that freezes the enzyme in an unusual “DFG-out/loop-in” conformation. However, although in vitro assays RPM1722 was able to also inhibit the N-Myc/AURKA interaction, it seemed quite ineffective in cell-based assays. In this scenario, we described the design and synthesis of a new library of 2,4-disubstituted pyrimidine structurally related to RPM1722. The pyrimidine core and the 4-carboxyphenylamino substituent in position 2 have been kept. Conversely, the nitrogen atom was replaced with an oxygen or sulfur and the phenyl ring in position 4 of the pyrimidine was modified by introducing halogens in 2, 3 and 4 positions. On the other hand, it has been also shown a covalent Coenzyme A inhibition of AURKA as a result of the formation of a sulfur bridge between the thiol group of the pantetheine tail and the side chain of Cys290 residue located in the activation loop of AURKA [2-3]. This mechanism is specific and provides the proof of concept for a potential irreversible inhibitory mechanism of AURKA which would possibly keep the AURKA in a conformation unsuitable for N-Myc binding. Hence, we retained the 2-(4-carboxyphenylamino) pyrimidine core of RPM1722 as anchor site and decided to design a long branch with a terminal electrophilic warhead to mimic the pantetheine tail of acetyl-CoA to reach for the Cys290 residue. All the newly synthesized compounds were evaluated in enzymatic inhibition assays and X-ray crystallographic experiments were performed to corroborate our biological results. Further investigations are needed to better understand the mechanism of action of our compounds.

Keywords: pyrimidines; AURKA; N-Myc; conformation disruptors; kinase inhibitors.

INFLUENCE OF GINGER EXTRACT ON STABILITY AND SENSORIAL QUALITY
OF SMOKED MACKEREL (*Scomber scombrus*) FISH

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Abstract

The effect of ginger extract on the stability and sensorial quality of smoked mackerel fish stored at $28 \pm 2^\circ\text{C}$ was determined over 20 days. Chemical, microbiological and sensory analyses were performed to investigate quality changes, and to determine the shelf stability of the products. The proximate, thiobarbituric acid (TBA) value, peroxide value (PV), mould count, and trimethylamine (TMA) were found statistically significant ($p < 0.05$) in the smoked mackerel fish throughout storage. Protein, fat and ash contents of the ginger extract treated samples had marked % increase compared to the control. The lowest TBA (0.08 mg MDA/kg), peroxide (4.50 mEq/kg) and TMA (3.46 mg N/100 g) values were recorded in 5% ginger extract treated samples, while the highest TBA (1.45 mg MDA/ kg), PV(30.07 mEq/kg) and TMA (15.52 mg N/100 g) occurred in the control. The result also revealed that samples treated with ginger extract had lower mould count than the control. The organoleptic results showed that samples treated with 5% ginger extract had the best acceptance, and were significantly different ($p < 0.05$) when compared to the control after 10 days of storage.

Keywords: Smoked mackerel fish, ginger, stability, quality, thiobarbituric acid.

**PERFORMANCE OF MECHANICAL & DURABILITY PROPERTIES OF TERNARY
BLENDED CEMENT CONCRETE**

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Abstract

Cementitious composites are the most frequently used man-made material, with a 25 billion tonne manufacturing volume and 5% greenhouse gas emissions. Concrete composites release a lot of CO₂ into the environment. Thus, replacing concrete composite raw material is a priority. To reduce this industry's carbon footprint, large-scale reuse of industrial byproducts including Fly Ash (FA), Silica Fume (SF), and Ground Granulated Blast-Furnace Slag (GGBS) in cementitious composites is growing. This method addresses waste management for industry byproducts in two ways. The mechanical strength and durability of cementitious composite products with many ingredients must be documented. The study's major goal is to evaluate high-strength cementitious composites' mechanical strength and durability. FA (20%, 30% & 40%), SF (5%, 7.5% and 10%), and GGBS (10%, 15% and 20%) binder were used to make high-strength cementitious composites. Waste management has developed into a problem for the environment. The illegal and unethical practices involved in mining natural river sand (NRS) have gotten worse. Therefore, by substituting Granite Quarry Dust (GQD) for fine aggregate, the lack of NRS for building is prevented. GQD was employed to replace natural river sand at different levels of replacement as the fine aggregate phase in 10%, 20% and 30%. The fresh cementitious composites used to describe the cementitious composites. Additionally evaluated were its flow-ability and the cured cementitious composites' properties, particularly their compressive strength, flexural strength, and split tensile strength. Additionally, the strength characteristics such water sorptivity and the Rapid Chloride Permeability Test (RCPT). We shall evaluate it with normal concrete based on the results.

Keywords: Cement, fine aggregate, coarse aggregate, fly ash, Silica fume, GGBS and Water

ON THE SPECTRA OF A NEW CORONA TYPE GRAPH AND APPLICATIONS

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Abstract Let $S(G)$ be the subdivision graph of G . Given two graphs G_1 and G_2 , the S_G corona, $G_1 \cup G_2$ is the graph obtained from $S(G_1) \cup G_1$ and n_1 copies of G_2 , all vertices distinct, by joining i^{th} vertex of G_1 to every vertex in the i^{th} copy of G_2 . In this paper, we determined the adjacency spectrum (respectively Laplacian and signless Laplacian spectrum) of $G_1 \cup G_2$ for a regular graph G_1 and an arbitrary graph G_2 in terms of the corresponding spectra of G_1 and G_2 . Finally, as an application of these results, we constructed infinitely many pairs of cospectral graphs. In addition, the Kirchhoff index and the number of spanning trees of $G_1 \cup G_2$ are also calculated.

Keywords: spectrum, corona, cospectral graphs, Kirchhoff index, spanning trees.

AMS Subject Classification (2010) : 05C50

IMPORTANCE OF NUTRITIONAL BIOCHEMISTRY

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Abstract

This research highlights the importance of nutritional biochemistry. Daily nutrition is a matter of biochemistry. A good state of health with an optimal level of nutrition must take into account the chemical needs of the body. The main purpose of this study is to look at the effect of nutrition on the human body and focuses on the importance of nutrients that the human body needs. The methodology of this study used descriptive methods to describe the separation of nutrients and to analyze them depending on their role in the organism. A literature database by searching the electronic MEDLINE via PubMed was performed. Eating healthy means regularly eating foods that are rich in vitamins and minerals, such as fruits, vegetables, whole grains, and low-fat dairy products. There are six major classes of nutrients essential to human health: carbohydrates, lipids, proteins, vitamins, minerals, and water. Carbohydrates, lipids and proteins are considered macronutrients and serve as a source of energy. Water is required in large quantities, but it does not provide energy. Vitamins and minerals are considered micronutrients and play an essential role in metabolism. Vitamins represent organic chemical compounds (or a group of related compounds) that the body cannot synthesize at all or in sufficient quantities and must obtain through nutrition. They have different biochemical functions in human health. This article contributes to the body of knowledge by highlighting how the biochemistry of nutrition affects human health and the organism. Nutrition is the only way through which the nutrients that are necessary for the construction of tissues, and organs and for the maintenance of their vital functions, are consumed and introduced into the organism, and thus it represents an integral and inseparable part of life.

Keywords: nutrition, human body, nutrients, food

**REVIEW OF ENVIRONMENTAL DNA METABARCODING FOR FRESHWATER
BENTHIC MONITORING**

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Abstract

Aquatic biomonitoring is being transformed by environmental DNA (eDNA) metabarcoding, which uses parallel DNA/RNA sequencing to identify entire groups within a targeted group. Water eDNA and macroinvertebrate bulk samples have been the subject of the majority of metabarcoding research to date that try to evaluate the ecological state of aquatic ecosystems. To evaluate microbial or meiofaunal biota, eDNA metabarcoding has also been used on soft soil samples. eDNA metabarcoding offers potentially significant advantages for evaluating the environmental quality of sediments when compared to traditional approaches based on manual sorting and morphological identification of benthic organisms. To increase their robustness, comparability, and usability within regulatory frameworks, sediment eDNA metabarcoding methodologies and processes must be standardized because they can vary greatly between research. With an emphasis on the stages of sampling, preservation, and DNA extraction, we examine the information that is currently available on eDNA metabarcoding used on sediment samples. The variety of eDNA sources, states, and permanence in the sediment are only a few of the difficulties we explore when it comes to sediment eDNA analysis. With the widespread use of sediment eDNA in future benthic monitoring, this research seeks to identify best practices and allow method harmonization.

Keywords: eDNA, Metabarcoding, Benthic Macroinvertebrates

**MODEL PREDICTION OF POTENTIAL DISEASE EFFECTS FROM PM_{2.5} EMISSION
AMONG SCHOOL CHILDREN IN COMING 30 YEARS IN SOUTH TANGERANG**

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Abstract

Background: The largest global environmental health risk factor is the ambient of air pollution, that largely attributed to transportation emissions. One of the main causes of PM_{2.5} emissions is thought to be on-road transportation. PM_{2.5} has an impact on health, especially on children that relate to the respiratory system such as asthma, lung cancer, and decreased intelligence. **Objective:** The research objective was to predict the risk potential disease due to PM_{2.5} in children from vehicle emissions in South Tangerang City. **Method:** This research is an observational analytic study with a cross-sectional study design using a dynamic model approach using STELLA software. The environmental and human samples are used to calculate the exposure level to PM_{2.5}, taken from 32 points in 7 sub-districts of South Tangerang City (North Serpong, Serpong, Pondok Aren, Ciputat, East Ciputat, Pamulang, and Setu). then, meteorological data was also collected. Results: The number of vehicles in the city of South Tangerang is quite high, especially between 11:00 and 15:00 with the majority of vehicles passing by are cars and motorbikes. PM_{2.5} pollution levels will fluctuate until 2053. The effects of temperature, weather, and humidity might cause an increase in

PM_{2.5} pollutants at specific times. According to the modeling calculation results, even though there are occasions when PM_{2.5} pollution levels fall, acute respiratory infection (ARI) incidence in children will continue to rise over time. Although PM_{2.5} emissions fluctuate, exposure to PM_{2.5} in low concentrations poses a risk to human health.

Keywords: Children, transportation, particulate matter, acute respiratory infection

**PORSELEN LAMİNATE VENEER RESTORASYON ÖNCESİNDE YAPILMASI
GEREKEN ESTETİK ANALİZLER**

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Özet

Estetik diş hekimliği, bilimsel prensipler ve sanatsal yeteneğin birleşimi objektif ve sübjektif verilerin uygun kombinasyonu ile sağlanmaktadır. Diş hekimi, doğal ve estetik bir gülüş tasarlarlarken hastanın yüz analizleri, ten rengi, göz rengi ve bu değerlerin alt başlıklarındaki tüm basamakları dikkate alarak yol almanın yanında hastanın sübjektif yargılarını, hastaların beklentilerini, kişisel özelliklerini dikkate alarak ekip çalışması ile hastaya optimum güncel estetiği sağlayabilir. Optimum estetik için Maryland adeziv köprüler, dişlerin tamamen prepare edilmesi ile yapılan full kron restorasyonlar, minimal invaziv, non-prep ve prepless porselen lamina veneer restorasyonlar yapılabilmektedir. Materyal metod: porselen laminate veneerler ile tedaviye başlanmadan önce intraoral olarak; orta hattın belirlenmesi, insizal uzunluk tespiti , zenith noktalarının belirlenmesi, dişlerin aksı, şekli ,konumlarının değerlendirilmesi altın oranın sağlanması gerekirken, extraoral olarak ise konjunktiva rengi, parlaklığı, dudak desteği, yüz simetri ve dengesinin sağlanması, cinsiyet ve yaş özelliklerinin göz önüne alınması, üst, orta ve alt yüz yüksekliklerinin değerlendirilmesi, interpupiller mesafe, camper düzlemi gibi kriterlerin mutlak değerlendirilmesi ve yapılan restorasyonlara aktarılabilmesi gerekmektedir.

Sonuç: Laminate veneerler ile optimum estetiğin sağlanması yüksek oranlarda mümkündür. Bu nedenle laminate veneerlerin yapımından önce bahsedilen estetik analizlerin yapılmış olması %100 hasta memnuniyeti sağlayarak güncel bilimsel verilerle elde edilmiş tedaviler ortaya koyar.

Keywords: laminate veneer, estetik analiz, dental estetik, minimal invaziv, prepless

**YEREL YÖNETİM BİRİMİ OLAN BELEDİYELERİN SOSYAL MEDYADA
VARLIĞININ ANALİTİK YÖNTEMLERLE İNCELENMESİ**

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Özet

Devletlerin kurulmasıyla ortaya çıkan yerel yönetimler belirli hizmetlerin sağlanması, yürütülmesi ve denetlenmesi gibi konularda merkezi yönetimlerin önemli bir parçası konumundadır. Günümüzde yeni medya olarak da adlandırılan sosyal medya, geleneksel medya araçlarının aksine çift yönlü iletişim ortamı sunarak anında geri bildirim alınmasına olanak tanımaktadır. Özellikle sosyal medya platformlarından biri olan Twitter sayesinde belediyeler; faaliyetleri ile ilgili kamuoyuna bilgi sağlama imkanına sahip olmuştur. Bunun yanında yüz yüze görüşmeye gerek kalmaksızın çeşitli istek, şikâyet, öneri ve beklentilerini iletilebilme gibi durumlarda belediye yetkilileri tarafından hızlı bir şekilde geri dönüş alma kolaylığına da sahip olmaktadır. Bu çalışmada belediyelerin sosyal medyayı nasıl kullandıklarını tespit etme ve daha iyi kullanım yolları önerme amacıyla yapılmıştır. Araştırmaya Ege bölgesinde kurumsal Twitter hesabı bulunan Aydın, Denizli ve İzmir olmak üzere 3 büyükşehir belediyesi dahil edilmiştir. İlgili belediyelerin 1 Şubat 2023 ve 1 Nisan 2023 tarihleri arasında resmi hesaplarındaki tweetleri veri madenciliği programları yardımıyla elde edilerek Çok Kriterli Karar Verme Yöntemleri yardımıyla elde edilen veriler üzerinden performans analizi gerçekleştirilmiştir. Araştırma sonucunda, sayısal yöntemler yardımıyla belediyelerin sosyal medya kullanımlarının performans değerlendirilmesi yapılmış sonuçlar karşılaştırılarak konuya ilişkin çözümler geliştirilip ilgili kurumlar başta olmak üzere tüm belediyelere sosyal medya kullanımı ile ilgili öneriler sunulmuştur.

Anahtar Kelimeler: Yerel yönetimler, Sosyal Medya, Çok kriterli karar verme

3PL (ÜÇÜNCÜ PARTİ LOJİSTİK) FİRMA SEÇİMİNDE KULLANILAN KRİTER AĞIRLIKLARININ ÇKKV YÖNTEMLERİ İLE BELİRLENMESİ

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Özet

Günümüzde işletmelerin çoğu lojistik faaliyetlerini gerçekleştirmek için 3. Parti Lojistik (3PL) firmalarından hizmet almaktadır. 3PL, firmanın lojistik faaliyetlerinin bir kısmının ya da tümünün işletme dışarısından yabancı firmalar tarafından yerine getirilmesi durumunu kapsamaktadır. İşletmeler 3PL firma seçiminde birçok kriteri göz önünde bulundurmakta ve karar verme aşamasında güçlük çekmektedirler. Bu çalışmada lojistik firma seçim aşamasında kullanılacak olan kriter ağırlıklarının ÇKKV (Çok kriterli karar verme) metoduyla tespit edilmesi ve sıralanması amaçlanmıştır. ÇKKV, karmaşık durumları ele almak ve Karar Vericilere yardımcı olma amacıyla yaygın olarak kullanılan güçlü bir araçtır. Çalışmada uygulanmak üzere ÇKKV ağırlıklandırma metodlarından olan SWARA (Step-Wise Weight Assessment Ratio Analysis- Adım Adım Ağırlık Değerlendirme Oran Analizi) metodu seçilmiştir. Kriterlerin belirlenmesinde ve kriter ağırlıklarının hesaplanması aşamasında literatür incelenerek alanında uzman kişilerin görüşlerinden faydalanılmıştır. Çalışmanın sonucunda lojistik firma seçiminde kullanılacak en etkili kriterin tercih edilecek olan firmanın lojistik sektöründeki tecrübesi olduğu tespit edilmiştir. Analizler sonucunda bu kriteri takiben sırasıyla güvenilirlik, hizmet kalitesi, fiyat, hız ve lojistik ekipman yeterliliği olduğu analizler sonucunda bulgulanmıştır. Elde edilen sonuçlar bu alanda yapılan araştırma sonuçlarıyla uyumludur. Buna ilaveten ÇKKV metodu olan SWARA'nın lojistik alanında kullanılan kriter ağırlıklarının belirlenmesinde gerçeğe yakın sonuçlar elde edebileceği tespit edilmiştir. Aynı zamanda uygulama sonucunda kriter ağırlıklarının belirlenmesi 3PL firması seçerken işletmelere yardımcı olacağı düşünülmektedir.

Anahtar Kelimeler: 3PL (üçüncü parti lojistik), Çkkv (Çok kriterli karar verme), Swara

**MODELING OF COOLING STRATEGY BY ARTIFICIAL INTELLIGENCE
TECHNIQUES IN THE ANALYSIS OF RESIDUAL STRESS OCCURRED IN THE
MACHINING OF SUPER ALLOY**

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Abstract

Superalloys offer high strength, high-temperature resistance, and corrosion resistance, making them popular materials in industries such as aerospace and defense. However, residual stress can occur during machining, which may result in cracks or fractures in the part. Therefore, optimizing residual stress is crucial. Cooling conditions during machining have a significant impact on the occurrence of residual stress, making it an optimization problem. An experimental design of the turning process was made with the Taguchi technique. Experimental studies were carried out using a constant feed rate, depth of cut, three different coolant systems (conventional cooling, minimum quantity lubrication, and dry), and cutting speeds. This study used data obtained from experiments during the machining process of superalloys to obtain models via artificial intelligence (AI) techniques. These models were compared using evaluation metrics, and their success was determined. The study investigated and modeled the residual stress effects on the material surface during machining while considering different cutting speeds, feed rates, depths of cut, and cooling conditions using experimental data. However, the study focused on revealing and quantifying trapped stresses, which are of vital importance in terms of post-processing operational conditions. Meaningful estimation and evaluation optimization of these obtained values has been revealed with AI algorithms.

Keywords: Artificial Intelligence, Machine Learning, Residual stress, Superalloy, Cooling conditions

**EFFECTIVENESS OF PREFABRICATED FUNCTIONAL APPLIANCES DURING
ORTHODONTIC TREATMENT IN YOUNG PATIENTS**

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Abstract

Prefabricated functional appliances (PFAs), are made of soft elastomeric material, were first introduced in the 1980s. They are available in different shapes and designs related to their indications. During the last years clinical trials are performed aiming to summarize clinical effects of PFA. The aim of this presentation is to show our experience using them in young orthodontic patients. Material and methods. Clinical cases will be discussed during the presentation. All patients at the beginning of therapy were 8-10 years old, with Class II, division 1 malocclusion, large overjet and deep bite. They were treated with PFA, keeping the appliance during night. During the first year they controls were performed every 2 month and after one year, follow up every 6 months. Results. After one year of treatment with PFA, cephalometric tracing confirmed reduction of ANB angle, large overjet and overbite was in all cases. Molar sagittal relationship was improved toward a Class I. Changes were observed in patient's profile as well. Improvements were found regarding lip incompetence, respiratory problems and self esteem. In follow up controls after the first year, the situation was generally stable. Conclusion. PMA are effective in correcting increased overjet, over bite, lip incompetence and Class II malocclusion in early mixed dentition, leading to an improved or normal occlusion. Many times no further orthodontic treatment is needed after their use. By correcting some dental risk factors for dental trauma such as large overjet and lip incompetence, they may be considered as an effective preventive treatment regarding this issue.

Keywords: Functional appliances, orthodontic, early treatment.

PROSTHETIC DENTISTRY AFTER THE PANDEMIC OF COVID 19

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Abstract

COVID-19 has put the health care in a new prospective. The dental studio environment is considered one of the most spreading environments due to concentration of aerosol. The ongoing crisis, during 2020 put patients in difficulties as they couldn't access the dental visits even though their needs. The purpose of the study was to analyze common prosthetic emergencies and provide recommendations to manage these issues during pandemic situations. Objectives: 1. To evaluate strategies on the control of COVID-19 infection in a dental clinic during prosthetic manipulations 2. To access the possible transmission routes of COVID-19 in dental clinics 3. To examine dentists personal experiences and the impact of the pandemic for the prosthodontist. Medical scientific articles and books were used for the literature review and two categorized questionnaires for patients and dentists were used for the exploratory-descriptive study. Study results report of an increase in the cost of prosthetic services, alternation of prosthetic sessions both in duration and frequency, an increase in preventive protective measures reported in the same values with 71% among dentists and 73 % in patients. During the COVID-19 pandemic, services and materials costs were increased the applicability of prosthetic have been and difficult, especially for young dentists. This has had an impact in the in the cost of prosthetic services.

Keywords: COVID 19, Edentulism, Prosthodontist.

**THE EFFECTS OF URBAN MICROCLIMATES ON CONTROLLING THE
INTENSITY OF HEAT ISLANDS AND ADJUSTING CLIMATIC CONDITIONS**

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Abstract

The issue of the expansion of urban heat islands and the resulting problems, including climate change at the global level, is one of the topics that must be seriously pursued. The morphology of urban street canyons is one of the cases that aggravate urban heat islands and their side risks on a large scale with the change in urban micro-climate conditions and the increase in temperature. For this reason, this article focuses on the significance of optimizing the conditions of street canyons and the results obtained in this field. Achieving optimal values about the configuration of street canyons, in addition to creating a balance between land use ratios (in terms of the importance of land in dense urban areas) and the thermal comfort conditions of citizens, since it can guidance for Architects and urban planners will be important in reducing the climatic problems of the cities and improving the living conditions of the residents.

Keywords: Configuration of street canyons, Optimization, Reduction of urban heat island, Thermal comfort of citizens, Urban microclimates.

**SOCIAL COMPARISON, SELF-COMPASSION, SELF-IMPROVEMENT, AND
MENTAL HEALTH PROBLEMS IN YOUNG ADULTS**

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Abstract

The current study explored the relationship of social comparison with self-compassion, self-improvement, and mental health problems in young adults. The sample size of this study consisted of 300 men and women young adults with the age range of 18 to 25 years ($M = 21.8$, $SD = 1.77$), in equal proportion from the Bs four years program. The sample was selected through a stratified random sampling technique from the different private universities of Lahore. Indigenous scales were used to make the study more culturally relevant. The scale of social comparison, self-compassion, self-improvement, and DASS was provided to students to find out the relationship between variables. The present study investigated that, downward social comparison, self-compassion, and self-improvement were inversely associated with mental health problems in young adults though downward social comparison and self-compassion have a significant positive association. Moreover, self-compassion and self-improvement also have a significant positive relationship. Regression analysis revealed that downward social comparison and self-improvement were significant predictors of mental health problems in young adults. The results were discussed indigenously in terms of gender difference, demographic variables, and implications for counseling services.

Keyword: social comparison, self-compassion, self-improvement, mental health problems, young adults

VICTOR BRAUNER: FROM DADA TO SURREALISM

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Abstract

This paper examines the work of Victor Brauner (1903-1966), a surrealist artist of Romanian origin, from his avant-garde beginnings to his diverse major works expressing a true surrealist spirit. First, I will seek to explore the concept of "picto-poetry" that he created in 1924 with the poet, Ilarie Voronca, in the avant-garde magazine *75 HP*, where words and images are joint as in a Dada collage. Next, I will attempt a comparative analysis between his visual work and his only work of fiction, "Promenade" -- a text written in 1941 and published for the first time in 2005 -- in order to establish how Brauner succeeds in merging the real and the surreal, as well as multiple fields such as myth, occultism, and Kabbalah.

CHANGING TRENDS AND ATTITUDES TOWARDS ONLINE ASSESSMENT

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Abstract

The presentation aims at eliciting insight into the results of ongoing research regarding evolving trends and attitudes towards online assessment of English and other languages in higher education. The focus pinpoints *online* as one of the most trending forms available during the global pandemic. The study was first initiated in 2019 in which its main target was to reveal the intriguing question of students' and assessors' attitudes towards online assessment. The research questions the attitudes towards the latest trends, possible online task types, their advantages and disadvantages through an in-depth experimental process currently undergoing implementation. Material and methods include surveys, needs and wants analysis and thorough investigations regarding candidates' and assessors' attitudes towards online tests in the field of languages. The survey was carried out at the University of Pécs Medical School. Over 400 respondents from more than 28 countries participated in the survey, which gives us an international and intercultural insight into how students with different cultural and educational background deal with the evolving online world. The results show the pandemic's impact which brought the slumbering online world of assessing roaring alive, fully operational and now bears phenomenal relevance in today's global education. Undeniably, the results can be used as a perspective in a vast array of contents. The survey hypothesized the generation of the 21st century expect everything readily available online, however, questions whether they are ready for this challenge are lurking in the background.

Keywords: assessment; English; international; languages; online; testing;

**EXPLORING THE RELATIONSHIP BETWEEN ANTI-CONSUMPTION AND
CONSUMERISM**

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Abstract

The present article theoretically discusses the relationship between anti-consumption and consumerism. The article starts with a general review of the most critical aspects of both concepts and concludes with a conceptual discussion of the link and interrelationships between the two. This includes a review on anti-consumption manifestations and the related concepts of brand avoidance, politically motivated brand rejection, resistance to consumption, the link between anti-consumption and self-identity and a discussion of involuntary anti-consumption. The article then moves to analyze consumerism, including its relationships with the marketing concept, political consumerism, ethical consumerism and how the concept of consumerism has been framed within the mainstream theories of consumers' role in free market systems. It is concluded that anti-consumption is a complex concept that encompasses less emphatic manifestations such as the preference to consume one product, service, brand or organization over other, to stronger types of anti-consumption manifestations, involving resistance or even rejection of consumption in general. Consumerism, which may be regarded as a soft and collective form of anti-consumption was developed in response to the power imbalance between corporations and consumers and although

it represents a movement of empowerment of the consumer it is not incompatible with the marketing concept. On the contrary, it can be considered an opportunity for marketing. The article conceptually frames the relationship between anti-consumption and consumerism, by arguing that both concepts: i) are centered on the consumer, reflecting a certain disposition towards consumption; ii) are multifaceted concepts, encompassing a large variety of manifestations, positive and negative, constructive and destructive behaviors, with differentiated levels of severity; iii) constitute a response to modern capitalism and power imbalances between companies and consumers and; iv) inspire a considerable interest in recent consumer behavior research. The article then analyses the dichotomy of altruistic/egoistic motivations and how consumerism and anti-consumption may reflect a disposition towards social ethos in the current post-modern society. It is concluded that consumerism, as an expression of consumer activism, seems to entail an altruistic dimension that is not present in some anti-consumption practices. However, it is argued that in some cases consumerism, at the individual level, is not necessarily the result of purposeful acts of altruism, ideological protest or the outward expression of countercultural sentiments. Some consumers may engage in consumer activism for personal well-being, while having few qualms about indulging in others.

Keywords: Anti-consumption, Consumerism, Consumer behavior, Market system, Post-modern.

**ATTITUDES TOWARDS CONSUMPTION: THE DEVELOPMENT OF NA
OPERACIONAL SCALE**

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Abstract

The western economic development, which allowed the consumer to have access to goods and services in an easy and accessible way, brought the attention of the academia and practitioners for the current mass consumption society and consumption's role in generating happiness among consumers. However, contradictory to the contemporary way of life, some consumers have established a different current, in which anti-consumption is seen as a way to also achieve well-being, while contributing to the sustainability of the planet. The discontented consumer and the consequent upraising of the activist consumer means that negative consumers' attitudes towards consumption and the corporate world need to be addressed. The concept of consumerism comprises the activities of governments, businesses, and independent organizations to protect and promote consumers' rights. This rather different approaches from the consumers to the market offer requires better understanding, due to the impacts on marketing practitioner's policies and actions. The purpose of this study is threefold. First, to assess the relationship between consumers' consumption

and consumers' anti-consumption, and its influence on well-being and happiness. This relationship is subjective by nature, because each individual behaviour is the sum of a set of social-cultural, personal and psychographic traits, in which not only the perception depends on each consumer's interpretation of the reality and self-concept of well-being, but also of its state of mind, sensations, emotions and memories. Composite by force, because marketing and other macro and micro environmental forces, stimulate and influence customers' perception. Second, the study provides a conceptual model encompassing five constructs (consumption, anti-consumption, materialism, well-being and happiness); third, to construct and develop an operational scale to measure attitudes towards consumption. In this regard, we conducted a literature review on anti-consumption and consumerism. A conceptual model based on the literature reviewed was developed and an operational scale constructed. Implications for the academia and practitioners are then discussed.

Keywords: Anti-consumption, Consumerism, Materialism, Attitudes, Conceptual model, Scale

**PUBLIC ADMINISTRATION CONCEPTUAL TRANSFORMATIONS UNDER THE
MARTIAL LAW IN UKRAINE**

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Abstract

Under the martial law in Ukraine, special attention of public administration is focused on the social, environmental, economic and managerial vectors of development. It was determined that the destructive consequences of military actions turned out to be critical for almost all internal economic indicators, which caused, according to the domino principle, an imbalance of all macroeconomic indicators not only in the European region, but also on a global scale. It is substantiated that: global energy security, progress in the gradual transition to clean energy; global food security has had the greatest destructive impact at the world level; global ecosystem related to the conservation of water resources, land resources; the state of multilateralism of international relations and cooperation in achieving the goals of sustainable development. At the regional and national levels, problems are observed in achieving all the sustainable development goals, the most vulnerable were: zero hunger, no poverty, quality education, good health and well-being, affordable and clean energy, etc. The years of independence, Ukraine overcame the path of post-socialist transformation – democratic society stable institutions were formed, market economic relations were developed, and civil society institutions were actively being formed. These positive transformations took place against the background of serious crises and public opposition. Key trends analysis show uneven development, which was accompanied by a significant number of crises. While state building and introducing new tools for socio-economic processes market regulation, Ukraine needed clearly defined and socially acceptable strategic development frameworks. Ukraine consistently implemented the concept of building a democratic society with a market economy and European integration. This situation required joining at the level of strategic understanding to the processes of the global level, the best and most effective practices of state building.

**THE PERINATAL ASSISTANCE SYSTEM STATE REGULATION: APPROACHES
AND CHANGES**

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Abstract

The issue of the perinatal services system development is always extremely relevant for any country. Unfortunately, in situation that has developed in Ukraine is paid attention to the system of perinatal care not according to a comprehensive, but according to a branch approach. As a result, the efficiency of all components at the already mentioned levels decreases. We see this as a problem, first of all, of a managerial nature, which is laid down by the methodology of the attitude to perinatal services from the post-Soviet period, with a division into separate areas of responsibility: medical, social, informational and educational, etc. The war in Ukraine demonstrated that perinatal services should be provided comprehensively and preferably in one place. This is a guarantee of their effectiveness and efficiency. The specificity of the information base for studying the problems of perinatal care research methodology lies in the variety of sources of data collection, namely: medical documentation, information of social services, scientific developments on exclusively medical issues of providing medical services to pregnant women, newborns and women in labor, newmothers and children up to 3 years old, their social security, issues of management of medical and social spheres, regulatory settlement, etc. As a result, the processing of such information, which is diverse in content and sources, as well as huge in volume, requires the specifics of research methods. As for research on changes in the state regulation of the perinatal care system in Ukraine during the war, today we only have the practice of solving current issues in extreme conditions and in an emergency manner. Research and awareness of the consequences of this practice can enrich theoretical and scientific approaches to the mentioned problems in the future. Currently, in Ukraine, and in fact throughout the world, a research methodology is being developed in conditions of great risks. This need to manage various areas of health care and social welfare of the population was caused by the global pandemic of COVID-19, and then also by the war in Ukraine. It cannot be said that the war in our country concerns only the scientific community and studies of perinatal care problems exclusively in Ukraine. A large number of countries, primarily European ones, provided an opportunity and assisted in the movement of patients and entire medical institutions within the country and abroad, and in the further deployment of these institutions or the integration of Ukrainians into the perinatal care systems of a certain country. And this requires coordination of the methodology of the processes: medical, diagnostic, pharmaceutical, management, support, logistics, financing and subfinancing, etc. Formation of new approaches to the study of these processes is necessary.

**CULTURAL PRACTICES HINDERING GIRL CHILD'S ACCESS TO EARLY YEARS
EDUCATION. A CASE OF NOMADIC PASTORALISTS OF MARSABIT COUNTY,
KENYA**

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Abstract

Early years' education provides children with learning skills which helps them to have a strong start and critical life skills. This means that children denied access to early education will lack the benefits of early years education. Literature reviewed has shown that girls are more affected in access to education than boys due to geographic locations and community beliefs. Consequently, there was need to establish the cultural practices hindering girl child's access to early years education among the nomadic pastoralists of Marsabit County, Kenya. The study was guided by Urie Bronfenbrenner's Ecological Systems Theory. Mixed methods research design was employed in the study. The target population was parents, teachers, chiefs and area Education Officers. Purposive and simple random sampling techniques were used to select sample for the study. Interview schedule and focus group discussions were used to collect data which was analyzed using qualitative and quantitative techniques and results presented using tables, figures and text. The results had shown that many girls of school going age did not have access to early years education due to several cultural practices. The practices include: Cultural roles; early betrothal for marriage; and Female Genital Mutilation. The study recommends that varied strategies should be used to improve children's access to early years education like community education and stakeholder involvement.

Keywords: Harmful Cultural Practices; factors hindering; girls' access; early years education; Nomadic Pastoralists; Marsabit County; Kenya

**DEVELOPMENT PROBLEMS OF ASSISTED REPRODUCTIVE TECHNOLOGIES
MANAGEMENT**

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Abstract

Under the war, the priorities and institutional vision of the development of the health care system, approaches and views on reforming various areas of ensuring the functioning of the entire health care system, including the reproductive one, changed. In order to determine the priorities of health care policy in the conditions of war, it is necessary to clearly understand the existing problems. The WHO European Regional Office has drawn up recommendations for Ukraine on the development of the health care sector. Among the measures of the short-term perspective, the following were noted: the need to integrate the provision of humanitarian aid with the provision of primary services by health care institutions; provide modular training of medical workers according to programs for wartime needs (mental health, sexual violence and physical rehabilitation); carry out critical short-term repairs in hospitals with an increase in energy efficiency. Among medical problems, the following are identified: issues of temporarily displaced persons - medical workers; mass departure of medical personnel outside the country due to non-pecuniary, economic or other reasons; the question of the motivation of medical workers in conditions of increased workload on them; training of medical personnel of various qualifications taking into account the needs of war and post-war times; establishment of competitive remuneration for medical workers, etc. Another problem is that the use of assisted reproductive technologies is not perceived in the worldview of society as primary or emergency medical care, so support for the provision of such medical services has, as expected, fallen into the background. On the one hand, there is logic in this, but on the other hand, in the conditions of recording a huge number of sexual crimes in the occupied territories, non-compliance with annual medical examinations, problems with access to medical services and their quality in the occupied territories and territories of active hostilities, etc., problems with reproductive health, unfortunately, cannot be avoided. In the medium and long term, there is the risk of personnel and technology crisis in this area. As for the development of assisted reproductive technology programs, we believe that the proposed directions will have a slight positive effect. The demand for assisted reproductive technology programs will recover after some time, and in the future of 5-10 years it will even increase, but even in the near future, the cost of such programs will be covered mainly by the couples themselves or by the person who decided to have a child.

**MULTIMODAL DISCOURSE ANALYSIS OF SEXISM AND GENDER
STEREOTYPING POPULAR NIGERIAN ONLINE COMIC SKITS**

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Abstract

This study examined sexism and gender stereotyping in two popular online comic skits using multimodal discourse analysis as theoretical framework. aspect which accounts for the grammar used in the skits. The study appraised the verbal and the visual choices of the characters and attempted to establish patterns of sexism in both. It was discovered that while focusing on the goal of entertainment, the skits portrayed evidence of sexist use of English in the linguistic choices of the characters. The study also found that through the instrumentality of both verbal and visual choices, the skits portrayed gender-based prejudices. Based on these findings, the study concluded that these Nigerian online comedy skits primarily present characters as stereotypes and uses sexist language. However, both the stereotypes and the sexism target females more than the target males and this reflects the sociocultural context of patriarchy. It recommended that content creators should adopt a more inclusive language and avoid sexism in online comedy skits.

Keywords: Sexism in entertainment, multimodality, gender stereotyping in skits, media and language, semiotics, Nigerian comedy, linguistic sexism, and visual grammar.

**THERMAL LATTICE BOLTZMANN METHOD FOR RAREFIED GAS FLOW IN A
MICRO CAVITY WITH OBSTACLES**

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Abstract

This work deals with the numerical simulation of the flow of a gas in a micro cavity, using the lattice Boltzmann method (LBM) as a numerical alternative to purely kinetic methods to describe the behavior of rarefied gases. We studied the flow of a rarefied gas in a micro cavity in the presence of two obstacles, one is adiabatic in the lower wall and the other is heated in the upper one. The cold fluid enters with a constant speed from the left wall and exits out in the right side of the cavity. the effects of rarefaction given by the Knudsen number on the velocity and temperature profile have been studied.

Keywords: lattice Boltzmann method - rarified gas - Knudsen number - obstacles.

**NUMERICAL ANALYSIS OF NATURAL CONVECTION IN A SQUARE CAVITY
FILLED WITH NANOFLUID USING THE LATTICE BOLTZMANN METHOD**

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Abstract

The numerical analysis of natural convection in square cavities filled with nanofluid is a rapidly growing research topic in the field of fluid thermodynamics. This subject poses challenges for engineers who seek to understand and optimize the behavior of nanofluids in various applications. In this work, a numerical study of natural convection was conducted in a square cavity filled with Al_2O_3 -water nanofluid, with one heated wall and two cold horizontal walls. The lattice Boltzmann method was used for the analysis. The influence of the Rayleigh number and nanoparticle fraction on the structure of natural convection is discussed through temperature and velocity profiles, streamlines and isotherms. The study results show that the presence of nanoparticles leads to an increase in the average Nusselt number and fluid velocity in the cavity. These results are important for optimizing the design of cooling and heating systems using nanofluids.

Keywords: Natural convection – Square cavity – Nanofluids – Lattice Boltzmann Method.

**STUDY ON FLIGHT OF THE SUMMER AND WINTER FORM OF PINE
PROCESSIONARY MOTH**

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Abstract

In present work, the flight dynamic of the summer and winter form of *Thaumetopoea pityocampa* was studied. The experiment was conducted under laboratory conditions (room temperature and natural lighting). A bimodal and even a trimodal distribution of flight over time with multiple peaks has been found. Our preliminary results show a lack of dependence of multimodal flight distribution with temperature fluctuations in the study area. The statement, that the flight of the winter form begins around the date of the summer solstice (21.06.2021) is confirmed, and their flight period coincides with the hottest time of the year (June and July). Conversely, the flight of the summer form begins a month earlier (May-June) and precedes the hottest time of the year. No relationship was found between the time of peak flight and the length of the flight period. On the other hand, a relationship between the time of their occurrence and the culmination of local temperatures has been established.

**SURVIVAL OF SUMMER AND WINTER FORM OF THAUMETOPOEA
PITYOCAMPA IN THE HIBERNATION PERIOD**

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Abstract

In the present work the survival of summer and winter form of pine processionary moth (*Thaumetopoea pityocampa*) during the hibernation period and the influence of its factors are studied. The investigation was carried out under laboratory conditions at room temperature and natural light. The development of 1224 individuals was followed, of which 708 individuals of the summer form found in the ground (224 hibernating larvae and 484 cocoons) and 516 larvae of the winter form (taken from processions). Prepupae were found in all summer form cocoons excavated at the end of the winter season. In the winter form, an average higher parasitism rate by Tachinidae was observed-10.5% against 0.6% in the summer one. At the same time, in the summer form the mortality caused by entomopathogenic fungi was much higher-av. 35% against 1% in the winter form. In both phenological forms, the mortality caused by unknown factors (av. 10.7%) was low, as well as the number of unemerged pupae (av. 5.3%). Within the summer form, the mortality caused by entomopathogenic fungi was high-av. 27.7% (larvae) and 37.4% (prepupae), respectively. A significant difference was found in the mortality caused by unknown factors-av. 31.7% (larvae) vs. 2.5% (prepupae). In both hibernating stages of the summer form, the rates of parasitism and unemerged pupae were negligible.

**APPLICATIONS OF JIAO THEORY IN DECISION MAKING FOR SOCIAL
ENTREPRENEURSHIP ADOPTING**

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Abstract

This research identifies the influencing factors for entrepreneurs' decision in order to embrace a social career by establishing and maintaining a social entrepreneurial structure on the market. The research is based on the conceptual model of analysis the antecedents of social entrepreneurship proposed by Jiao in 2011, which was used to predict the intentions leading to the emergence of social enterprises. Previous research has focused on traditional entrepreneurship, being much less focused on social entrepreneurship, a newer concept with various interpretations. The present research specifically explores the measure of relationships between Jiao Theory predictors and social entrepreneurial career intentions. The research conducted in Romania is based on a general sample of 142 social entrepreneurs and their assessments of social entrepreneurial career intentions and compares the factors underlying the decision to start a social enterprise. The results of this research, obtained only from social entrepreneurs who could shed light on the phenomena prior to the formation of social enterprises, support the universal effects of antecedents, but the influence of external factors on social entrepreneurial career intentions should not be neglected either. Researchers in the field of social entrepreneurship can expand their study of the factors that influence the creation of social companies using the framework described in this paper. The framework also aids in the theoretical development of the definition of social entrepreneurship by emphasising the link between social enterprise activities and the production of social impact as a group that together make up social entrepreneurship. Since a poor conceptualization can lead to deviations during data collecting or data analysis, permitting the development of potentially incorrect results, this conceptual clarification helps to minimise errors that may exist in both

theoretical and practical studies. The research explains specific societal challenges faced by social entrepreneurs, assisting those looking to start a social enterprise in understanding how this organisation type is initially formed. The development of educational programmes for the training of social entrepreneurs in social incubators and accelerators may also be aided by a knowledge of the factors that led to the founding of social companies.

Keywords: social entrepreneurship; antecedents; factors; social entrepreneur

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**VISION SDG 2030 CLEAN WATER, SANITATION AND ZERO EMISSION INDUSTRY
POLLUTION MANAGEMENT USING NWSN BASED GREEN IOT APPLICATIONS: A
TECHNO-LEGAL ASPECTS FOR SMART WORLD**

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Abstract

We present techno-legal and techno-socio-economical aspects of research to human rights on the clean and safe water, sanitation, pollution free industry infrastructure context in Smart World for 17 sustainable development goals (SDG) item no. 6 & 9 and present views regarding the possible use of the Green Internet of Things (G-IoT) in India and so are intended to be achieved globally by 2030. This research has as main goal to evaluate the feasibility of a Next Generation Nano-structured Wireless Sensor Network System (n-WSN) as G-IoT application for fresh air and pollution free industry detection and ecological disaster protection. Although there has been immense development of more sensitive and selective nano-structured sensor arrays and Artificial Intelligent (AI) enabling advanced data mining technology, there have been very few reports on the applications of electronic nose (e-Nose), electronic tongue (e-Tongue) and electronic vision (e-vision) for the detection of pollution free industry, ecological disaster and forest fire protection and management. The current Techno-legal and Socio-economical and techno-legal research sheds light on the practical applicability of e-Tongue for heavy metal detection from drinking water and waste-water and e-Nose for the pollution free industry and detection of hazards gaseous like as volatile organic compound (VOC) emissions detection, those are ingredient of air pollution, ecological disaster and forest fire.

Keywords: Clean water, Sanitation, GIoT, nWSN, e-Tongue, e-Nose, Zero emission industry.

**PARENTAL ROLES IN RELATION TO ADOLESCENT RISK BEHAVIOR: BASIS
FOR INTERVENTION PROGRAM**

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Abstract

The parent is the first home teacher as it is where the adolescents learn not only the basic aspects of life but also the skills necessary to develop into responsible members of the community. Parents have roles in terms of how they carry out their responsibilities that associate to adolescents' risk behavior. This study aimed to find out the relationship between parental roles and adolescents' risk behavior and further determine the extent of risk behavior committed among adolescents. An intervention program will be conducted based on the results of the study. Descriptive – correlational research was employed and a non-parametric test was used for data analysis. There was no significant difference in the parental roles when data were analyzed by gender, parents' marital status, parent's educational attainment, family monthly income, religious affiliation, type of family and living arrangements. However, there was a significant difference in the parental roles when data were analyzed by age. Adolescents 18 to 19 years old scored their parental roles just satisfactory. Moreover, variables such as parent's marital status, religious affiliation, and type of family did not influence the adolescents' risk behavior. On the contrary, variables such as age, gender, parent's educational attainment, parent's occupation, family monthly income, and living arrangements affect the adolescents' risk behavior. Adolescents aged 18-19, males, parents obtaining elementary level as highest education, fathers whose occupation were laborers/unskilled workers, mothers who stayed in the household, families having a family monthly income of below Php 5,000, and those who don't have mothers/fathers have higher risk behavior. Apparently, there was no significant relationship between parental roles and adolescent's risk behavior. The study recommended for the development of an intervention program on Skills Training Development to augment the income of the families and to address risk behavior, a seminar – workshop on Moral Values Regeneration is suggested.

Key words: parental roles, adolescent, risk behaviors, intervention program

ENDONEZYA'DA YOLSUZLUK VE BÜROKRATİK REFORM

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Özet

Endonezya Hükümeti Bürokratik Reformunun Büyük Tasarımı Bürokratik reform 2010 yılından bu yana devam etmektedir ve 2024 yılında tamamlanması beklenmektedir. Bu çalışma, Google Scholar ve resmi hükümet web sitesi aracılığıyla raporlar, araştırmalar, kitaplar, dergiler ve hükümet ve özel taraflardan diğer veriler gibi çeşitli kaynaklardan elde edilen veri ve belgeleri kullanan ikincil bir veri araştırmasıdır. Bu çalışmada üç ana gösterge kullanılmıştır: Endonezya'da yolsuzluğun gelişimi, bürokratik reform çabaları ve bürokratik reformun önündeki zorluklar/engeller. Çalışmanın bulguları, Endonezya hükümetinin idari reformunun iyileştiğini, ancak yerel yönetim düzeyinde yüksek yolsuzluk seviyelerinin yanı sıra belediyelerdeki bürokratik dönüşümün genel seviyesinin oldukça zayıf kalması nedeniyle büyük bir endişe kaynağı olmaya devam ettiğini göstermektedir.

Anahtar Kelimeler: Yolsuzluk; reform, bürokrasi, Endonezya.

**EFFECTS OF LAMTORO LEAF (*Leucaena leucocephala*) EXTRACT
CONCENTRATION ON MUSTARD GREEN (*BRASSICA JUNCEA* L.) IN
HYDROPONIC SYSTEM**

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Abstract

The use of nutrients in a hydroponic system is very important to obtain optimal plant growth and development. One of the popular hydroponic nutrients used as hydroponic nutrition is AB mix nutrition, but there are many obstacles in its use, namely it is expensive, difficult to obtain, and sometimes not suitable for plant needs. So we need alternative organic nutrients in the form of lamtoro leaf extract which is cheap, easy to obtain, and rich in nutrients for mustard green. This study used a completely randomized design (CRD) with 4 single factors of various nutrient solutions in the form of P1 = 100% AB mix (Control), P2 = 75% AB mix + 25% lamtoro leaf extract, P3 = 50% AB mix + 50% lamtoro leaf extract, and P4 = 100% lamtoro leaf extract. Results showed that the treatment with 75% AB mix + 25% lamtoro leaf extract had an effect on increasing number of leaves, green level of leaves, and harvest index of mustard green. The best concentration of lamtoro leaf extract is 25% lamtoro leaf extract substituted with AB mix nutrients because it can balance, complement, or act as a nutritional substitute for AB mix.

Keywords: harvest index, hydroponic, nutrient, organic farming

**EFFECT OF GENDER ON THE WILLINGNESS TO PAY FOR ORGANIC FOOD IN
THE FUTURE: TURKISH'S AND ALGERIANS EXPERIENCE**

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Abstract

This study has an aim to check the impact of gender of respondents on the willingness to pay additional price for organic food consumption's in the future. This type of products are illustrated on natural milk and natural oil generated from olive. The method explored in this research is an online survey between January-November 2022 among 81 respondents from Turkiye and Algeria. Then, the results were analysed through SPSS software V26 in order to use the Chi-square test. The results indicate that the independency between the willingness to pay in the future in order to consume organic food and the gender of respondents is ensured. It means that both men and women are agreeing to pay extra price in this case.

Keywords: Consumer behaviour- Green marketing- Organics food- Chi square test- Gender-Turkiye-Algeria.

**CREATING ERGONOMIC WORKSPACE WITH A TROLLEY ADAPTED TO SUIT
VARIOUS PURPOSES**

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Abstract

This project intends to develop a specifically modified trolley to fulfil various functions, namely extracting car components particularly gearbox and transferring these components to a specific workspace. It also aims to examine its efficiency when utilized to perform these two tasks. It was found that many car mechanics and students of automotive courses found these tasks to be physical demanding and exhausting and sometimes put them at risk of undesirable incidents. Thus, this trolley was designed to minimize physical workload, reduce time taken to perform tasks related to removing gearbox and transferring car components as well as mitigate health and safety risks. There will be 20 respondents involved in this study and they are required to test the project before completing observation checklists and questionnaires developed to elicit their feedback on the trolley. The findings from this research might be useful to study how this project can be improved to be safer and more efficient.

Keywords: Trolley, gearbox, automotive

TEACHING CHILDREN THE BASIC SKILLS IN NUMERACY THROUGH PICTURE CARDS

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Abstract

The purpose of this project was to examine the effectiveness of a specially designed teaching aid known as “Galaxy Mat” on children’s ability to recognize and remember basic numbers through galaxy-themed print visuals. It was found that the preschool children had difficulties recognizing numbers and remembering them properly. Thus, this teaching aid was created in order to help children identify numbers and apply its concept accordingly by using a set of galaxy-themed print cards. Due to the pandemic regulation, only 10 children were involved as subjects in this research. Their behavioral responses and ability to perform the task were observed using a checklist. The findings revealed that the children displayed greater interest in mastering the numerical concept and they were able to demonstrate their understanding of the subject matter correctly during the task. It signified the potential of the teaching aid to be used as an educational activity for children at preschools.

Keywords: recognition, remembering, visuals

**THE REVALORIZATION OF THE TECHNIQUE OF PISE IN THE NORTH OF THE
ALGERIAN SAHARA, (CASE KSAR OF AIN MADHI)**

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Abstract

The rammed earth, one of the ancestral techniques of construction in raw earth, knows a new rise today in the world thanks to its energy performance in all the life cycle of a building. This strong point makes it possible to consider the rammed earth as a promising material of the building sector in the context of the sustainable development. However, this material which constitutes a large part of the built heritage in raw earth in Algeria in the Ksour of the Sahara and in the habitas of the Highlands and Kabylie. In the north of the Sahara, the Ksour of Laghouat present not only a favorable environment rich in cultural, cultural, historical and architectural potentialities, but also a know-how so particular in the region, is that of the rammed earth. Indeed, the rammed earth, and earthen constructions in general, constitute a quality response to very contemporary issues. The questions of ecological footprint, renewable materials and lower consumption during the construction as well as during the use of the building are at the heart of the current reflection. The old ksar of Ain Madhi located north of Laghouat is one of the ksour so well known in the region by its architecture, its gardens and especially by an ancestral know-how so particular where the shy presence of the rammed earth material is marked like a treasure in danger. From there, came the idea of the revalorization of the technique of the rammed earth in the ksar by the creation of a training center in earth architecture built in rammed earth at the level of the region and precisely above the tourist extension zone of Ain Madhi, in the vision of a development of the local heritage considered as a socio-economic promoter. The present study is part of a master's thesis that focuses on the revaluation of the rammed earth technique in the Ksar of Ain Madhi, in order to better understand this technique, discover the architectural heritage of the region, analyze the site and design a training center in raw earth. The research is based on the contextual approach and the conceptual approach.

Keywords: revalorization, rammed earth, contextual approach, conceptual approach, earth center, Ksar Ain Madhi (Algeria)

**INVESTIGATION OF THE ANTI-INFLAMMATORY ACTIVITY AND NUTRITIONAL
VALUE OF THE LEAVES OF *Calopogonium mucunoides***

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Abstract

Objective: *Calopogonium mucunoides* is a medicinal plant used widely in the south eastern Nigeria for the management of a number of ailments including aches and pains. The clinical symptoms of many diseases like headache, fever, other aches and pains related to various diseases are indirectly or directly because of inflammatory process. However, most conventional anti-inflammatory drugs are associated with adverse side effects; hence need for the search for cheaper and safer anti-inflammatory drugs. This study was designed to assess the nutritional composition and anti-inflammatory activity of ethanol extract of *Calopogonium mucunoides* leaves (EECML) applying *in-vitro* and *in-vivo* models.

Method: In this study, *In-vitro* anti-inflammatory studies of EECML were performed using inhibition of platelet aggregation method, phospholipase-A₂ enzyme activity, egg albumin denaturation inhibition assay as well as hypotonicity-induced membrane stabilization method. *In-*

vitro antioxidant potential and nutrient composition of the plant extract were evaluated using standard biochemical procedures. In the *in-vivo* anti-inflammatory assay, a total of twenty five (25) adult male albino rats (120-160g) were divided into five (5) groups of five (5) rats in each group. Group 1 received normal saline; Group 2 received 10 mg/kg body weight of Indomethacin, while Groups 3, 4 and 5 received 100, 200 and 400 mg/kg body weight of EECML respectively.

Results: The plant's qualitative and quantitative analysis of the secondary metabolites revealed the existence of flavonoids, saponins, glycosides, alkaloids, tannins, phenols, steroids and terpenoids in varying amounts. The acute toxicity test of the extract was safe up to 5000 mg/kg b.w. The results revealed significant amounts of antioxidant vitamins and minerals. Proximate analysis of EECML showed the presence of appreciable amounts of protein, carbohydrate, fat, crude fibre, ash and moisture contents. In the systemic rat paw oedema model, scalar doses of the extract significantly ($P < 0.05$) suppressed the development of paw oedema induced by egg albumin. This compares well with the standard anti-inflammatory drug indomethacin (10 mg/kg b.w) which at 5 hours inhibited egg albumin-induced rat paw oedema (84.25%). The extract at different concentrations (10-640 μ g/ml), significantly ($P < 0.05$) exhibited DPPH (1-1diphenyl-2-picrylhydrazyl) radical scavenging activity, in a concentration-dependent manner, similar to the standard antioxidant, ascorbic acid. Also, varying doses of the extract significantly ($P < 0.05$) inhibited platelet aggregation, phospholipase-A₂ activity, albumin denaturation as well as hypotonicity-induced hemolysis of red blood cells in a concentration-related manner, provoking inhibition comparable with the standard anti-inflammatory drug used.

Conclusions: These results indicate that the extract possesses significant anti-inflammatory and antioxidant activities as well as nutritional potential. Furthermore, the results indicate that the plant extract can be a potential source of anti-inflammatory agents as well as a possible source of cheap food nutrients.

Keywords: Anti-inflammatory, *Calopogonium mucunoides*, nutritional composition, anti-oxidant.

OPTIMIZATION OF A NEW ANTIOXIDANT FORMULATION USING A SIMPLEX
LATTICE MIXTURE DESIGN OF *Apium graveolens* L., *Coriandrum sativum* L., AND
Petroselinum crispum M. GROWN IN NORTHERN MOROCCO

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Abstract

A statistical Simplex Lattice Mixture design was applied to develop a new formulation based on a combination of three plants grown in northern Morocco: *Apium graveolens* L., *Coriandrum sativum* L., and *Petroselinum crispum* M. We examined the extraction yield, total polyphenol content (TPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity, and total antioxidant capacity (TAC). The results of this screening study showed that *C. sativum* L. had the highest content of DPPH (53.22%) and TAC (37.46 ± 0.29 mg Eq AA/g DW) compared to the other two plants, while *P. crispum* M. showed the highest TPC (18.52 ± 0.32 mg Eq GA/g DW). Furthermore, the ANOVA analysis of the mixture design showed that all three responses (DPPH, TAC, and TPC) were statistically significant, with determination coefficients of 97%, 93%, and 91%, respectively, and fit the cubic model. Moreover, the diagnostic plots showed good correlation between the experimental and predicted values. Therefore, the best combination obtained under optimal conditions ($P_1 = 0.611$, $P_2 = 0.289$, $P_3 = 0.100$) was characterized by DPPH, TAC, and TPC of 56.21%, 72.74 mg Eq AA/g DW, and 21.98 mg Eq GA/g DW, respectively. The results of this study reinforce the view of stimulating the effect of plant combinations to achieve better antioxidant activities, thus providing a better formulation using designs of mixtures for the food industry and in cosmetic and pharmaceutical applications. Moreover, our findings support the traditional use of the Apiaceae plant species in managing many disorders cited in the Moroccan pharmacopeia.

Keywords: *P. crispum* M.; *C. sativum* L.; *A. graveolens* L.; mixture design; antioxidant activity.

**CREATING ERGONOMIC WORKSPACE WITH A TROLLEY ADAPTED TO SUIT
VARIOUS PURPOSES**

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Abstract

This project intends to develop a specifically modified trolley to fulfil various functions, namely extracting car components particularly gearbox and transferring these components to a specific workspace. It also aims to examine its efficiency when utilized to perform these two tasks. It was found that many car mechanics and students of automotive courses found these tasks to be physical demanding and exhausting and sometimes put them at risk of undesirable incidents. Thus, this trolley was designed to minimize physical workload, reduce time taken to perform tasks related to removing gearbox and transferring car components as well as mitigate health and safety risks. There will be 20 respondents involved in this study and they are required to test the project before completing observation checklists and questionnaires developed to elicit their feedback on the trolley. The findings from this research might be useful to study how this project can be improved to be safer and more efficient.

Keywords: Trolley, gearbox, automotive

**A NEW PROTOCOL FOR ENDODONTIC TREATMENT, FROM IN VITRO STUDIES
TO A CLINICAL APPROACH**

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Abstract

Root canal treatment (RCT) is one of the most common dentistry practices. Indeed, this kind of treatment allow not only to take away the pain from irreversible pulpitis but also to solve periapical inflammation such as granulomas and cysts. The RCT consist in different “surgical” phases: opening of the root chamber, scouting of the canals, Coronal flaring, Glide path establishment, Shaping of the canal, cleaning and filling. The introduction of Nickel-Titanium (NiTi) in the routine daily practice has completely changed the root canal treatment. Despite this world changing introduction, it is still controversial the use of NiTi in root canal shaping. Indeed, while the number of rotary instruments available on the market, with different mechanical characteristics thought to challenge every clinical situation. Despite the current literature highlighted the uncountable advantages of NiTi files over the traditional stainless steel (SS) files, a lot of Endodontist and General Practitioner still use them. Indeed, SS files are still mainly used at least in the first phases of the root canal treatment, such as scouting and coronal flaring. This procedure is often motivated by a higher safety of the SS files, which less frequently are broken inside the root canal. Despite this safety idea could be true especially in the past, the SS files could lead to several problems such

as ledge, zipping and perforation. These problems often lead to the failure of the root canal treatment. Moreover, the introduction of thermal treatments of the NiTi drastically increased the safety of the rotary files, reducing the separation percentage inside the root canal. For these reasons, the authors created a different approach to the shaping procedures of the root canal treatment. This new protocol, so called Only Rotary Endo (O.R.E.) Protocol, is based on the current literature, leading to an Evidence Based Dentistry. This allows to split the shaping procedures into different phases, based on the anatomy difficulties of the canal. This approach allows to use the most proper instrument for the different phases of the treatment, matching the inevitable anatomical difficulties with the properties of the instrument used to challenge it.

Keywords: Endodontics, Root Canal Treatment, NiTi Rotary Files

**APPLICATION OF POLYMERIC WASTES AS CORROSION INHIBITORS: A
REVIEW**

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Abstract

Corrosion is a major challenge in various industrial sectors, and numerous methods have been developed to control it. The use of corrosion inhibitors is one of the most efficient methods for corrosion control. However, the high cost and environmental concerns associated with the use of conventional corrosion inhibitors have led to the search for alternative materials. Polymeric wastes, which are abundant and cost-effective, have been explored as potential corrosion inhibitors. This review paper provides an overview of the application of polymeric wastes as corrosion inhibitors. The paper discusses the different types of polymeric wastes that have been investigated for their corrosion inhibiting properties. The synthesis and characterization techniques of these polymeric wastes are also highlighted. The mechanisms of corrosion inhibition by polymeric wastes, including adsorption and film formation, are discussed. The effectiveness of polymeric wastes as corrosion inhibitors for various metals and alloys, including carbon steel, aluminum, and copper, are also reviewed. Furthermore, the paper discusses the limitations and challenges associated with the application of polymeric wastes as corrosion inhibitors, including their stability, solubility, and compatibility with other additives. The review concludes with suggestions for future research directions in the area of polymeric waste-based corrosion inhibitors. Overall, the review highlights the potential of polymeric wastes as an alternative source of corrosion inhibitors, which can contribute to reducing the environmental impact of industrial processes.

COMPARATIVE STUDY ON THE EFFECT OF DIFFERENT KINDS OF URBAN CONTEXTS BLOCKS (TRADITIONAL AND MODERN) ON USING NATURAL WIND FLOW FOR CREATING THERMAL COMFORT IN URBAN CROSSINGS (CASE STUDY: KASHAN, IRAN)

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Abstract

Urban crossings are important component of the cities. Creating thermal comfort especially in the marginal cities of the deserts could improve the life quality. How we can solve this problem effectively? By natural wind flow. The block formation of buildings in urban crossings are different in traditional and modern contexts. In Kashan, a city in Iran, as our case study, the building blocks formation are divided into 4 general categories:

- 1) Completely traditional context: often central yard, 7-meter height
- 2) Semi- traditional context: some of newly build building, one side built, at last 7.5-meter height (according to the existing rules.)
- 3) Urban new context with non-ordered routes: different heights, at last 5 floors.
- 4) Urban new context with ordered axis: the same heights for the buildings, from 3 to 6 floor, more than 6 floors in some cases.

The current research question is that what is the difference between the block formation of buildings in Kashan, Iran for modern and traditional context in confronting natural wind flow and air flow in urban crossings and which one has more thermal comfort?

Research tools are based on the newest maps of Kashan, Iran to investigate different plaques of different parts (traditional and modern) and the differences of wind flow formation and have an effect on creating thermal comfort of the urban outdoors.

Research tools are CFD like Ansys Fluent and Autodesk CFD and making maquettes and doing test in wind tunnel in order to simulate natural air flow. Finally, a comparative study showed the effect of different forms of urban contexts on thermal comfort and help to propose the utilized block form. Finally, a comparative study showed the effect of different forms of urban contexts on thermal comfort.

Keywords: Block forms in urban contexts, Traditional context of the city, Modern context of the city, Natural wind flow, Thermal comfort, Urban outdoors

**THE EFFECT OF THE URBAN CONTEXT FORMS ON USING NATURAL WIND
FLOW FOR CREATING THERMAL COMFORT IN URBAN CROSSINGS (THE
MARGINAL CITIES OF THE DESERTS IN IRAN)**

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Abstract

Urban crossings are important component of the cities. They may cause one of the most important health problems for humans. The buildings which are conforming urban crossings, are decreasing fresh wind heavily. Urban crossings are the main source of pollution in the city caused by traffic and other human activities. Creating thermal comfort especially in the marginal cities of the deserts could improve the life quality. How we can solve this problem effectively? By natural wind flow. To understand the relevant procedures, it is necessary to understand the main currents at first. The forms of buildings should be used as a passive strategy in order to improve air conditions, in addition to morphology of the city. The wind behavior could be investigated confronting different kinds of buildings in different scales (from city scales to residential units and interior design.) some of the elements are considered in the urban scale and have an effect on block building. Then, the investigation should be according to urban and the neighborhood scale. The current research question is that utilizing the block forms in marginal cities of the Deserts in Iran how affect using natural wind for creating thermal comfort? In this research plaques of newly build parts of the city are based on the confirmed descriptive plan for the city to investigate the effects of the relevant parameters changes in wind flow formation and have an effect on creating thermal comfort of the urban outdoors. Research tools are CFD like Ansys Fluent and Autodesk CFD and making maquettes and doing test in wind tunnel in order to simulate natural air flow. Finally, a comparative study showed the effect of different forms of urban contexts on thermal comfort and help to propose the utilized block form.

Keywords: Utilization, Block forms in urban contexts, Natural wind flow, Thermal comfort, Urban outdoors

ASSOCIATION BETWEEN WORK-LIFE BALANCE AND JOB SATISFACTION OF EMPLOYEES

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Abstract

The research aims to study the relationship between work-life balance and the job satisfaction in the Indian service sector. A survey was conducted for data collection from 184 workers in Indian service sector. Data analysis was performed using SPSS. The findings reveal that work-life balance had a significant influence on job satisfaction. The workforce in Indian service sector reported a middling level of work-life balance in this study. The results suggest that work-life balance approach, work-load, and organizational support exerted a positive and significant impact on the job satisfaction of the service sector workforce. It is recommended that service enterprises should examine their working environment in order that the workforce gets fascinated toward joining the service sector and make a contribution to India's financial development. Organizations should frame and execute well-designed work-life balance policies, programs and practices for supporting and stimulating work-life balance skills. The institutions must provide work-family programs such as flexi-timings for reducing the stress of the workforce and enabling them to balance their personal life and job successfully. This study makes a contribution to literature since Indian organizations have recently executed numerous work-life balance policies. The research findings would aid HR practitioners in understanding the employees' work-life balance requirements and its influence on their job satisfaction.

Keywords: Job satisfaction, Banking sector, Work-life balance, Service sector

**CONVENTION OF FISH WASTE INTO AN ECO-FRIENDLY BIOSORBENT FOR
DYES IN AQUEOUS SOLUTION**

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Abstract

A chitin complex derived from shrimp carapace (CV) was tested for its ability to biosorb Acid Red 337 (AR) and the chromic 1:2 complex of Acid Blue 349 (AB). Sorbent characteristics, dye concentration, contact time and working pH were the factors considered. SEM images of the CV show different morphologies and pore structures. The FTIR spectra of the CVs show the presence of chitin. AR dye showed higher absorption compared to AB dye for all sorbents. Excellent adsorption capacity for red and blue acids with maximum adsorption capacities above 150.42 mg/g. Adsorption kinetics obey the pseudo-second order model. The Freundlich model best fits the experimental sorption isotherms. Through these processes, we have been able to clean up industrial wastewater, as well as prove the value of chitin as an effective biopolymer in several fields of application. The methods of preparation and chemical functionalization as well as the characterization techniques allowed us to successfully solve this problematic. The present study suggests that the sorbent derived from the studied wastes is effective for the removal of low molecular weight acid dyes from water.

Keywords: Biosorption, Acid dyes, Biosorption, Chitin, Shrimp waste, Isotherm Kinetic.

**SIMULATION OF MICROWAVE TUMOR ABALTION BASED ON MULTIPHYSICS
SOFTWARE PACKAGE**

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Abstract

Modeling the MWA as a multiphysics problem involves the simultaneous modeling of multiple physical phenomena that occur during the procedure, including electromagnetic wave propagation, heat transfer, and tissue damage. These phenomena are interrelated, and modeling them together can provide a more accurate and comprehensive understanding of the behavior of tissue during the procedure. The first stage encompasses the accurate modeling of the microwave radiation of the antenna. The second stage involves modeling the interaction between the tissue and antenna radiation, heat transfer, blood flow effects, etc. The third stage requires estimating cell death due to heating. While the material parameters of the antenna components can generally be observed as constant during ablation, the material properties of the healthy tissue and tumor are temperature (time) dependent. Tumor shape is patient-specific, so a general approach with a spherical or static tumor model is not accurate. The water concentration in the tissue changes with increasing temperature, which effectively changes the physical properties of the tissue.

Keywords: Multiphysics, microwave balation, tissue.

Acknowledgements. This study was supported by the Science Fund of the Republic of Serbia, The Program IDEAS, GRANT No. 7739583, SimSurgery.

**FINITE ELEMENT ANALYSIS OF THE EFFICIENCY OF MULTISLOT ANTENNA IN
MICROWAVE TUMOR ABLATION**

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Abstract

Microwave ablation is a medical procedure that uses high-frequency electromagnetic waves to create heat and destroy abnormal or cancerous tissue in the body. It is a minimally invasive alternative to surgery that is often used to treat liver, lung, kidney, and bone cancer, as well as other conditions such as benign tumors, nodules, and cysts. Microwave ablation is generally considered a safe and effective treatment option for certain types and stages of cancer. It is often performed on an outpatient basis, which means that patients can go home the same day as the procedure. However, like any medical procedure, there are some potential risks and side effects associated with microwave ablation, such as pain, bleeding, infection, and damage to nearby organs or tissues. Patients should discuss the benefits and risks of this treatment with their healthcare provider before deciding whether it is right for them. For this study, the finite elements method (FEM) is used to solve coupled electromagnetic-field and heat-transfer equations, including all details of multislot antenna design and properties of healthy and tumoral tissue. The obtained simulation results reveal that precisely localized heating distributions and heating effectiveness can be achieved by using a multi slot antenna probe than a single slot antenna.

Keywords: finite element, multislot antenna, microwave ablation

PROGRESS IN THE DEVELOPMENT OF CASSAVA-BASED INSTANT NOODLE FOOD

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Abstract

Across the globe, instant noodle is one of the most patronized quickie foods. Ideally, noodles are made from wheat, a gluten-rich grain that is linked to type 2 diabetes, obesity, and some other wheat-related disorders. Unfortunately, the same wheat protein (gluten) behind wheat-related disorders is responsible for the unique sensory qualities of wheat-based baked foods and noodles. In pursuit of wheat/gluten-free foods, cassava, a relatively cheap root tuber, has garnered much interest. This study presents recent progress in cassava-based instant noodle food development. A mixture of cassava flour and water does not yield a malleable matrix; hence, a method of preparing whole-cassava dough was discussed. While most reports are focused on improving the nutritional composition of the carbohydrate-rich cassava-based noodle via fortification, the major bottleneck remains the relatively poor sensory qualities of cassava noodles. Although more appealing cassava-based noodles could be made by compositing cassava and wheat, such foods compromise the “wheat/gluten-free” content. For the unappealing cassava-based features, I concluded the study with some future perspectives. I hope this could pave the way for the development of other cassava-based food products.

**DEVELOPMENT OF PHONOLOGICAL ABILITIES AT THE PRESCHOOL AGE
EDUCATION IN THE NEW WORLD**

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Abstract

Numerous studies indicate that phonological abilities are one of the most important factors in children's reading adoption, so it is important to encourage them. The paper presents action research in Preschool institution "Plavi Chuperak" in Serbia, an initial research aimed at determining the development of phonological abilities in preparatory preschool groups. The sample was 100 children tested individually with a test of phonological abilities - FONT 2.1. (51% boys) average age of 6.5 years. The results indicate that almost all children have a developed ability to segment syllables, over 70% and to rhyme and identify the initial phoneme, while 45% of children successfully identifying the final phoneme. In half of the children, the ability of voice analysis was developed, the ability of phonemic substitution developed less than 40% of children, and the elimination of the initial phoneme less than 20% of children. The results confirm that non-phonemic abilities develop earlier, and that phonemic analysis, which are directly related to the adoption of reading in the largest number of children, develop in the year before starting school. It is important to work in a partnership with parents and the school on encouraging phonemic segmentation, initial phoneme elimination, and phoneme substitution so that children are ready to acquire initial reading.

Keywords: phonological abilities, reading adoption, prompting, partnership, transition

**SERBIAN ORTHODOXES AND GREEK PHANARIOTS UNDER OTTOMAN
TURKISH RULE AN THE BALKANS IN THE 16-18 CENTURIES**

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Abstract

There is a common misconception that the Serbs fled the Balkans because the Ottoman Muslim occupiers did not allow them to practice their Christian culture, but it is not true. The Church Slavonic liturgy, understood by Serbian believers, was not destroyed by the Turkish invaders but became impossible with the advent of the elite of the Greek Phanariots. As highlighted in the classic monograph on Serbian history by English scholar Temperley, following the author of Balkan history by Jireček, the rule of Greek Phanariots in monastic schools made it impossible to write the Cyrillic alphabet in Slavic, and they denied the usage of the Church Slavonic Liturgy. (Temperley, 1917: 123, 163-166. Jireček, 1876. 466-467.) In the Ottoman Empire, Greek priests held ecclesiastical power in their hands, because the patriarch of Constantinople was the head of all Christians. The Turkish Sultan appointed him the head of the Christian “millet”. The millet system is well-known to those who have studied the history of the Ottoman Empire. (Karpát, 1982, 1997) Islamic practice did not prohibit the “peoples of the book” from practicing their religion if they paid proper taxes. The Orthodox (Byzantine) church had a well-established administration when the Turks conquered the Balkan peoples. Therefore, it was advantageous that the secular head of the Christian millet became the parochial leader. But in the seventeenth century, the wealthy and educated Greek bourgeoisie, named after the Phanar (Lighthouse) part of Istanbul, seized both economic and administrative power over all Christians under Ottoman rule and even corrupted the patriarch together with the entire church. Ecclesiastical positions were the object of sale in the Greek-dominated Balkan clergy, and the largest amount of corruption money had to be paid for the highest rank, that of the patriarch. The rich Greek Phanariotes hated the Slavic peoples, thus the Serbs and Bulgars. As a Balkan historian, Constantin Jireček wrote in his monograph, The Greek Phanariots did not allow Serbs to use the Church Slavonic language, only Greek, and Slavic liturgical books and manuscripts were even lit. The Turkish Sultan's goodwill was shown by the fact that the soldier of Serbian origin, Sokolović, could rise to the highest rank, and by the name of Mehmed Sokollu, converting to Islam, he became the Grand Vizier of Suleiman the Magnificent and helped his Serbian brother, who remained Christian. It was he, the Grand Vizier Sokollu Mehmed, who re-established the Serbian Orthodox Christian Patriarchate in Peć in 1557 and appointed his brother as patriarch. Serbian Grand Vizier, who was the second person after the Sultan, had good opportunities to provide his Christian Serbs. Sulejman the Magnificent is known in Roman Catholic historiography as a Cruel Conqueror, albeit he was a great statesman thus under his reign the great Empire worked by a good administration. Thus nothing repression and ruination went by the Turks but by the Greeks. Islam never burned books anywhere, because it honored the

Peoples of the Book. But, on the other hand, the Greek Orthodox Christian priests burned the Serbian temple books, because they persecuted the Slavs. This was one of the reasons why Serbs fled to the Kingdom of Hungary and were free to practice their religion there. Therefore, the Serbs bought Slavic liturgical books in the territory of the Kingdom of Hungary, and by this time they had already acquired them from the Ukrainian territories. The author of the paper is a researcher of the migration of books between the Polish-Lithuanian Commonwealth and the Serbs, thus he studied the situation of the Serbian culture in the Balkan and In the Hungarian Kingdom and has already published several papers about the Serbs purchasing their Slavic books from the Eastern Slavic lands while on the Balkans their situation became sad. (Földvári, 2014, 2022).

Keywords: Serbs, Balkan, Phanariots, Book-culture, Orthodoxes, Ottoman_Empire.

**A PROSPECTIVE STUDY ON THE WILLINGNESS TO ACT AND SUSTAINABLE
PURCHASING OF YOUNG CONSUMERS**

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Abstract

This paper aims to determine a relationship between the attitudes and willingness of young consumers to promote sustainable consumption (accordingly to the expectations of the Sustainable Development Goal 12 of the United Nations Agenda 2030 and its targets) and their behaviour in practice. In this sense, research studies suggest an increasing tendency towards sustainable consumption as well as producers are conscious on it. Thus, the use of sustainability claims and logos to publicize their initiatives has become a common practice up to the extent that quite a percentage of the population indicates that there is an overinformation making hard to differentiate a label that certifies the positive impact of a product of a mere (or totally empty) claim. This circumstance, which is also mentioned in the Proposal for a Directive on Green Claims in the European Union, generates a feeling of confusion and reduces the effectiveness of 'true' seals, then questioning the role of consumers and brands to be part of the active solution to face the current environmental challenges. On this basis, an experimental study was conducted to test the perception of sustainability labels and certificates by young consumers. Specifically, a sample of 24

individuals were involved in a neuromarketing experiment with eye-tracking. While the members of the experimental group received a previous training on sustainability labelling (concrete pieces of information on the purpose and types of labels, together to some 'tips' to differentiate between 'real' labels and commercial 'empty' claims), the members of the control group did not. Then, members of both groups faced three options of a same product (chocolate), including either a formal eco-label, a commercial claim or nothing in their package, and they were asked to choose the sustainable option. The eye-tracking software collected information on the time that subjects used in their decisions as well as the times they stared at each one of the alternatives. The results obtained suggest the influence of training in consumers when taking their decisions on the sustainability of products, as those individuals who had received a previous training on labelling required less time to locate the elements which could effectively help them to make their purchase decisions, as well as they devoted more time and stared more times at formal eco-labels when compared to informal claims. As a consequence, the need to complement the information of sustainability issues with a prior training that allows consumers to distinguish those elements that really provide useful information is concluded, as well as the convenience of simplifying the information provided, accordingly to the intentions of the aforementioned Proposal for a EU Directive.

Keywords: sustainable development; responsible consumption; environmental labelling; sustainable purchasing; neuromarketing; eye-tracking.

**THE BENEFITS OF MINDFULNESS IN TEACHING ENGAGEMENT FOR
TEACHING EFFECTIVENESS: A LITERATURE REVIEW**

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Abstract

Teaching effectiveness is directly related to the level of engagement teachers put on the teaching process, but building and maintaining the engagement is a challenge for educators. One suggested effective tool to support teaching engagement in the classroom is to train teachers mindfulness skills. This review outlines some of the major benefits of mindfulness on teaching engagement to improve teaching effectiveness. We used the Consensus search engine to find the most relevant scientific papers on the topic, by asking the questions "Does mindfulness improve teaching engagement?" and "Does teaching engagement improve teaching effectiveness". The responses highlighted were assessed to select the most relevant papers. We then used Google and Google Scholar search engines to access the full text version of the studies. Overall, mindful teachers are better at keeping students engaged in the learning purposes and learning process; engaging with students; and providing a supportive teaching environment, all factors leading to a better teaching effectiveness. In conclusion, mindfulness is very helpful in keeping the teachers focused on those factors contributing to the effectiveness, but also in recognizing their distracted moments and guide themselves back to these factors. We suggest that to improve teaching effectiveness through mindfulness, educators should be trained in mindfulness to experience the benefits on a personal level and apply it in the classroom and attend to conferences on the potential of mindfulness on education effectiveness.

Keywords: mindfulness, teaching engagement, teaching effectiveness.

**SEMI-NUMERICAL ANALYSIS OF MHD BOUNDARY LAYER FLOW OF A CASSON
FLUID OVER AN EXPONENTIALLY SHRINKING SHEET VIA COLLOCATION
TECHNIQUE USING SHIFTED CHEBYSHEV POLYNOMIALS**

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Abstract

The analysis of magnetohydrodynamic (MHD) boundary layer flow of non-Newtonian Casson fluid over an exponentially shrinking surface has been carried out. The appropriate similarity transformations of exponential kind, transforms the governing equations into a nonlinear ordinary differential equation and it is numerically solved through semi-numerical technique viz. Shifted Chebyshev Collocation Method (SCCM). The influence of various parameters such as magnetic parameter, suction/injection parameter, and Casson fluid parameter describing the flow characteristics on velocity profiles are studied. The obtained results are presented through graphs and table, which are in well agreement with previous findings.

Keywords: Casson fluid, MHD, Shifted Chebyshev polynomial, Collocation method.

**MULTIGRID METHOD FOR THE SOLUTION OF THERMAL
ELASTOHYDRODYNAMIC LUBRICATION POINT CONTACT PROBLEM WITH
SURFACE ASPERITIES**

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Abstract

In the present paper, the numerical solution of thermal elastohydrodynamic lubrication (EHL) point contact problem with surface asperities is analysed. The effect of the temperature and surface roughness on the fluid film thickness is studied in detail. The governing equations comprises Reynolds, film thickness, load balance and energy equations with appropriate boundary conditions. The second order finite difference approximation is used to discretize the governing equations. Multi level multi integration technique is employed to solve the film thickness equation. Multigrid V-cycles is employed to solve the resultant non-linear algebraic equations with FAS technique. The obtained results are illustrated in the form of graphs and tables which are comparable with earlier findings. The film thickness profiles shows dimple near to out let region due to temperature-viscosity wedge mechanism. Isothermal minimum film thickness is higher than the thermal minimum film thickness. Minimum film thickness is much smaller when slide to roll ratio is positive than compared to negative, whereas the central film thickness behaviour is contrast to that of minimum film thickness.

Keywords: EHL, Multigrid method, FAS, Thermal, Slide to roll ratio, MLMI.

**POST-PANDEMIC TIMES OF COVID-19 AND ROLE OF LIBRARIES: A STUDY OF
GOETHALS INDIAN LIBRARY AND RESEARCH SOCIETY; KOLKATA**

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Abstract

In the post-pandemic situation both the factors; library services and the user behavior are being changed. In the adverse situation of the Covid -19 pandemic, people picked up much more competitive ways of survival, where libraries are no different. As a result, online library services demanded a different panorama, like digitized documents, e-books, e-journals, and different other resources at the remote end of every user at their perusal. All the academic libraries attached to higher education and research institutes, IITs, IIMs, Medical Institutes, Engineering Institutes and Law Institutes made themselves more suitable to serve the users with the latest online technologies. Besides this library professionals managed to be trained to fulfill the contemporary needs related to information provision at the desk of library services. In this paper, the discussions are made on Goethals Indian Library and Research Society, Kolkata. The library has preserved rare documents and archived documents for the research need of scholars. The study will reveal the services of this library and how far it is acquainted with to deal current situation, especially the combating capacity in a pandemic situation.

Keywords: Pandemic, library and post-pandemic situation, research need and archive, digital preservation of rare document in digital mode, library services, librarian and their role

**CHALLENGES OF CURRICULUM REFORM IN THE CANTON OF SARAJEVO,
BOSNIA AND HERZEGOVINA FROM PARENTS' PERSPECTIVES**

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Abstract

Education sector in Bosnia and Herzegovina is much decentralized and it is organized autonomously on a state, entities and cantons' levels. Nevertheless, one of the biggest and financially strongest cantons, the Canton of Sarajevo, has engaged in curriculum reform as a way to equip students with the knowledge, skills and competences needed for today's fast-changing world. However, how to initiate such change both, in this canton and wider within BiH in the most suitable and effective way remains somewhat challenging not only for teachers, but also for parents. Each parent that thinks a great deal about the future of their children should seriously reconsider all the aspects of a new curriculum and ask themselves if they would wish their child to grow up and live in a modern, educated and technologically advanced society. Therefore, the aim of this article is to do a research on parents' perspectives what their roles would be in curriculum reform. The research is conducted on the sample of 150 parents whose children attend pre-school institutions (50), primary schools (50), and high schools (50). The results of the research show that parents do not have a clear picture of what the curricular reform means and that they should be more involved into educational process of their children. Due to that, it is necessary to achieve better connection between school and family, the one that will contribute to better implementation of the curriculum.

Keywords: curriculum reform, the role of parents

APPLICATION OF INTELLIGENT SYSTEMS IN THE DESIGN OF PRODUCTION SYSTEMS

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Abstract

The main difficulty in training intelligent systems is an insufficient data set. Let's focus on a specific example. Let there be a task of ensuring fire safety at the enterprise through the introduction of intelligent systems. The main difference between such systems and conventional sensors is the ability to make decisions independently depending on the situation and the current situation. To do this, the system must be properly trained. It must clearly understand what a fire is, what its main signs are, so as not to confuse it with ordinary smoke. The mistake of such a decision-making will cost a lot of material costs. It is necessary to talk about the rationality of the use of intelligent systems in the enterprise. The advantages include high measurement accuracy, the possibility of retraining the system when the location changes, the analysis of many factors affecting the safety of technological production. In addition, the intelligent system can be integrated into a network of intelligent systems that will simultaneously control many parameters and cover a large area. For example, it is possible to install intelligent fire safety sensors, temperature, pressure and humidity control of the room; monitor the concentration of harmful substances in the production process. Based on a comprehensive assessment of all factors of production, the intelligent system will conclude that the working environment at the enterprise meets the required standards. In case of violation of these conditions, the data will be transferred to the appropriate services, and special measures will be taken against enterprises that violate the established legislation. This will protect the life and health of employees.

Keywords: intelligent system, production system, device

**ANALYSIS OF GENERALIZED BESSEL-MAITLAND FUNCTION AND ITS
PROPERTIES**

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Abstract

In this paper, we present the generalized Bessel-Maitland function (EGBMF) by using extended beta function and obtain some interesting properties of it. Then, we show interesting relationships of this function with Laguerre polynomials and Whittaker functions. Further, the Mellin transform of this function is evaluated in terms of generalized Wright hypergeometric function and Euler transform is also evaluated. Finally, we used the Gaussian quadrature and Laguerre-Gauss quadrature method to derive several graphical representations and it was shown that the numerical and theoretical simulations are consistent. Besides, the derived results are applied to find potentially useful in several fields notably physics, applied mathematics and engineering.

Key words: generalized Bessel-Maitland function, extended beta function, fractional derivative, Mellin transform, Laguerre polynomials, Whittaker functions, Wright generalized hypergeometric functions

**ENTREPRENEURSHIP EDUCATION AND HUMAN CAPITAL DEVELOPMENT:
NEXUS FROM NIGERIAN PERSPECTIVE**

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Abstract

The study examines Entrepreneurship Education and Human Capital Development with particular reference to the state universities students in South-East, Nigeria. Specifically, the study examines the relationship between Curriculum content, Content knowledge, Content Delivery, Skill Acquisition, Infrastructural development as the independent variable and human capital development as the dependent variable. The study anchored on Social Cognitive theory by Bandura (1978) and Human Capital Development theory by Robert (1991). the study adopted descriptive survey research. The area of the study covered the South-East, Nigeria. The population of the study comprises 1325 final year students of Accountancy and Business Administration Department of the state universities in the South-East, Nigeria. Mathematical formular devised by Taro Yamane was used to ascertain the sample size at 307. Data were sourced through both primary and secondary sources. Primary data were generated through the use of structured questionnaire on a five-point likert scale. Data generated were analyzed using descriptive statistics such as simple percentages and mean for presentation of data while inferential statistics involving Pearson Product Moment Correlation Coefficient was used to test hypotheses. From the analysis, the study revealed that; curriculum content, content knowledge, content delivery and skill acquisition have positive and significant relationship with human capital development while infrastructural development has no significant relationship with human capital development. The study concluded that entrepreneurship education has a positive significant relationship with human capital development.

Based on the findings, the study recommended that; Entrepreneurial curriculum should be designed in such a way that it will contain the vital topics that translate to achieving entrepreneurial success. The lecturers of entrepreneurship education should possess adequate and full knowledge of the course contents embedded in the curriculum that will enable them to impart into the students the right entrepreneurial spirit. Universities authorities should ensure a “fit” in the recruitment of entrepreneurial education lecturers. Tutors and lecturers of entrepreneurship education should possess the right teaching methods that will encourage and promote innovative behaviours in budding entrepreneurs. Students should be equipped with entrepreneurial skills that will enable them to become job creators instead of job seekers after graduation. Basic infrastructural facilities should be provided by the institution to enhance entrepreneurial education and training

**DESIGN A HORIZONTAL AXIS WIND TURBINE BLADES BASED ON INSPIRATION
OF BIOMIMICRY FOR WHALE TUBERCLES**

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Abstract

Wind speed is the major factor in generating power in a wind turbine. However, due to the non-optimum and redundant design of wind turbine blades, not nearly enough wind is captured for utilization. In the present study, modifications were done on the leading edge of the HAWT blade using tubercles showing their effects on aerodynamic performances. From this research, the following results found with respect to the performances of HAWT with leading-edge tubercles were that; blades with tubercles on the leading edge will have superior performance in the post-stall regime by 35 %, tubercles with a smaller amplitude and lower wavelength will produce higher lift and lower drag in the low wind speed condition, and tubercle blade will have a stable and smooth performance in varying wind speed conditions, producing higher torque and power at low wind speed. Using a small wind turbine model, Solid Works Motion Analysis Simulation was used for dynamic modeling to evaluate and determine the force and torque of the mechanical structure. These results were compared and examined using standard wind turbine blades which showed an improvement of 48% in efficiency.

Keywords: wind turbine BLADE, tubercle blade, horizontal-axis wind turbines, biomimicry, analysis simulation

SEPARATION AXIOM IN TOPOLOGICAL SPACES

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Abstract

In this paper, six exciting new spaces like space, $g_s T_{\alpha J^{**}}$ -space, $g T_{\alpha J^{**}}$ -space, $\alpha J^{**} T_{\delta}$ -space, $g_{\delta} T_{\alpha J^{**}}$ -space, $\pi_{gp} T_{\alpha J^{**}}$ -space are introduced and the independence of these new spaces with other existing separation axioms are analysed.

**USING MACHINE LEARNING TO PREDICT MENTAL HEALTH TRENDS POST
COVID-19 PANDEMIC IN CONFLICT SETTINGS**

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Abstract

The COVID-19 pandemic has had a substantial influence on mental health worldwide, disproportionately affecting some of the most vulnerable people, like those who live in conflict zones. In this situation, utilising machine learning to forecast mental health trends can give policymakers and medical experts a useful tool to better comprehend and care for the mental health requirements of persons living in conflict zones. In order to forecast changes in mental health following the COVID-19 pandemic in conflict areas, this study will employ machine learning algorithms. The study will train the machine learning algorithms using data from prior conflicts as well as data gathered during the COVID-19 pandemic. A wide range of variables will be included in the data, including demographic details, social and economic characteristics, and access to healthcare services. In order to forecast post-pandemic mental health patterns in conflict zones, machine learning algorithms can be used. Large and complex datasets can be handled via machine learning, which can also be used to make accurate predictions and spot patterns and trends that conventional statistical analysis would miss. The study's findings will shed important light on the mental health requirements of people residing in conflict areas, which can help in the creation of efficient treatments and regulations to aid these populations. However, this strategy has its drawbacks as well. Algorithms for machine learning rely on the quality and quantity of data that is readily available, which may be scarce in areas of armed conflict. The application of machine learning to forecast mental health outcomes also poses ethical questions, such as the necessity to safeguard patient privacy and the possibility of prejudice. In order to gain a deeper knowledge of the complex aspects influencing mental health in conflict zones, machine learning algorithms can also be used to spot patterns and trends that may not be immediately obvious through traditional statistical research. With a more sophisticated and data-driven approach to assessing and addressing the mental health needs of persons residing in conflict zones following the COVID-19 pandemic, this study has the potential to significantly advance the field of global mental health.

Keywords: Conflict, Covid-19, Machine Learning, Mental health, Prediction, Conflict

**ASSESSMENT OF AIR QUALITY DURING COVID 19 PERIOD WITH REFERENCE
TO NASHIK CITY OF INDIA**

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Abstract

India has imposed a nationwide lockdown in March 2020 in order to stop the spread of the coronavirus. From March 23 through June 30, 2020, a nationwide lockdown was implemented in stages, with services restarting on June 8, 2020, in a staged manner known as Unlock. Prior to lockdown, during lockdown, and after lockdown, this study was undertaken in Nashik, India, to monitor and measure air quality and the Air Quality Index (AQI). Data was acquired from the Central Pollution Control Board (CPCB), Ministry of Environment, Forest and Climate Change, Government of India's Online Air Quality Index dissemination website for the Nashik-MPCB Air Monitoring Station. The concentration and status of PM 2.5, PM 10, NO₂, NH₃, SO₂, CO, Ozone, and the Air Quality Index (AQI) were measured from January 1st to December 31st, 2020. During the nationwide lockdown, air pollution and AQI in Nashik city decreased considerably, but concentrations of air pollutants and AQI began to climb during the post-lockdown period, according to this comparative analysis. According to the data, India's nationwide lockdown had a positive influence on air pollution and the AQI in Nashik

Keywords: COVID-19, Air Pollution, Air Quality Index, Environment, Central Pollution Control Board, Nashik, India.

**ACHIEVEMENT OF A FAVOURABLE BALANCE OF PAYMENT: THE ROLE OF
MONETARY POLICY IN NIGERIA**

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Abstract

This study investigated the nexus between monetary policy and balance of payment in Nigeria for the period of 32years (1990-2021). The data such as monetary policy rate, exchange rate, inflation rate and net balance of payment figures were culled from the Central Bank of Nigeria (CBN) statistical bulletin. The data were analyzed using descriptive statistics, correlation analysis, Autoregressive Distributed Lag (ARDL) and error correction model via Eviews 9. The study found the existence of short run relationship between monetary policy variables and balance of payment in Nigeria. Similarly, the evidence of long run connection between monetary policy and balance of payment was proven in the study as reported by ARDL bound test. Among all the regressors, only inflation rate has no significant influence on balance of payment over the short and long runs. Hence, the result of Error Correction Model (ECM) is negative and significant at -1.196. This confirmed the correction of short run disequilibrium in the long run at 119%. The study concluded that moderate monetary policy rate and stable exchange rate are the main ingredients of achieving favourable balance of payment in Nigeria. It was therefore suggested among others, that government should embark on efficient and effective expenditure switching policy or devaluation of currency (Naira), as devaluation of the country's currency could make exports cheaper and imports more expensive, thus, leading to a favourable balance of payments position in the country.

Keywords: Monetary Policy Rate, Exchange Rate, Balance of Payments, ARDL

δ J-IRRESOLUTE FUNCTIONS IN TOPOLOGICAL SPACES

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Abstract

This paper introduces a new class of irresolute functions termed δ J-irresolute functions and derives some of its features. The interactions between this newly constructed function and other functions are examined. Some of their features under the composition of functions are deduced.

BIOREMEDIATION OF MARINE OIL SPIILLS

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Abstract

The present study has carried out to understand the scenario and status of Bioremediation of spills. Bioremediation is one of the most promising technology to the problem of hazardous waste, which relies on microorganisms such as bacteria and fungi like *Vibrio*, *Aspeergillus*, etc. to transform hazardous chemicals into less toxic or non toxic substances. In the recent years, we are frequently heard about the oil spills which has attracted the environmentalist to control its impacts on the most of the marine organisms, seabirds, filterfeeders. This review paper is designated to overview and compares the role of microbes in bioremediation for oil spills. An oil spill can be caused by breakdown of equipments such as pipelines, mistakes done by people or by their carelessness, natural disaster such as hurricanes and also deliberate actions by terrorists, countries at war, vandals or illegal dumpres. Use of microorganisms is preferd because they directly degrade contaminants rather than transferring them from one medium to another, employ metabolic degradation pathways and can be used In situ to minimize disturbance of the cleanup site. Bioremediation of oil spills can be approached by two ways depending on the case, this includes bioaugmentation which involves introducing oil degradation microorganisms to the affected site, and also biostimulation which involves adding supplemental nutrients to the affected site to aid the existing oil degradation microorganisms. Secondary data has been collected and extracted from the quality research articles published in reputed research journals. The result of the present study shows the adverse impact of oil spills and their management with the help of using technology Bioremediation.

Keywords: Bioremediation, Oil spills, Bioaugmentation, Biostimulation, Oil degradation microorganisms

**SYSTEMATIC REVIEW OF IMPORTANCE OF ENVIRONMENT EDUCATION IN
NEW EDUCATION POLICY 2020 OF INDIA**

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Abstract

As we are currently going through various global environmental issues which are making adverse impact on living health and economy at large. Environmental education helps students understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. India is in the phase of implementing New Education Policy 2020 (NEP 2020) with many drastic changes in the entire education system in the country. Present study has carried out with the aim of understanding and making systematic review of how India is considering environment education and its implementation through New Education Policy 2020. The systematic study of NEP 2020 has been made in present study with focused on environment education right from primary level to higher education system. The data has been extracted from government published NEP 2020 draft, documents, notifications and research articles. It has been found that India is considering environment education seriously in entire education system by NEP 2020. This study also highlighted some importance aspects of environment education in NEP 2020 and its proper implementation to achieve environmental sustainability goals.

Keywords: Environment Education, New Education Policy, NEP 2020, Environmental Pollution

SILVER NANOPARTICLES – A NEW INSIGHT INTO INDANDIONES

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Abstract

Indanedione structural motifs are widely distributed in natural products, pharmaceuticals, and functional materials. In particular, They present diverse biological applications by acting as pharmacophores and by providing useful scaffolds for the rational designing of pharmaceuticals deliberated at diverse biological targets. The goal of the current research is to create drug-loaded silver nanoparticles with an anticoagulant 2-phenyl-1,3-indandione, as well as to investigate their biological activities. Among different metallic nanoparticles developed so far, nanoparticles of silver have been the most anticipated, due to their diverse applications in the fields of electronics, environmental remediation, electrochemistry, and biomedicine. Antimicrobial and antifungal activities are the most investigated biological properties of silver nanoparticles. A simple procedure for green synthesis of galactose-assisted silver nanoparticles as an anticoagulant-loaded system was reported. Research in the field of green synthesis of nanoparticles continues to expand because of the abundance of biomaterials in nature, which are a potent source of organic reductants for the

eco-being production of nanoparticles. Analytical techniques like ultraviolet-visible spectroscopy (UV-Vis), X-ray diffraction (XRD), spICP-MS, and transmission electron microscopy (TEM) were used to analyze the production, crystallinity, and morphology of bio-reduced silver nanoparticles. The drug-release properties of the synthesized nanoparticles were investigated, as well. The antibacterial study was performed by following the standard disc diffusion method. These green synthesized silver nanoparticles were found to have potent antibacterial, and anticoagulant properties which make them an attractive choice for future medical applications.

Keywords: silver nanoparticles, green method, galactose, indandiones, anticoagulant, antimicrobial

MODERN PREVENTION OF RELAPSES OF GASTRODUODENAL HEMORRHAGE

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Abstract

Introduction The solution of the problem of effective treatment of gastroduodenal hemorrhage of ulcer origin remains a topical issue in modern surgery. At present, the incidence of gastroduodenal hemorrhage continues to be high, 7.4-16%, lethality 13-15%. Such a high percentage requires new research in the treatment and prevention of gastroduodenal hemorrhage. **The aim of the study** is to improve the results of complex treatment and prevention of gastroduodenal hemorrhage of ulcer origin. **Materials and methods** During 2013-2021, 410 patients diagnosed with gastroduodenal hemorrhage of ulcer origin were under our supervision at the City Clinical Hospital No. 5. Of the patients, 110 were women and 300 were men. The age range of patients was 20-80. hemorrhage from gastric ulcer in 102 patients, bleeding from 12-finger intestinal ulcer in 308 patients. In these patients, the diagnosis was made by emergency fibroesophageal gastroduodenoscopy, hemostatic in the complex treatment of patients (aminocaproic acid 100ml x 3 times intravenously, dision 2ml x 4 times intramuscularly, transamine 5ml x 2 times intravenously, kleston 5ml x2 times histamine, H-histamine H) blockers - ranitidine 50 mg x 3 times, kvamatel 20 mg x 2 times or proton pump inhibitor (pantoprozole - 30 mg intravenously x 1 time), infusion-transfusion (erythrocyte mass, plasma, protein preparations, etc.), antihelicobacterial (clarithromycin 0,5 x 2 times, amoxicillin 1.0 x 2 times) were used in the treatment. In the majority of patients receiving this treatment regimen, the acute period was eliminated, and the bleeding was stopped quickly. In 55 patients, endoscopic hemostasis (coagulation + sclerotherapy) was performed because the bleeding continued and conservative treatment was ineffective, thus stopping the bleeding. In 12 patients, due to the continuation of profuse bleeding, even if endoscopic hemostasis is performed, there is a high probability of recurrence of bleeding, emergency surgery was performed, and the bleeding vessel was closed. **Conclusion** In the majority of patients receiving the above treatment regimen, the acute period was eliminated, the bleeding was stopped quickly. Due to the continuing bleeding and the high probability of recurrence of bleeding, even if endoscopic hemostasis is performed, emergency surgery was performed. According to our observations, the complex treatment of gastroduodenal hemorrhage with modern drugs is a convenient method, which allows to quickly eliminate the bleeding, to quickly stop the acute period, to discharge patients from the hospital as soon as possible. In addition to diagnosing gastroduodenal hemorrhage, endoscopy examination also stops the bleeding by endoscopic hemostasis for therapeutic purposes, thus significantly reducing the risk of surgery.

**COUNTERFEIT BRAND SHOES AND PURCHASE INTENTION IN VIETNAM – IS
MORALITY FACTOR SIGNIFICANT ENOUGH TO MITIGATE THE PROBLEM?**

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Abstract

Counterfeit fashion products are common in Vietnam, both on online and traditional retailing platforms. Despite several strict actions from the government, this phenomenon still carries on and leads to detrimental effects on genuine fashion brands. While top-down regulations and rules may not fully respond to the problem, inducing actions from customers might be considered. Examining the issue from the perspective of consumption, the research aims at identifying and analyzing factors influencing purchase intention of Vietnamese consumers, focusing specifically on counterfeit brand shoes. A model was established on the basis of theory of planned behavior (TPB) with an emphasis on factors relating to attitude towards purchase intention and how morality was relevant to the issue. The study adopted the exploratory factor analysis method prior to two regression models for six independent variables including price, perceived value, attitude, morality, subjective norm and perceived behavioral control. Descriptive statistics, reliability statistics and one-way ANOVA were also used. The first regression was carried out to examine how perceived value and price affected attitude, which is a vital variable in the second regression model, and indirectly influenced the dependent variable of purchase intention. In the second regression model, three major variables in the TPB model and morality were captured to identify their magnitudes in the purchase intention. A sample of 163 valid respondents was collected. All technical data analysis was performed via SPSS. The results show that perceived value and price have a positive significant relationship with consumers' attitude towards counterfeit brand shoes, and, indirectly leading to an intention to purchase them. As expected, morality is negatively significant in the second model but its magnitude is the least among independent variables. In general, consumers' overall feeling towards counterfeit products is the most important factor in inducing purchase behaviors. Comparing to authentic shoes, Vietnamese consumers opt for counterfeits due to favorable price and perceived value that a pair of fake shoes can bring to them. The study contributes to the literature of purchase intention to counterfeits and points out possible implications on solving the problem.

Keywords: purchase intention; counterfeits; counterfeit shoes; perceived value; morality

NEW CLASSIFICATION USING NLP TECHNIQUE

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Abstract

eNews is the most readable content in current world and reading the news is common in everyday life. In the current paper we will observe the implementation of a news system that will be making a classification of the news based on the content present in the news article. The approach used is a Novel approach in the field of Artificial Intelligence. We will be making a usage of the area called Natural Language Processing to Deal with the Problem addressed. The Language used for implementation is indeed Python. Python is the tool on which the entire development of the application is made. The accuracy value obtained in the current work is very electrifying and we are making the best out of it. The Algorithm used is a Novel and a versatile one.

Keywords: Algorithm, NLP, AI, ML, Python.

GENETIC DIVERSITY OF MEDICINAL PLANT (*Euphorbia resinifera* O. berg) USING MORPHOLOGICAL TRAITS AND ISSR MARKERS

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Abstract

To evaluate the genetic diversity of *Euphorbia resinifera* O.Berg using ISSR markers. 12 natural populations were chosen from its geographical area of and analyzed. Using 14 ISSRs primers generated 101 polymorphic bands corresponding to a percentage of polymorphism nearly 80%. This high percentage of polymorphism suggests that there is an important genetic diversity in this melliferous and medicinal species in Morocco. While the mean of I and Ht indicates that there is a high genetic diversity in this species. Thus, the high values of PIC and Rp parameters show that the ISSR primers are very informative and effective to analyze the genetic diversity of *E.resinifera*. The results of the AMOVA showed that the high degree of variability is present within population. The high value of FST suggest that the studied populations are highly differentiated in agreement with very limited gene flow between each population. Additionally, the genetic structuring of populations into two groups obtained from UPGMA and Structure analysis revealed a dependence on the geographical origin of the populations. The data obtained will be useful to define conservation strategies and improvement programs of this melliferous and medicinal species.

Keywords: *Euphorbia resinifera*; genetic diversity; medicinal; ISSR; polymorphism; Morocco

**ASSESSMENT OF CURRENT SCENARIO OF AIR QUALITY INDEX IN SELECTED
CITIES OF INDIA**

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Abstract

Air Quality Index (AQI) forecasts the future pollution levels and how harmful the current air is. The health risks that may be a result of the air quality are also explained by the AQI. Specifically, it examines the short-term health risks associated with breathing polluted air. This study carried out to monitor and assess the current scenario of Air Quality Index (AQI) in selected cities of India to understand how much air quality is polluted across the country. Data has been executed from Online Air Monitoring Stations located in selected cities in India. The concentration and status of PM 2.5, PM 10, NO₂, NH₃, SO₂, CO, Ozone and Air Quality Index (AQI) has been assessed for the month of 1st January 2023 to 31st March 2023. The AQI in the cities that were compared in this study increased within the time frame that was examined. According to the findings, the air quality in India is deteriorating as a result of the release of several air pollutants into the environment.

Keywords: Air Pollution, Air Quality Index, Environment, Assessment

**BLACK WOMEN REVOLT IN THE STRUGGLE FOR FREEDOM: AN
EXPLORATION OF TONI MORRISON'S FICTION**

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Abstract

This research work about black women's contribution in the struggle for black freedom in America as dramatized in Toni Morrison's works. Drawing from the New Historicism and the sociological approach which allow enlighten a literary text within its socio-historical dimension, it purports to highlight strategies of revolt settled by black female characters against social injustices and discrimination in order to integrate the American society. The exploration of the selected narrative evidences the manifestations of black women's struggle for black freedom; a revolt related to the history of America with abolitionists like Harriet Tubman called by 'black Moses,' Harriet Jacobs, Rosa Park to quote only some. Being the most vulnerable for ages in the practice of slavery, black women revolted and involved themselves into concrete actions to claim not only their identity as black people but also the right to be considered human beings as white people in the American soil. To get rid of the white system of slavery, black women inner motivation of revolt has been expressed by the psychological awake allowing them to act for their identity and freedom. This study finally shows not only the involvement of black women in the struggle for black freedom, but also the black women power in conflict regulation testimonies of which are substantial in the history of America.

Key Words: Black women, revolt, freedom, discrimination, strategies, consciousness-raising

**HEAVY METAL STATUS OF SOIL AND UNDERGROUND WATER IN URBAN AREA
OF PRISTINA DISTRICT, KOSOVO**

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Abstract

Environmental pollution results when hazardous items, including chemicals, sewage, and waste materials, oil spills are dumped into the surroundings. The need to reduce pollution is very important since they have a direct impact on both humans and other living organisms. The only way how pollution may be addressed is by implementing better waste management procedures, enforcing restrictions on industrial and agricultural operations, raising public knowledge and awareness of the problem. Through this study, the determination of Cu (water; 0.029 mg/l and soil; 4.98 mg/kg) Fe (water; 0.712 mg/l and soil; 2.78 mg/kg), Mn (water; 0.033 mg/l and soil; 2.56 mg/kg), Ni (water; 0.039 mg/l and soil; 2.65 mg/kg), Pb (water; 0.241mg/l and soil; 4.98 mg/kg), Zn (water; 3.564 mg/l and soil; 5.62 mg/kg), As (water; 0.028 mg/l and soil; 0.028 mg/kg), Sb (water; 0.049 mg/l and soil; 0.041 mg/kg) and Cd (water; 0.089 mg/l and soil; 0.098 mg/kg) was made in soil and groundwater samples in the urban district of Pristina. From the results obtained, we are dealing with a higher concentration of water samples than the soil samples. Therefore, some water samples have exceeded the maximum amount allowed value, so they must go through the purification process before using them. The sampling was done during august of 2022. The experimental procedure was done by using Atomic Absorption Spectroscopy, (AA Spectrophotometer- S2 SERIES- AA System- Thermo Electron Corporation).

Keywords: Water monitoring; Urban area; AAS- technique; Heavy metals!

VIDEO FORGERY DETECTION USING K-MEANS CLUSTERING ALGORITHM

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Abstract

There is significant role of digital images and videos in our daily life. Video is nothing but the collection of images or frames. Manipulating a video has become an easy task with the increased number of sophisticated forgery tools. However, image tampering has become very easy by using editing software's. Now a day image authenticity is a big concern. Image forgeries may have many types- such as copy-move forgery, splicing, and many more. Most widely used method to make forged image is copy-move forgery. It refers to copy one part from another image, and paste it inside same image. In the current work we will observe the Detection of forgery done by means of K-Means Clustering Algorithm.

Keywords: Algorithm, Forgery, Video, K-Means, Clustering.

PREDICTING HEART RISK LEVEL -MULTIVARIABLE LINEAR REGRESSION

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Abstract

Heart Disease (CVD) is, for the most part, alluding to conditions that include limited or blocked veins that can prompt a heart attack, chest torment (angina) or stroke. The input dataset is collected from dataset repository. After that, we have to implement the pre-processing step. Then, we have to implement the machine learning algorithm such as linear Regression. The experimental results shows that the accuracy as r2-score. Heart Disease (CVD) residues the number one cause of death throughout the world. The application of machine learning brings a new proposing to Heart Disease prediction. There are differing types of heart conditions like coronary heart disease, angina, congestive coronary failure, cardiomyopathy, congenital heart condition, arrhythmias, and myocarditis. The reason for Heart Disease failures and strokes is generally the nearness of a blend of hazard factors, for example, tobacco use, unfortunate eating regimen, and heftiness.

Keywords: Algorithm, ML, CVD, Data set, Experiment.

THE IMPORTANCE OF COGNITIVE PSYCHOLOGY IN OUR DAILY LIVES

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Abstract

Cognitive Psychology, which forms the basis of Cognitive Behavioural Therapy, can be defined as one of the unique branches of psychology which deals with the study of our internal mental processes and mental activities. The processes and activities include our thinking ability, remembering things, creatively expressing ourselves. Making decisions, learning new things and drawing conclusions. Cognitive psychology focuses on how sensation and stimulation impact our behaviour and our changing behaviour. It is also useful for treating mental illness such as anxiety, eating disorders and depression. Cognitive psychology has also been found to be making a very beneficial impact on educational, social, abnormal and developmental psychology and in linguistics and economics as well. It is different from other branches of psychology as the other branches focus on our behaviour and activities that are external and observable whereas the cognitive psychology focuses on the thought processes which influence our behaviour and actions. This paper aims to discuss the importance of cognitive psychology in our daily lives and how it can be effectively put to use to help people lead better lives.

COMPUTATIONAL MUSICOLOGY IN SOCIETY 5.0

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Abstract

Music is an indispensable outlook of human civilizations and it has the potential to intensely, ethically, and culturally influence societal behaviours. When the human beings from one cultural society reciprocate music with others from other culture, they achieve significant insight into the other dimension of societal life. The Big Data analytics, Internet of Things, sensor networks, intelligent automation, and virtual-augmented realities are just numerous of the technological advancements which influence the Industry 4.0. These progresses enhances functioning states and improve the creativeness and the quality of industrial manufacturing. Although, they can also enhance the human life and societal issues principally. An innovative viewpoint is alligned towards the social well-beings and named as, Society 5.0. Industry 4.0 bears the transformation to the newly-designed society, however additional drivers are also required. For guiding the transformation, it is much needed to recognise the enabling factors which confluence the Industry 4.0. Society 5.0 illustrates as a human-centric society that stabilizes the economic progression with the resolution of social challenges by a systematic endeavours that principally integrates the cyber-space and physical space, such as Music. The music learning and computational Musicology were fundamentally based on offline teaching-learning mechanisms. These transformation happended because of the communal contributions to be habituated to new requirements, potential conditions, and phenomena related to the growth of the society. Not accomplished with the aspects of the Industry 4.0, nowadays people are facing issues of the Society 5.0, objects and every persisting social orders associated with virtual reality. Here from the concept of Internet of Music Things highlighted. Primary objective is to resolve durability of qualitative music education in the trend of Society 5.0. The outcomes of this conceptual and human-centric research dimension are anticipated to arrange wisdom values because the music is one of the significant ingredients for society to face a social transformative era.

Keywords: Society 5.0; Internet of Music Things, Sustainability, Computational Musicology, Human Centered Computing.

POSSIBILITIES OF INTRODUCING PLANTS OF THE DNIPRO STEPPE

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Abstract

Artificial woody plantation stands provide people with a softened microclimate in their residential areas and other positive changes in urbanized areas. Local communities are slowing down the pace of global warming and generally reducing their negative impact on the microclimate by using artificial forest stands in mining districts. Modern economic relations and the level of development of the introduction of plants open up new prospects for the introduction of both new types of well-known crops and non-traditional rare crops for various countries, including Ukraine. The aim of the work was to reveal the phytoremediation role and recreational potential of introduced vegetation species using the example of the genus *Chaenomeles* (ch.) and the genus *Berberis* (b.), as well as *Prinsepia Uniflora* Batalin, *Jošta* plants for their further possible use in the steppe zone on the territory of Ukraine with insufficient diversity types of fruit plants that have health-improving properties. The first plot is located on the territory of the Botanical Garden of the Dnipro National University (48 ° 26'7 "N, 35 ° 2'34" E, Dnipro city, Ukraine; plot 1). The second plot is located in a private subsidiary farm (48 ° 24'45 " N, 33 ° 42'12 " E, Dnipropetrovsk province; plot 2). In plot 2, unfavourable regional climatic conditions (low air temperatures in winter and high in summer, insufficient moisture in the soil, frequent hot dry winds) have a significant impact on the growth and development of plants. The study of the component composition of biologically active substances of fruit crops reveals prospects in the use of antibacterial and antifungal effects of plant extracts.

Keywords: Dnieper Steppe, resistance to arid growing conditions

BACTERIOLOGICAL QUALITY ASSESSMENT OF COMMONLY USED COSMETIC BRANDS IN KADUNA METROPOLIS, KADUNA, NIGERIA

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Abstract

Cosmetics are substances intended to enhance the visual appeal of the human body. The cosmetics industry takes bacterial spoilage extremely seriously because it can result in both product and financial losses. The purpose of this research was to assess the bacteriological quality of regularly used cosmetics in the Kaduna Metropolitan Area. Twenty five (25) samples of Body lotion, Cream, Foundation, Powder and Mascara were randomly purchased. Five (5) samples of each cosmetic brands were acquired from five separate markets. Using standard protocol, the samples were inoculated onto nutrient agar and macConkey agar for the isolation and identification of bacteria. *Staphylococcus aureus*, *Bacillus* sp. *Pseudomonas aeruginosa*, *Salmonella* sp. *Micrococcus* sp. and *Escherichia coli*. were found in the samples. The percentage of bacteria present in the samples varies by species and market. P 0.05 indicates a statistically significant difference between the different brands of cosmetics analysed in terms of the prevalence of bacterial isolates in the marketplaces. The percentage of germs detected in the study clearly demonstrates the extent to which the cosmetics brand was contaminated during production, packaging, or storage. Numerous bacteria, including *Escherichia coli*, *Staphylococcus aureus*, *Bacillus* sp., *Micrococcus* sp., *Pseudomonas aeruginosa*, and *Salmonella* sp., were discovered to be contaminating the various cosmetic products that were analysed. Microbes may contaminate personal care goods during production due to the handling of raw materials, or a finished product may get contaminated during sale or storage. The necessity to prevent bacterial contamination of products has sparked significant anxiety among cosmetic makers. Frequently, quality assurance should be considered alongside raw material controls, process controls, and product inspections.

Keywords: bacterial spoilage, cosmetics, *Pseudomonas aeruginosa*, *Salmonella* sp., process controls

IN-VITRO ANTIOXIDANT ACTIVITIES OF THE SELECTIVE EXTRACTS OF
PLANTAGO LANCEOLATA L. OBTAINED BY SUPERCRITICAL FLUID
EXTRACTION

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Abstract

Plantago lanceolata L. belonging to the Plantaginaceae family is a common perennial weed of arable fields and grassland abundant throughout Europe, North and Central Asia. In traditional medicine *Plantago lanceolata* L. it has multiple uses due to antiviral, anti-inflammatory, astringent, anti-helminthic, analgesic, antihistaminic, anti-rheumatic, antitumor, anti-ulcer, diuretic, expectorant and hypotensive properties. The pharmacological properties are due to the complex chemical composition consisting of iridoid glycosides, polysaccharides (plantaglucide, glucomannan), flavonoids and flavone glycosides, phenolic carboxylic acids, alkaloids (indicain, plantagonin), terpenoids (loliolide, ursolic acid, oleanolic acid and other constituents, like allantoin. Considering these biological properties, the present work aims to obtain selective extracts with a high content of polyphenolic compounds by applying supercritical fluid extraction (SFE) and at the same time, *in vitro* evaluate their antioxidant activity by applying three distinct methods. The selective extracts were obtained by employing the supercritical fluid extraction (SFE), procedure followed by filtration at normal pressure and concentration by roto-evaporation under vacuum. Antioxidant activity were evaluated by *in vitro non cellular* assays using the chemiluminescence technique in luminol hydrogen peroxide system, DPPH(2,2-diphenyl-1-picrylhydrazyl) free radical scavenging assay and ABTS (2,2'azinobis-(3-ethylbenzthiazoline-6-sulfonic acid) methods. In addition, the biochemical analysis carried out by UV-VIS spectrometric method determined the total phenolic contents (TPC) expressed as gallic acid equivalent/g (mg/GAE g⁻¹) using the Folin-Ciocalteu reagent, total flavonoid contents (TFC) expressed as rutin equivalent/g (mg/RE g⁻¹), by aluminium chloride colorimetric assay and the caffeic acid derivatives content (CADc) expressed as mg caffeic acid equivalent/g dry extract (mg/CAG⁻¹) by using Arnows' reagent. From the obtained results, we can conclude that the application of the SFE method leads to obtaining selective extracts with a high content of active polyphenolic principles and improved antioxidant biological potential, compared to the extracts obtained by classical methods.

Keywords: Supercritical fluid extraction, antioxidant activity, *Plantago lanceolata* L.

HARVESTING PEDAL ENERGY FOR AUTOMOTIVES (HPE)

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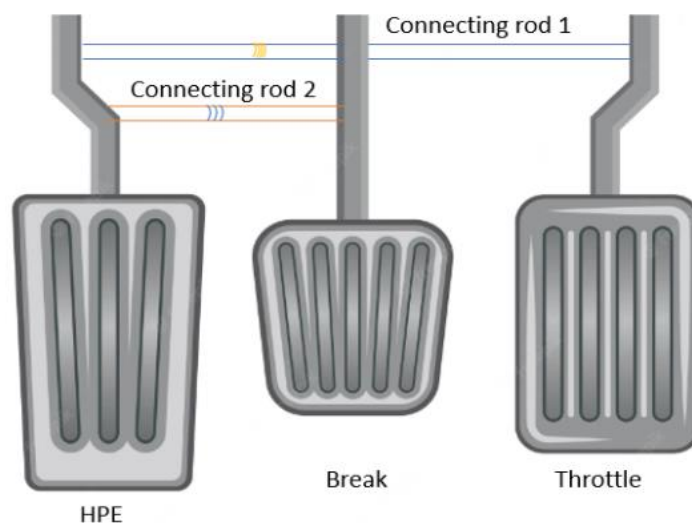
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Abstract

Renewable energy sources have become increasingly popular recently, with wind turbines and solar panels widely used for energy harvesting. However, Electromechanical energy harvesting has emerged as a highly promising source of electric energy due to its ability to generate significant amounts of electricity that can be utilized in various ways. Electromechanical energy harvesting is a method of generating electrical energy from mechanical motion. This technology works by converting the kinetic energy produced by mechanical motion into electrical energy, which can then be used to power various devices and systems. It is a promising source of electric energy due to several advantages it offers. The automotive industry is one of the areas where electromechanical energy harvesting is being explored as a supplement. The energy-harvesting pedal, for example, generates electricity from the driver's motion, which can be used to power the vehicle's electrical systems or charge its battery. This technology could potentially reduce the reliance on external power sources and improve the overall energy efficiency of the vehicle. The energy-harvesting pedal receives motion from the driver's throttle or brake pedal through a mechanical connection rod, generating electricity that can power the vehicle's electrical systems or charge its battery. Overall, electromechanical energy harvesting has the potential to revolutionize the way we generate and use energy, providing a sustainable and renewable source of power for a wide range of applications.

Keywords: Energy harvesting, break, and throttle pedal, Mechanical parts (connecting rod, shaft, and bearing)



VITALITY OF TREES IN THE CONDITIONS OF URBOGENIC ENVIRONMENT

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Abstract

The city is a complex and multi-component organism, where a special microenvironment is created. The operation of transport and industrial enterprises, high density of buildings and heating of buildings, continuous asphalt or other hard covering of streets and squares increase the general temperature of the air, making it overheated and too dry. Green spaces protect urban agglomerations from high temperatures, the consequences of the greenhouse effect, from direct solar radiation, severe overheating, from atmospheric air pollution, motor vehicle emissions, and the effects of industrial gases and heavy metals. They are unique indicators of ecological conditions and the state of the environment, as they perform the role of a universal natural filter against man-made pollution. Greening of the urban environment is one of the prerequisites for its sustainable development. The problem of finding optimal conditions for the growth and development of plants in the urban area in conditions of elevated temperatures is complex and multifaceted, as it depends on many factors. One of the important factors in the functioning of physiological processes and optimization of plant productivity is their water supply. Violation of the water regime causes a decrease in the water content in plant tissues, causes them to lose mineral substances, inhibits and stops their growth, causes browning, drying and falling of leaves, etc. The process of transpiration is an important factor in the vitality of trees in the urbogenic environment. It is necessary and useful for the development and functioning of plants. Thanks to this process, water and mineral substances rise up the stem from the roots to the leaves, the plant is cooled, it is not allowed to overheat, etc. The plant has a number of physiological features that allow you to significantly regulate the return of water. The process of transpiration depends on the effectiveness of the absorption action of the root surface, the structure and size of the plant itself, its age, the location and structure of the leaves, their area, size, and shape. The intensity of the process of water evaporation by the plant also depends on external factors, namely: the speed of movement of air masses, an increase in the temperature regime and the level of humidity and dustiness of the air, the lack of water vapor pressure in it, etc.

THE DEPICTION OF MESOPOTAMIAN QUEENS IN CHILDREN'S LITERATURE

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Abstract

The aim of the research is to shed the light on two Mesopotamian queens as depicted in children's literature. The researchers selected two children stories each for one of the two queens and analyzed the portrayal of these queens in literature in comparison to facts known about them. Unlike queen Puabi, many children books are written about Queen Semiramis yet the facts in those literary works are not accurate and manipulated for religious and political reasons. Thus the researchers selected George Capaccio's *Queen Pu-abi's Royal Tomb* (2009) as a literary example for the Mesopotamian queen Puabi; the queen of Ur is skillfully portrayed. Queen Puabi was buried in one of the wealthiest tombs at Ur of the Chaldees, which Sir Leonard Woodley discovered at the Ur III Period Royal Cemetery. The second queen is Semiramis, a great Assyrian queen and a legendary warrior that is portrayed in *Queen Semiramis: The Legend* by Ingrid de Haas (2020). The researchers, after detailed literary analysis concluded that these children books accurately portray the facts about these queens and thus they are recommended not only for literary reading but for educational purposes as well.

Keywords: golden harp, Queen Pubai's seal, royal cemetery, royal game, Shammuramat warrior queen.

ANALYSIS OF THE APPLICATION OF THE PRINCIPLES OF ISLAMIC BUSINESS ETHICS AT DADDY BRO COFFESHOP TULIS BATANG DISTRICT

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Abstract

Islamic business ethics are morals in doing business in accordance with Islamic principles, so that in doing business there is no need to worry, because you already believe that something is right and good. The application of Islamic business ethics is also required in all areas of the economy, including the implementation of production, consumption and distribution. This is done by several economic actors by applying Islamic business ethics in their operations. In this study using qualitative research with descriptive methods. Primary data sources by conducting interviews and observations. Research object at Daddy Bro Coffeeshop located on Jl. Raya Write, Gondangan Village, Write District, Batang Regency, Central Java. The research aims to determine the implementation of the application of the principles of Islamic business ethics in Daddy Bro Coffeeshop. The results of the study show that the application of the principles of Islamic business ethics which include monotheism (unity), balance (equilibrium), free will (free will), and responsibility (responsibility) has been implemented by Daddy Bro Coffeshop and is considered quite good in its business implementation.

Keywords: Application of Principles, Islamic Business Ethics, Business, Economics.

**OPTIMIZED THE PREDICTION FATIGUE LIFE OF WIND TURBINE BLADE
UNDER HYGROTHERMAL CONDITIONS**

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Abstract

Composite materials are the essential element in the design of wind turbine blades, these materials degrade as they are exposed to high environmental conditions such as humidity and temperature, and it is for this reason that their impact on wind turbine blades must be studied from the design stage.

Environmental effects will affect the resin matrix as well as the interface and fibers. The objective of this study is to identify the most resistant resins to humidity/temperature in terms of fatigue life. A variety of resins are compared, using the resins most commonly used for manufacturing wind turbine blades, and tested under temperatures of 20°C and 50°C in "dry" and "damp" conditions. Due to predict fatigue life under different environmental conditions. The performances of three algorithms (Backpropagation BP, Particle Swarm Optimization PSO and Cuckoo Search CS) are compared to adjust the synaptic weights and to evaluate their effectiveness in predicting the fatigue life of the materials studied, under given conditions. In order to evaluate the accuracy, the Mean Square Error MSE is used as an objective function to be optimized by the three algorithms.

Keywords: Wind turbine blades; fatigue life; artificial neural network; optimization algorithms; composite materials; hygrothermal effect.

EDUCATION AS A SPACE FOR PERSONAL DEVELOPMENT

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Abstract

The current stage of the development of society testifies to the situation of a civilizational transition from the values and priorities of the industrial era to the post-industrial one. The new context of social reality significantly affects the existence of a person. Those familiar symbolic landmarks that determined his life are disappearing. Modernity necessitates the formation of a person of a new formation, capable of creating and perceiving something new. Such a person shows the ability to quickly and flexibly adapt to changing realities, the ability to predict, and possibly prevent negative and destructive processes. The field of education is called upon to help a person quickly adapt to changes in society, learn to learn, navigate among a large amount of information, without losing touch with traditions, spiritual augmentations of previous generations. It is in this area that human capital is formed, the quality of which determines the possibilities and prospects for the development of society in the future. The emphasis on the future is changing the purpose of education in public life. From a translator and repository of the cultural experience of generations, the educational sphere is turning into a workshop in which a person with an innovative type of thinking is becoming. It focuses more and more on developing the ability to learn. The situation of civilizational transition provides for a change in the fundamental positions of the educational process. The strategic guideline of modern education is the awakening of a person's creative potential, his ability to perceive and create something new.

**FIRST OCCURENCE OF CAT LICE *FELICOLA SUBROSTRATA* IN CATS IN THE
BELGRADE AREA**

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Abstract

Cats are increasingly the favorite pets of people in urban areas, including Belgrade. Despite this, their parasitic fauna has not been sufficiently examined, especially the fauna of ectoparasites. From that reason in the period 2018-2021, we performed a parasitological examination of the 250 pet cats. All cats brought for examination from Veterinary clinics in the Belgrade. During our examination ectoparasites infection we established at 31.2% animals. To closely identify a lice, a piece of clear tape can be used to collect it and then it can be examined under a microscope. Parasites were collected from cats and determination was made on the basis of their morphological characteristics. During our examination lice infection we established at only 3 cats that often went outside and stayed for several days outside the house and lived in an unfavorable environment. At all cases they are presented *Felicola subrostrata*. Infestations with lice is common to be seen more in cats and kittens that are strays, feral, neglected, malnourished, weakened, sick, dirty and those kept in unclean overcrowded environments. Nits are also small but visible to the naked eye and can be seen as tiny white dots at the base of the hair when the hair is parted. Lice are a rather uncommon finding in cats that are receiving flea control; however, lice do infest cats on occasion, especially young, old, debilitated, or neglected cats. Chewing lice attach at the base of the hair and are typically located around the head, neck, tail, and body openings. Infestation can cause irritation and pruritus, which can lead to rubbing, scratching, and alopecia of the infested areas, which we occurred at all infected cats. This was the firs occurence of cat lice *Felicola subrostrata* in pet cats in the Belgrade area.

Keywords: cat lice, *Felicola subrostrata*, Belgrade

**DECENTRALIZED LEDGER DATABASE MANAGEMENT THROUGH BLOCKCHAIN
TECHNOLOGY UTILIZING CRYPTO HASH ALGORITHMS**

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Abstract

The internet is rapidly expanding and gaining a lot of attention, with a focus on making life easier for people. It has progressed from static pages to smart industries and factories where machines are directly connected to the web. These systems can make autonomous decisions and visualize the entire production process. Blockchain technology, based on hashing, is at the foundation of platforms for trading cryptocurrencies and executing smart contracts. Industry 4.0, also known as the fourth industrial revolution, includes IoT, CC, Big Data, and AI, and is fostering IIoT. Blockchain version 4.0 is ensuring supply chain transparency, record immutability, and end-to-end trading organization trust. Blockchain has several characteristics, including decentralization, stability, security, and non-modifiability, which have the potential to change network architecture. The consensus algorithm plays a crucial role in maintaining the safety and efficiency of the blockchain, and selecting the right algorithm can significantly increase performance. This work provides an overview of the consensus algorithms, their characteristics, and performance and application scenarios. It also gives technical guidance on selecting an appropriate consensus algorithm and summarizes the limitations and future development of blockchain technology.

Keywords: Blockchain, algorithms, smart contracts

**ANALYTICAL STUDY OF SAVINGS AND INVESTMENT PATTERNS OF
COOPERATIVE INDUSTRY WORKERS**

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Abstract

Cooperative industries have emerged as a significant economic model, with worker participation and ownership being key features. One crucial aspect of financial well-being for workers in these industries is their savings and investment patterns. This study aims to analyze the savings and investment patterns of cooperative industry workers in Islampur Sangli District, with a focus on understanding their financial behaviors and decision-making processes. The study utilizes a mixed-methods approach, combining qualitative and quantitative research methods. Primary data is collected through structured questionnaires and interviews with cooperative industry workers. The study sample of 285 workers from various cooperative industries, such as agriculture, manufacturing, the findings reveal that cooperative industry workers exhibit diverse savings and investment patterns, influenced by various factors such as income level, age, education, family size, and financial literacy. The study identifies several common saving and investment practices, including savings in cooperative banks or credit unions, investment in cooperative shares or bonds, and participation in collective investment schemes offered by their respective cooperatives. The study also identifies challenges faced by cooperative industry workers in their savings and investment practices, such as lack of financial literacy, limited access to formal financial services, and fluctuations in income due to market conditions. Additionally, the study highlights the importance of social and cultural factors in shaping the savings and investment behaviors of cooperative industry workers. The findings of this study have implications for policymakers, cooperative leaders, and practitioners in developing strategies to enhance the financial well-being of cooperative industry workers. This study contributes to the existing literature by providing empirical insights into the savings and investment patterns of cooperative industry workers and highlighting the need for tailored financial education and support services to address their unique financial challenges.

Keywords: Cooperative industry, savings, investment, financial behaviors, financial literacy.

DESIGN AND FABRICATION OF WHEAT STRAW PRESSING MACHINE

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Abstract

This project is based on wheat straw pressing machine. In this project chopped wheat straw is collected and added manually into trolley which is then filled into pressing chamber of machine which is operated on this machine. Then, through trolley straw is inserted into main frame of the machine. Afterwards, machine is switched on and straw is pressed by hydraulic press of the machine. In this way, the straw is converted into a sack of straw. The handling of sack of saw is very easy which saves lots of time and money having low cost and maintenance, easy to operate. Wheat Straw Pressing Machine is mainly used in agricultural industry and is very helpful for conversion of chopped wheat straw into useful, handy and manageable wheat straw sacks. The study about this machine is that in wheat season, farmers face lots of problems related to high volume of wheat straw storage methods, they hire lots of workers for the storage of high-volume of wheat straw. This makes expensive and time-consuming storage method for farmers. The solution that we came up with after theoretical study is that, by using wheat straw pressing machine, we can overcome above said problems. This machine is composed of three sections, hydraulic system, electrical system and main frame. This is really useful to bind huge hay or straws in minimum size, so the transportation and storage can be easy. With this machine, we can reduce the labour cost, transportation cost, stock cost and space for handling huge amount of wheat straw.

Keywords: Wheat straw, Hydraulic press, Electrical system.

**NIGERIA'S ELECTORAL ACT 2022: THE NOVEL INNOVATIONS AND RECENT
JUDICIAL INTERPRETATIONS**

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Abstract

Recently, the Independent National Election Commission (INEC) conducted the country's general election, using the newly enacted Electoral Act, 2022. This paper highlights the novel innovations introduced into the country's electoral politics, the constitutional issues arising from them and the recent judicial interventions as they affect the mischiefs, the new legislation intended to cure. It argues that these innovations are in tandem with the provisions of the grund norm of Nigeria, which is the Constitution of the Federal Republic of Nigeria, 1999 (as amended). However, for the Act to be effective and cure the mischiefs intended, the judiciary must avoid technical justice and arrive at substantial justice, in the overall interest of the country's democracy. It proposes effective judicial actions to avoid the Act going the part of its predecessor and causing more havoc to the country's democracy than good.

Keywords: Electoral Act, constitutional democracy, judicial review, public servant, party nomination

WASTE DERIVED CARBON NANOFIBER FOR WATER PURIFICATION

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Abstract

The advent of inexorable human, and industrial activities as well as the input of nature has impacted the environment by releasing Heavy Metals into the aquatic system. Hence, the physical removal of hazardous HM remains a demand of the day. This review envisages the use of agro-waste with the incorporation of nanotechnology for the removal of HM from aquatic systems and aid in water purification. The focus is on plant parts, plant metabolites, and plant-cellulose-derived Carbon Nanofibers (CNF) as materials used for the removal of pollutants in aquatic systems. Owing to their high surface area, high mechanical strength, greater chemical reactivity due to the presence of dangling bonds, non-toxicity, high porosity, channel-like morphology, and lower cost as the precursor, energy-efficient production; makes CNF an effective adsorbent. CNF synthesized from agro-waste and plant-metabolite to adsorb Heavy Metals; as well as acts as a filtration base has been touched upon with the hope of bridging the gap between ever-increasing demand and available clean water. A brief introduction to the CNF, its structure, properties as well as common methods of synthesis of CNF is given. Moreover, Physico-Chemical and Biological methods that are being used is also touched upon. The article suggests the need for innovative, low-cost, and environmentally friendly surface modification techniques and the use of agro-waste-derived CNF for water purification.

Keywords: Adsorption, Agro-waste, aquatic systems, Bioremediation, Carbon Nanofiber, Chemical Vapor Deposition, Desorption, Filtration, Phytoremediation, Porosity

CARDIOTOXICITY OF ANTIDEPRESSANTS

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Abstract

There is a definite correlation between cardiovascular diseases and depressive disorders. Most antidepressants have a negative effect on the cardiovascular system. They can affect blood pressure, the inotropic state of the heart and cardiac conduction. Side effects may occur due to the direct action of these agents or through drug interactions. The purpose of this work is to identify the causes and reasons of cardiotoxicity in patients who use short-term or long-term antidepressant therapy. Serotonin reuptake inhibitors (sertraline, paroxetine, etc.) are the most commonly used agents because of their profile. Hypertensive crisis, tachycardia, bradycardia, weight gain, drowsiness, gastrointestinal problems, etc., are the most serious problems associated with the administration of antidepressants. Antidepressants are not considered socially safe. Indeed, similar effects have been reported with the administration of antidepressants, among which the effects of cardiovascular use are of great importance due to their life-threatening nature. Since these agents can be lethal both in therapeutic dose and after overdose, recognition of this abnormality is for safe prescribing and also some of the salient issues in antidepressant therapy versus cardiovascular considerations should be considered when prescribing medications like that. We cannot conclude about cardiotoxicity, for this we need the follow-up of biochemical and echocardiographic parameters as well as other more advanced studies, but we can suggest patients to be more careful during therapy, monitoring the presented symptoms and have a more serious approach during taking monotherapy and combined therapy. Especially patients who wish to discontinue therapy after long-term treatment will need information and support to cope with the potentially severe effects of discontinuation.

Keywords: antidepressants, cardiotoxicity, side effects.

UNDERSTANDING GREEN BRAND EQUITY

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Abstract

Consumers who care about the environment are always looking for green goods. This has led companies to create new product lines that meet or exceed customer environmental concerns. Still, not all companies were able to make a big profit from their investments in environmentally friendly goods. But when there is a lot of competition, businesses must shift their attention to building a trustworthy brand that is good for the environment and can green all parts of the marketing mix. If a company is able to provide goods or services that meet the environmental needs of its customer base, then those customers will be more likely to purchase those goods or services from that company. With the advent of the environmental era, businesses are obligated to identify opportunities to enhance the environmental performance of their products in order to build brand equity. In this way, businesses must not only come up with eco-friendly goods that don't sacrifice traditional qualities, but they must also find a way to get people to think positively about their green marketing efforts. In response to increased customer demand for environmentally friendly products, companies are shifting their management focus from brand equity to green brand equity. As a result, green brand equity is going to emerge as a new marketing phenomena. This study is conceptual in nature, attempts to understand the concept of green brand equity and the factors that influence green brand equity. Additionally, the owners and managers of the companies could benefit from this study by learning more about the significance of green brands alongside strengthening the green brand equity.

Keywords: Brand, green brand equity, green satisfaction, green trust, green image

21ST LUDDITES AND ETIDDULS IN THE 4TH INDUSTRIAL REVOLUTION

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Abstract

The 4th Industrial Revolution (IR4.0) is likely to present unprecedented challenges to all knowledge professionals with social and economic consequences more serious than those experienced in the 1st Industrial Revolution (IR1.0) of the 18th and 19th centuries. At the dawn of IR4.0, we see serious global challenges in healthcare, environment, education, business and society, manifestations of how digital technologies have disrupted traditional practices and relationships, leading to their breakdown or collapse as they are threatened by new processes, perceptions, tasks, devices and environmental situations. These problems are inextricably linked to human factors and a failure to recognise, respond to and/or harness the impact of technologies associated with IR4.0. This presentation looks at the impact of the Digital Age on a range of professions and skilled trades between 1955 and 2021 in the context of salaries, training needs, cognitive challenges and responsibilities. Based on a series of case study examples where human intelligence, judgement, skills and/or knowledge has already become embedded within technology, it speculates on the future implications for knowledge workers, their skills, experience, career prospects, salaries and status in IR4.0. It draws the conclusion that, at the dawn of the IR4.0, the future of knowledge workers is highly uncertain, whilst skilled trades based on apprentice-ships are likely to prosper.

Keywords: Artificial Intelligence, IR4.0, Digital Disruption, Knowledge Workers, Luddites

PARENTAL ABANDONMENT AS A TRIGGER FOR SHAME AND GUILT IN ADOLESCENTS?

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Abstract

Theories related to human development suggest that childhood experiences are relevant throughout an individual's lifespan, and that the parent-child relationship is crucial for a child's physical and psychological health. The objective of this study was to examine whether parental abandonment has an impact on self-conscious emotions like shame and guilt. This quasi-experimental study included 230 adolescents and teenagers (mean age = 17.1, SD = 1.82), and data was collected via an online self-reported questionnaire. The Guilt Inventory, The Experience of Shame Scale, Childhood Trauma Questionnaire, and Parental Acceptance/Rejection Questionnaire were used for data analysis. The results indicated that a child's environment was significantly associated with feelings of shame. High levels of abuse had an impact on both shame and guilt, while paternal rejection was associated with guilt only. The study highlights the importance of considering the conditions in which children and teenagers develop and the crucial role of social work assistance for those who have experienced abandonment.

Keywords: abandonment; shame; guilt; parental rejection; adolescents and teenagers; institutional care; family environment.

**SUPPRESSION OF RUST RED FLOUR BEETLE, *Tribolium castaneum* HERBST
[COLEOPTERA: TENEBRONIDAE] WITH TWO *OCIMUM* SPECIES POWDERS ON
WHEAT GRAINS**

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Abstract

Stored product insect pests are problems throughout the world, as they diminish both the quantity and quality of grains. The resultant effect of this is an eminent threat to global food security which might negatively impact peoples' well-being. Efforts by humans to curb the menace of these insect pests have brought about negative effects because of the use of synthetic chemical insecticides. Recent development has been seen in the use of botanicals and agricultural wastes in the control of these pests. This research investigated effects of *Ocimum gratissimum*, and *O. basilicum* powders against *T. castaneum* infesting wheat grains in storage. Powders were tested singly and mix at dose 0.2, 0.4, 0.6, 0.8 and 1.0 g, while extracts were tested at concentration 0.1, 0.2, 0.3, 0.4 and 0.5 ml /20 g of wheat grains. Parameters that were tested include adult mortality, numbers of adult emergence, % seed damage, % weight loss and weevil perforation index. The results revealed that powders and the extracts of the *Ocimum* species were effective as the dosage and concentration ascended with different degrees of effectiveness based on exposure time. The two tested *Ocimum* species powders and extracts significantly ($P < 0.05$) reduced the population of adult *T. castaneum* on treated wheat grains. *O. basilicum* powder at dosage 1.0 g caused 50% mortality of adult *T. castaneum* after 24 hours of treatment. This followed by combination of *O. basilicum* and *O. gratissimum* powders that evoked 40% beetles mortality. The least toxic was *O. gratissimum* powder that caused 30% mortality of adult *T. castaneum*. The lethal dosage of *O. basilicum*, *O. gratissimum* and combination of *O. basilicum* and *O. gratissimum* powders at which 50% population of *T. castaneum* response after the first day of exposure were 1.09g, 1.44g and 1.45g while the lethal dosage needed to achieve 90% (LD_{90}) mortality after the first day of exposure were 4.24, 8.44 and 5.38 respectively. This research showed that *O. basilicum* and *O. gratissimum* powders had toxicity effects on the survival of *T. castaneum* on wheat grains. *O. gratissimum* had the lowest lethal dosage. The use of *Ocimum* species as bio-control in the management of red-rust flour beetle in stored wheat grains among poor resource farmers and foods merchants should be advocated.

Keywords: *Ocimum gratissimum*; *Ocimum basilicum*; *Tribolium castaneum*; Wheat; Biocontrol

DESIGN, SYNTHESIS, MOLECULAR DOCKING STUDIES OF SOME NEWER
BENZOTHAZOLE CONTAINING ARYL AND ALKARYL HYDRAZIDES

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Abstract

The alarming rise of bacterial *resistance* is occurring worldwide and endangering the efficacy of *antibiotics*. Therefore, development of new and efficient antibacterial agents remains paramount. In the present work we designed and synthesized a series of N'-(1,3-benzothiazol-2-yl)-substituted aryl/alkyl hydrazides **C1-C27**. In the extra-precision docking compounds **C1-C27** exhibited interactions mainly with the N-terminal and central domains of *S. aureus* GyrB catalytic pocket. Binding free energy (ΔG_{bind}) of compounds **C1-C27/3U2K** complexes were computed by MM-GBSA approach. Free energy components indicated Coulomb energy term as favourable for binding, while van der Waals and electrostatic solvation energy terms strongly disfavoured the binding. ADMET properties of synthesized compounds **C1-C27** are also computed.

**GREENING OF THE KERALA UNIVERSITY CAMPUS- AGRICULTURE AND
HORTICULTURE TO THE FORE**

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Abstract

The University of Kerala, earlier known as the University of Travancore, is a state-run public university in Thiruvananthapuram, Kerala. It is the state capital of Kerala, India. The University of Kerala was established in 1937 by a proclamation of the Maharaja of Travancore Sri Chitira Thirunal Balarama Varma, the 1st Vice Chancellor of the University of Kerala. Now the University of Kerala is accredited by NAAC A++, the highest grade, and scored 3.67 points out of 4. The University of Kerala has over 150 affiliated colleges and has 16 Teaching faculties, and 43 Departments of Teaching and research. The extensive green campus with 359 acres is close to the Kazhakuttom on National Highway 66. Kariavattom campus is situated Northeast of Thiruvananthapuram city and 3km nearest to the Arabian Sea. Geographically the Kariavattom campus lays 834'6 N latitude and 7652'51 E longitude at 60 m above sea level. The average tropical climate was predominant, with a mean rainfall of 1850 mm. The textural soil of the site has been categorized into lateritic soil. In 2019, the University authorities did away with acacia and eucalyptus trees that contributed much of the kariavattom campus's greenery and replaced them with crops. In 2014, Kerala University approved the proposal for a Green Charter for environmental conservation. The Green charter states that no plastic-wrapped bouquets, plastic wrapping of moments, plastic confetti, or "kodithoranam" decorations were not used in the functions conducted by the University. The monoculture of acacia in the kariavattom campus was replaced with various trees focused on preserving and enhancing the kariavattom campus's Biodiversity. Kerala University's Harithalayam project was an exemplary model of Biodiversity. The Government of Kerala would consider expanding this project and converting the campus into a significant seed production center. The high-yielding "Manuratna," the variety of rice harvested on the campus, was procured by Kerala Agriculture University. Then it was distributed among the farmers across the state for more production. Here the study is focused on explaining the greening of the Kerala university along with the agriculture and horticulture activities.

Keywords: Greening, Agriculture, Horticulture, Harithalayam Project, Kerala University, Kerala.

**CONTRIBUTIONS OF GENETIC ENGINEERING IN RAISING THE EFFICIENCY OF
GENETIC SELECTION IN LIVESTOCK**

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Abstract

Genetic engineering has become a powerful tool for improving the efficiency of genetic selection in livestock. Conventional breeding methods have their limitations when it comes to achieving rapid genetic progress in complex traits controlled by multiple genes. An important contribution of genetic engineering is the development of genetically modified (GM) animals with specific genetic changes to improve desired traits. For example, GM goats with reduced myostatin levels have more muscle mass and better meat quality, and GM dairy cows have higher milk production and better protein quality. Another important contribution is the development of gene editing tools such as CRISPR-Cas9, which allow targeted modification of genes associated with specific traits. Gene editing has created pigs resistant to African swine fever, reducing the threat to the global swine industry, and can introduce desirable mutations for disease resistance or improved production traits, accelerating genetic progress. Genetic engineering can be used to solve environmental and animal welfare problems in animal agriculture. For example, genetic engineering is being studied to reduce methane emissions from cattle, which contribute to climate change. By modifying genes that regulate methane production, researchers hope to create more sustainable and environmentally friendly livestock systems. Although genetic engineering offers potential benefits, there are concerns about its safety and ethical implications. There is a need to ensure that any genetic modifications introduced into animal populations do not negatively impact animal health, welfare, or the environment. In addition, potential social and ethical implications should be considered, such as concerns about animal welfare, genetic discrimination, and impacts on traditional agricultural practices. In summary, genetic engineering has greatly increased the efficiency of genetic selection, improved animal health and welfare, and solved environmental problems in animal agriculture. With continued research and development, genetic engineering can lead to more sustainable and efficient animal production systems. However, responsible and ethical use is critical, taking into account the potential risks and benefits.

Keywords: livestock, gene editing, genetic engineering, genetic selection

**DIPLOMATIC RELATIONS BETWEEN VIETNAM AND CAMPODIA FROM 1997 TO
2022**

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Abstract

Vietnam and Cambodia are two neighboring countries in Southeast Asia. The two countries have had diplomatic relations since early, going through many stages in history. After helping Cambodia escape the genocide caused by Polpot, Vietnam gradually supported Cambodia in many fields. In 1997, both countries joined the ASEAN organization and increasingly have closer relations, making important contributions to the development of Southeast Asia. Today, with the development of the region and the interweaving of interests among many countries in the ASEAN region and in the world, the Vietnam - Cambodia relationship has new advantages and challenges. This article aims to analyze the diplomatic relations between the two countries, thereby drawing out historical issues and international relations, serving the study of diplomatic.

Keywords: Vietnam, Cambodia, diplomatic, ASEAN

**DR. FAISAL DIRECTOR (HRIMS/ISMOHR) CARRIED OUT THAT AI MODULES IN
PAKISTAN LIKE MODERATE NATIONS IT IS SIGNIFICANT PREREQUISITE FOR
THE DEVELOPMENT OF PAKISTAN**

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Abstract

Executing computer based intelligence models requires cautious thought of different elements, like information accessibility, foundation, assets, and neighborhood setting, which might change significantly relying upon the particular use case and area. In any case, Dr. Faisal Director (HRIMS/ ISMoHR) from Ministry of Human Rights Government of Pakistan give a few general suggestions to man-made intelligence models that could be important for horticulture and IT areas in Pakistan: Irritation and Illness The board: man-made intelligence models can break down information on weather conditions, bother populaces, and infection episodes to give early advance notice frameworks and suggestions for vermin and sickness the executives procedures. This can assist with shielding basic IT foundation and information from digital assaults. It's essential to take note of that the turn of events and sending of simulated intelligence models require intensive assessment, approval, and moral contemplations to guarantee their viability, decency, and wellbeing. Legitimate information administration, protection, and safety efforts ought to likewise be set up to safeguard delicate information and guarantee consistence with applicable guidelines. Executing artificial intelligence models in Pakistan, or some other nation, would require joint effort among different partners, including government, industry, the scholarly world, and neighborhood networks. Modified arrangements that are customized to the particular requirements and difficulties of the horticulture and IT areas in Pakistan would be great for boosting the advantages of computer based intelligence reception in Pakistan. The Pakistani government can foster approaches and guidelines that support the utilization of man-made intelligence in horticulture and IT areas. This can incorporate giving duty impetuses, awards, and subsidizing for computer based intelligence innovative work, as well as making administrative systems that address issues connected with information protection, security, and moral contemplations. Pakistan can cultivate joint effort among the scholarly world and industry to work with the exchange of computer based intelligence examination to down to earth applications. This can include joint exploration projects, innovation move projects, and organizations among colleges and industry players to advance man-made intelligence development and business venture. Pakistan can team up with worldwide accomplices, including different nations, research establishments, and associations, to use worldwide mastery and assets in computer based intelligence. This can include joint examination projects, information sharing, and support in global computer based intelligence rivalries and difficulties.

Keywords: Irritation, Illness, boosting, impetuses, subsidizing, exploration.

**TECHNICAL EFFICIENCY DIFFERENTIALS OF MAIZE FARMER'S
PRODUCTIVITY IN OYO STATE, NIGERIA**

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Abstract

Farmer's inefficiency and low productivity in agriculture has been observed to be one of the problem affecting increased productivity and sustainable farm income among average farmers in Nigeria. The study examined the technical efficiency differentials of maize farmer's productivity in Oyo state using cross sectional data. The study uses five local government areas (LGAs) which are: Ogbomoso South, Oriire, Surulere and Ogooluwa LGAs respectively. A multistage sampling technique was employed in selecting 30 maize farmers from each of the four local government making 120 farmers. Data was collected through a well structured questionnaire and analyzed by the use of descriptive, inferential statistic (OLS) and The (Tran-slog) stochastic frontier production model. The estimated parameter using Trans-logarithm regression model revealed that land as a variable is statistically significant at different levels for all the LGAs considered while labour ($\beta=0.119$, $p<0.01$) and ($\beta=0.023$, $p<0.01$) are significant ($p<0.01$) percent level for Oriire and Ogooluwa LGAs, credits are only statistically significant ($\beta=0.046$, $p<0.10$) for Oriire LGA. The coefficient of the square term for all the variables shows a less than proportionate increase in maize output except for seeds in Ogooluwa LGA while the estimated coefficient for interactive terms shows a remarkable significant for land size, credits and between land and seeds. The estimated gamma parameter ($\Upsilon=0.50$) in Ogbomoso South, ($\Upsilon=0.99$) in Ogo Oluwa, ($\Upsilon=0.99$) in Surulere, ($\Upsilon=0.99$) in Oriire and ($\Upsilon=0.89$) for the pooled data indicated that 50%, 99%, 99%, 99% and 89% of the total variation in maize output is due to the technical inefficiencies in the local government area respectively. The mean technical efficiency was 0.810 in the pooled data, 0.810 in Ogooluwa and Surulere LGAs. Therefore, there is scope for increasing maize production in the local government areas by 0.19 percent, 0.19 percent, 0.22%, 0.20% and 0.09% with the present technology, it could be seen that maize farmers in Ogooluwa LGA are more technically efficient than farmers in other local government areas. It was therefore concluded that access to credit have positive impact on output and increase in size of production, though the production system is in stage three with respected to labour. It was recommended that more land should be cultivated at the current labour size, agricultural banks should be established in the rural areas in other to cater for the agricultural credit needs of small scale farmers and results of better researches of improved agronomic practices should be extended to the farmers.

Keyword: Technical Efficiency, Translog, Productivity, Maize, Oyo State, Nigeria

**ANAEROBIC DIGESTION OF OLIVE OIL MILL WASTE: INOCULUM/SUBSTRATE
RATIO FOR BIOGAS PRODUCTION**

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Abstract

The disposal of olive oil-crushing residues represents a major challenge, as huge quantities are generated every year that need to be treated. Anaerobic digestion is a feasible alternative for the management and valorization of this waste through the production of biogas, which offers an option to generate renewable energy. The use of inoculum can significantly improve the stability of the process as well as the generation of biomethane by increasing the load of methanogenic bacteria. Several experimental investigations have been carried out using anaerobic biodegradation of solid and liquid waste from olive oil mills mixed with sewage sludge or cow manure to find the optimal I/S ratio to produce methane. The aim of this work is to present anaerobic digestion as a solution for the management of these residues, and the recent advances in the use of inoculum for their treatment.

Keywords: Anaerobic digestion, inoculum/substrate ratio, Olive oil-crushing residues, Valorization.

**UNPACKING THE IMPACTS OF EDUCATIONAL TECHNOLOGY ON BEGINNER
LEARNERS' DISPOSITIONS TOWARD EFL PEDAGOGY AT TANGUIÉTÁ
SECONDARY SCHOOL IN BENIN**

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Abstract

This study aims to determine the influence of Information and Communication Technologies (ICT) on beginner learners of Tanguiétá Secondary School and their attitudes towards English as a Foreign Language (EFL) pedagogy. Specifically, the research examines the impact of ICT on students' performance, attitudes, and study habits in EFL instruction. Data was collected from third- and fourth-form students at Tanguiétá Secondary School, and a mixed-methods approach was used to analyze the data. The quantitative data were analyzed using descriptive and inferential statistics, while the qualitative data was analyzed through content analysis. The results demonstrate that using ICT significantly influences students' attitudes and study habits, although its effect on their performance requires further investigation. The findings underscore the importance of teachers and parents in guiding students' use of ICT. This study provides valuable insights into the integration of ICT in education and its impact on EFL learners, serving as a comprehensive guide for future research and educational policy.

Keywords: Information and Communication Technologies (ICT), Beginner learners, Tanguiétá Secondary School, EFL teaching, Students' attitudes and performance

**EXPLORING EFFECTIVE STRATEGIES FOR MANAGING CLASSROOM
CONFLICTS: A STUDY ON THE IMPORTANCE OF CONFLICT MANAGEMENT
FOR ENHANCING CLASSROOM INTERACTION**

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Abstract

This study explores effective strategies for managing classroom conflicts and the role of conflict management in enhancing classroom interaction in the context of English as a Foreign Language (EFL) instruction. The study investigates the significance of addressing and resolving conflicts among 438 EFL learners and 13 EFL teachers in a classroom setting. It examines the impact of conflict management on students' learning outcomes and overall classroom environment. The study utilized a mixed-methods approach, with a questionnaire administered to all participants and semi-structured interviews conducted with a subsample of teachers. The survey data was analyzed through thematic analysis, specifically a deductive thematic approach following the guidelines by Braun and Clarke (2006), while the interviews were analyzed through inductive content analysis, specifically an Interpretative Phenomenological Analysis (IPA) approach following the guidelines by Smith et al. (2009). The results indicate that effective conflict management strategies, such as communication, collaboration, and problem-solving, positively impact students' academic performance and foster a supportive and productive classroom environment. Additionally, the study reveals that teachers play a crucial role in managing conflicts in the classroom and that their beliefs, attitudes, and skills in conflict management greatly influence classroom dynamics. The findings of this study suggest that conflict management should be an essential component of EFL instruction and that teacher training programs should emphasize the development of conflict management skills to enhance classroom interactions and improve student learning outcomes.

Keywords: Classroom conflict management, Classroom interaction, EFL instruction, Thematic analysis, Interpretative Phenomenological Analysis

**THE CONSEQUENCES OF THE PANDEMIC ON BUSINESSES AS CARRIERS OF
ECONOMIC DEVELOPMENT – EVIDENCE FROM KOSOVO**

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Abstract

The study focuses on identifying the consequences of the CoVid-19 pandemic in business trends with a focus on Kosovo. In all countries, business is one of the main carriers of economic development. The pandemic has negatively affected the business of each type of companies, Kosovo is known for an economy in transition where the business field is under development, based on elaborated statistics it is observed that no type of business has been left untouched by the pandemic, ranging from small individual businesses to large businesses or joint stock companies in Kosovo. The pandemic has a negative impact on all economic sectors, starting from the gastronomy, tourism, food industry, agricultural sector, trade and so on. The objective of the research is to identify the state of businesses in the post-pandemic period, the focus of the paper is to identify the chain impact on economic development trends in countries through economic indicators. The study offers factual data processed from a critical point of view from the research carried out during the month of February - March '23 in 80 businesses in the country, the methodology of analytical processing of empirical data from the official reports of local and international institutions was used, with the aim of finding on the way to a faster recovery of the economic situation in Kosovo, not overlooking other countries that can take the findings as a model.

Keywords: Businesses, Economic sectors, Pandemic, Economy in transition, etc.

**STUDY ON BIOSORBENTS FOR THE REMOVAL OF CHLORIDE
ION FROM WATER**

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Abstract

The presence of pollutants in aqueous solution particularly from hazardous heavy metals and metalloids is an important environmental and social problem. The chlorides are one of the serious groundwater contaminants in rural areas. The chlorides are regulated in drinking water quality primarily because excess amounts can cause disease. Chloride in both its gaseous and liquid form can be irritating to the eyes, respiratory tract and skin due to its alkaline nature. Biosorption is one of the biological treatments that has emerged as a new technology for the removal and recovery of metal ions from aqueous solutions which is more environmentally friendly. In this study biosorption were used with the intention to remove heavy metals such as copper, zinc, chlorides and mercury ions from synthetic(distill) water. In the preliminary water analysis, the results indicated that several factors including Total Dissolved solids (1,07,000mg/l), Total solids (67,500mg/l), Suspended solids (1,81,000mg/l) shows higher value. After the treatment with biosorbent (fish scale powder) the value was found to be very less, the concentration of Total dissolved solids (9184mg/l), Total solids (13120mg/l), Suspended solids (4000mg/l).The optimum adsorption capacities of fish scale was investigated under several condition namely, pH, biosorbents dosage, initial heavy metals concentration, and contact time while final concentration was obtained by using the maximum percentage removals were observed at pH 6.5 and dosage 4.3g at biosorbent concentration at 90 rpm agitation speed with maximum removal achieved at 1/2 hours. Chloride analysis shows that presence of the heavy metal absorption by Solids and flowers. Every biosorbent had different physical, chemical and biological properties for heavy metals removal by biosorption from the water. The biosorption process can be made economical by regenerating and reusing of biosorbent after removing the heavy metals. Various bioreactors can be used in biosorption for the removal of metal ions from large volume of water.

Keywords: Water Quality, Chlorides, Biosorption's, Kinetic equilibrium, Isotherm data and Regeneration

**A GLUCOSE BIOSENSOR USING MEDIATED ELECTROCHEMISTRY OF *P*-
BENZOQUINONE AND GLUCOSE OXIDASE AND MACHINE LEARNING**

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Abstract

During the last three decades, a wide range of commercial portable blood glucose meters has been developed for patients with diabetes mellitus. However, according to the operating characteristics of these devices, their accuracy in determining the approximate concentration of glucose in the blood can be significantly influenced by environmental parameters. These conditions affect the activity of the glucose-oxidase enzyme significantly. The objective of this study was to develop an adaptive neuro-fuzzy inference system (ANFIS) to improve the performance of an amperometric glucometer in rough storage and operating conditions. ANFIS includes adaptive artificial neural networks (ANN) and a fuzzy inference system and uses a hybrid-learning rule merging gradient descent, backpropagation, and a least-squares algorithm to determine a set of parameters. An amperometric glucose oxidase biosensor was constructed using *p*-benzoquinone as the electron-transfer mediator. The adaptive neuro-fuzzy inference system as a robust machine learning method was utilized to learn the sensor's input features, including the current response of the sensor, operating temperature, and storage time period (in other words, the age of the enzyme; which can affect the enzyme's activity) to predict the glucose concentration of the human blood. The application of the proposed device in improper storage and operating temperature situations (e.g., temperatures higher than 40°C) resulted in lower than 0.015 mean squared error (MSE) compared with laboratory tests. Commercial glucometers usually need to be stored in relatively low temperatures to avoid decrement in enzyme activity. However, results showed that in comparison to laboratory tests and commercial devices, the system could predict blood glucose with acceptable performance even in improper thermal conditions. Machine learning is a promising technique when regression methods cannot model the system's behavior in nonlinear form.

Keywords: ANFIS, biosensor, glucose oxidase, portable device, *p*-benzoquinone

**THE IMPACT OF CLIMATE CHANGE ON MARINE KELP FORESTS AND THEIR
ECOSYSTEM SERVICES**

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Abstract

Marine kelp forests are productive and diverse ecosystems that provide habitat, food and shelter for many marine organisms, as well as fisheries, nutrient cycling and carbon sequestration. However, climate change can affect their distribution, structure and functioning by altering ocean temperature, acidity and oxygen levels. These changes can reduce the growth, survival and reproduction of kelp and associated organisms, as well as the economic value and social benefits of kelp ecosystem services. To understand and manage these vital ecosystems in a changing climate, we propose a research agenda that includes: monitoring kelp dynamics using remote sensing and citizen science; assessing climate change impacts on kelp physiology, ecology and biogeochemistry; evaluating kelp ecosystem services under different climate scenarios; and developing adaptive management strategies and policy options to conserve and restore kelp forests.

Keywords: Marine kelp forests; Climate change; Ecosystem services; Ocean warming; Biodiversity

VARIOUS WAYS OF WASTE MANAGEMENT

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Abstract

In this paper we have discussed about an important problem of our environment which is Waste and various ways of waste management. Waste management was among the biggest problems we are facing today. First, what is waste? So waste is any unwanted thing in our environment which are generated by human activities. According to The World Counts, more than 2 billion tons of wastes are dumped every year. Also, if all the waste was put on trucks, they can go around the world 24 times. And this great amount of waste is because 99 percent of the stuffs used by us are discarded within 6 months. For reducing this, we need to maintain or manage wastes so that they would not cause any harm to our environment. For waste management we must follow the 3R's that is Reduce, Reuse and Recycle. And for following 3R's we need to first segregate waste. Waste should be segregated because without segregation we cannot recycle the waste produced and it may result in severe environmental issues. For waste segregation, government are providing us with two types of dustbins which are coloured in two different colours that is blue and green. We should use it accordingly in blue one we have to have to dump dry, metal and anything that can be recycled waste materials and in green one we must dump wet wastes or organic wastes. Sadly, we fail to segregate or only few or very small amount of waste can be recycled because as we see that even having dustbin many people throw their waste all around the dustbin and do not even notice them and we also observed that the garbage collectors often mix them in same truck and the mixed waste is dumped in the open and fills near outskirts of cities. Recycling is not possible without segregation, government was helpless and unable to segregate this waste in its own, rag pickers do some good job in landfills, they segregate waste found in the landfills, in roads and in market places and sell them in private companies for recycling and help to save environment. Government is setting up many plants for waste segregation near landfills but that are also only helpful in planting only 10 -20 percent of waste. Remaining 80 percent of waste is left non recycled everywhere all-around and causing harmful risks to our environment. So, we should and everyone should segregate their waste at their home so that we can recycle almost all the waste formed. Like for example in Turkey they use zero waste management system.

ANTIDIARRHEAL ACTIVITY OF ETHANOL LEAF EXTRACT OF *Polyalthia longifolia* ON RAT MODELS

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Abstract

Diarrhea illnesses are one of the main reasons for morbidity and mortality in developing nations and are accountable for the death of hundreds of thousands of people every year. Traditionally, people used *Polyalthia longifolia* for the treatment of various ailments, including diarrhea. Therefore, this study was aimed to investigate the antidiarrheal activity of ethanolic leaf extract of *Polyalthia longifolia* against castor oil-induced diarrhea and gastrointestinal motility in Rat models. The results of phytochemical screening showed that alkaloids and tannins occurred in high concentration, flavonoids and steroids occurred in moderate concentration, whereas terpenoids, glycosides and phenolic acid occurred in lowest concentration. The acute toxicity study revealed that the plant extract were not toxic even at the dose of 500 mg/kg. Different doses of ethanolic leaf extract of *Polyalthia longifolia* (200,400 and 600 mg/kg b.w) were evaluated for their antidiarrheal activities using castor oil-induced diarrhea, gastrointestinal transit models in Swiss albino Rats. Groups treated with 200,400, and 600 mg/kg b.w of extract showed significant ($P < 0.05$) inhibition in the frequency of defecation of wet feces and total fecal output compared with positive control. Similarly, Groups treated with 200, 400, and 600 mg/kg body weight of extract demonstrated significant ($P < 0.05$) antimotility activity when compared with the positive control. In conclusion, these findings illustrated that the ethanolic leaf extract of *Polyalthia longifolia* supported the traditional claim of antidiarrheal activity of the plant though further investigations are warranted.

Keyword: Casto oil-induced diarrhoea, Gastrointestinal transit, ethanolic extract, *Polyalthia longifolia*

DESIGN AND DEVELOPMENT OF A GENERIC IOT GATEWAY

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Abstract

IoT technology has greatly benefited the general field of automation solutions. There are a few issues with existing automated processes due to the sector's significant number of data collection devices, most of which were developed and deployed long before the concept of the Internet of Things was introduced. The Internet of Things is a recent development in information and communication technology that provides worldwide connectivity and information management for users, devices, and sensors. As a result, over time, IoT and embedded technologies have collaborated to solve a variety of real-world problems. Because it employs gateways, the technology for integrating legacy equipment with IoT solutions is not novel. IoT gateways connect hardware to the Internet so that it can be used in real-world applications. A common real-world application is sending data from a microcontroller to a website, webpage, or web dashboard. Almost all of these applications favour wireless technology. Because of their smaller form factor when combined with a Wi-Fi shield, the ESPxxxx series of Wi-Fi modules is the most commonly used in these situations. An IoT gateway prototype is presented in this project to connect traditional Modbus RTU sensors to MQTT/HTTP cloud servers. The solution involves employing an ESP 8266 Node MCU as a bridge between the Modbus network and the cloud server. To make the data visible to the users, the data is transmitted from the sensors to the cloud server. This gateway will be able to take any type of value and it can be visible from anywhere in the world.

**BİYOKİMYASAL BAKIŞLA TRANSFÜZYON MERKEZİ DONANIM EKİPMAN
KRİTİK STOK SEVİYESİ DEĞERLENDİRMELERİ**

Uz Dr Naile Mısırhoğlu

Gaziosmanpaşa Eğitim ve Araştırma Hastanesi Biyokimya Uzmanı

Giriş ve amaç

Transfüzyon Merkezi; Acil durumlar dışında kan bağışıcısından kan alma yetkisi olmayan, kan ve bileşenlerini bağılı bulunduğu BKM'den temin eden, transfüzyon için çapraz karşılaştırma ve gerek duyulan diğer testleri yaparak hastalarda kullanımı için hazırlayan birimdir. Tüm yataklı tedavi kurumları sağıık kuruluşları TM açar. TM bu uygulama ile ilgili bilgileri BKM'ne iletmekle yükümlüdür. Transfüzyon Merkezi tanım olarak acil durumlar dışında kan alma yetkisi olmayan, kan ve bileşenlerini bulunduğu ildeki Kızılay BKM'den temin ederek, transfüzyon için çapraz karşılaştırma ve gerek duyulan diğer testleri yaparak hastalar için kullanıma hazırlayan birimdir (1).

Yöntem

Sonuçların onaylanması işleminde yerine getirilmesi gerekenler başlıca, gelen numunedeki kişiye özel tanımlama numarası, istem formundaki veya bilgisayardaki numara ile karşılaştırılmalı, etiketlemede ve kayıt safhasında hata yapılmadığından emin olunmalıdır. ABO ve RhD gruplarının, mümkünse elektronik ortamda, daha önce bakılan grupta sonuçlarıyla karşılaştırılarak doğrulaması yapılmalıdır. Transfüzyondan önce tüm uyumsuzluklar giderilmelidir. Laboratuvarda test sonuçlarının kontrolüne ve bağımsız iki kişi tarafından onaylanmasına olanak veren bir prosedür bulunmalıdır (2).

Sonuç

Kalibrasyonu geçmiş cihaz oranı, zamanında tamamlanmayan ekipman kalifikasyon oranı kan bağış sürecinin gerçekleştirilmesinde önemlidir. Güvenli kan için önemli kriterlerden biri de sürecin doğru ölçümlerle işletilmesidir. Bu nedenle her alanda kullanılan cihazların kalibrasyon zamanlarının planlanması ve bu plana uygunluğun takip edilmesi, kalifikasyon çalışmalarının etkinliğinin izlenip değerlendirilmesi kapsamında iyileşmeye açık alanların tespit edilerek ortadan kaldırılması önemlidir (3).

Anahtar kelimeler: Transfüzyon merkezi, Biyokimya, Kritik Stok Seviyesi

**THE ATTITUDES OF FEMALE AND MALE EMPLOYEES WORKING IN THE
INDUSTRIAL SECTOR TOWARDS GENDER ROLES**

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Abstract

In this study, it is discussed that gender, unlike biological sex, expresses learned patterns about femininity and masculinity and what kind of attitude differences this perception causes in business life. The socio-cultural & economic relations created by accumulating in the historical process during social life are also related to the gender role and social identity of the individual, and bring about the shaping of their behaviors accordingly. It causes problems in business life and can drag individuals exposed to it to a disadvantageous position. Restrictive identity labels created depending on gender roles are out of the hands of the patriarchal majority that rules the society and are used by the hegemonic patriarchal order to keep other minority crowds in a certain line with the pressure of "naturalization" towards gender. The aim of the study is to question gender attitudes, which rebuild the interpersonal social organization and determine the lives that people should live only depending on the biological sex they have, and turn them into a fixed necessity. The antidote to this polarization ultimately stands behind an alternative egalitarian theory as a more positive value. It has been tried to clarify feminism, which is thought to glorify women or to be hostile to men. Quantitative research model survey, one of the scientific research methods, was applied and the findings were reached with the SPSS. Questions in the research: The fairness of women working for lower wages than men, Whether marriage prevents women from working, the suitability of women to work after becoming a mother, the obligation of a working woman to give her husband her income, and contains content about men doing household chores such as laundry and dishes. As a result, the existing codes suppressed into thought structures needs to be changed. Recognizing two biological sexes, not masculinity and femininity, but one that is inextricably linked to the other, without the continuation of the lineage, and which can realize nature together, on the contrary, the destruction caused by artificial gender roles is clear. Having equal rights in theory does not mean that it can be applied in this way in practice. As it can be built with education and legal order, an enlightenment at the level of consciousness is also required.

Keywords: Gender roles, equality, feminism, work life balance, patriarchal system

R-CIRCULANT MATRICES WITH FIBONACCI-LIKE NUMBER ENTRIES

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Abstract

The Fibonacci sequence $\{F_n\}$ is one of the most famous and important sequences studied in mathematics throughout the history. Its terms are called the Fibonacci numbers and they are defined recursively by the relation

$$F_n = F_{n-1} + F_{n-2}$$

for $n \geq 2$ where $F_0 = 0$ and $F_1 = 1$ are the initial values. The same recurrence relation also defines the Lucas sequence when the initial values are $L_0 = 0$ and $L_1 = 1$. One of the generalizations of the Fibonacci sequence is the generalized bi-periodic Horadam sequence $\{w_n\} = \{w_n(w_0, w_1; a, b, c)\}$ defined by the recurrence relation

$$w_n = a^{\xi(n+1)} b^{\xi(n)} w_{n-1} + c w_{n-2}$$

for $n \geq 2$ where w_0 and w_1 arbitrary initial values, and a , b and c are nonzero real numbers. Indeed, the the generalized bi-periodic Horadam sequence reduces to the Fibonacci sequence when $w_0 = 0$, $w_1 = 1$ and $a = b = c = 1$. In other words, $\{F_n\} = \{w_n(0, 1; 1, 1, 1)\}$. Similarly, $\{L_n\} = \{w_n(2, 1; 1, 1, 1)\}$, $\{q_n\} = \{w_n(0, 1; a, b, 1)\}$, $\{p_n\} = \{w_n(2, a; b, a, 1)\}$, and $\{H_n\} = \{w_n(w_0, w_1; a, a, c)\}$ are the Lucas sequence, the bi-periodic Fibonacci sequence, the bi-periodic Lucas sequence, and the Horadam sequence, respectively.

Matrices can be formed from the terms of a sequence. A special case of interest is the r -circulant matrices $C = [c_{ij}]$ of size $n \times n$ with entries

$$c_{ij} = \begin{cases} c_{j-i}, & j \geq i \\ r c_{n+j-i}, & j < i \end{cases}$$

where r is a nonzero complex number. Our goal in this talk is to construct r -circulant matrices whose entries are Fibonacci-like numbers with a particular emphasis on the generalized bi-periodic Horadam numbers. We provide lower and upper bounds for the norms of these matrices. We then compute the eigenvalues and determinants.

Keywords: R-Circulant Matrix, Spectral Norm, Bi-Periodic Horadam Numbers

TÜRKİYE’DE SAVUNMA HARCAMALARI ile EKONOMİK BÜYÜME
ARASINDAKİ İLİŞKİ

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Abstract

Despite many studies on the relationship between defense expenditures and economic growth, there is no consensus on the effects of defense expenditures on growth. This study econometrically examines the relationship between defense expenditures and economic growth in Turkey using annual data for the period 1988-2021. The stationarity of the variables used in the study was tested by ADF and PP tests and ARDL bounds test was utilized to reveal the short and long run relationships between the variables. The findings reveal that defense expenditures have a negative impact on growth in the short run. In the long-run, although defense expenditures have a negative impact on economic growth, its effect on growth is found to be statistically insignificant.

Keywords: Growth, Defense expenditures, ARDL bounds test

**DOĞRUSAL OLMAMA DURUMUNUN TESPİTİNDE SHANNON, RENYİ, TSALLIS
KARŞILIKLI BİLGİLERİNİN KARŞILAŞTIRILMASI**

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Özet

Rastgele değişkenler arasındaki bağımlılığın doğası, istatistiksel araştırmaların bir asırdan fazla bir süredir odak noktası olmuştur. Ancak günümüzdeki araştırmalar, öncelikle doğrusallık analizine odaklanmaktadır. Shannon karşılıklı bilgi ölçüsü, toplam bağımlılığı değerlendirmek için en kapsamlı yaklaşım olarak kabul edilmiş ve iki değişken arasındaki doğrusal ve doğrusal olmayan bağımlılık bileşenlerini ayırt etmek için birkaç teknik önerilmiştir. Bu çalışmada, parametrik özellikleri nedeniyle, toplam bağımlılığı ölçmek için Rényi ve Tsallis karşılıklı bilgi ölçülerinin kullanılması önerilmektedir. İlk olarak, değişkenler arasındaki doğrusal bağımlılığı ortadan kaldırmak için artık analizi kullanılmaktadır. Daha sonra, orijinal verilerin Rényi ve Tsallis karşılıklı bilgi ölçüleri, doğrusal bileşenin kaldırılmasından sonra elde edilen ölçülerle karşılaştırılarak doğrusallık derecesi belirlenir. Ayrıca, sonuçlar Shannon karşılıklı bilgi ölçüsü kullanılarak elde edilen sonuçlarla karşılaştırılmaktadır. Literatür, Shannon karşılıklı bilgi ölçüsünün kullanımını tercih etmektedir, ancak çalışmamız, parametrik esneklikleri sayesinde Rényi ve Tsallis karşılıklı bilgi ölçülerinin değişkenler arasındaki ilişkinin doğasını daha iyi yansıttığını göstermektedir.

Anahtar Kelimeler: Doğrusal olmama, Renyi Karşılıklı Bilgi, Tsallis Karşılıklı Bilgi,

**CALLIGRAMS, INFOGRAPHICS AND CONCEPT MAPS TO REPRESENT
DESIGN IDEAS IN ARCHITECTURAL EDUCATION**

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Abstract

In architectural design education, students construct their ways of learning and reflect their ideas verbally in front of their tutors and visually through sketches, diagrams, plans, sections, digital models, and simulations. Although drawing, sketching, and model-making is crucial in architectural education, visualising textual and numeric data gathered through the design process could also help architecture students. To think with textual data could turn into an image to think with. Nowadays, the visualisation of textual data is more visible, doable and popular due to AI text-to-image-generated tools such as Midjourney and DALL-E. In that respect, this paper focuses on three types of visualisation based on textual and numeric data: calligrams, infographics and concept maps. This research compares examples of calligrams, infographics and concept maps to the current text-to-image-generated tools under five headings of data type, data collection, source of data, the aim of the visualisation, and types of visual narrative. As a result, comparing the five mentioned headings with numerous case studies could be a visual guide for architecture students. The visual guide is utilised to decrease their cognitive overload, communicate with their peers and tutors, find the necessary data for their project, analyse the textual and numeric data efficiently and enhance their design process.

Keywords: Architectural representation, calligram, concept map, infographics, text-to-image.

**BUILDING INFORMATION MODELING FOR ASSESSMENT OF CLIMATE
ADAPTIVE SMART CAMPUS DESIGN**

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Abstract

Cities must deal with increasing disasters due to global climate change. University campuses are socio-ecological systems that can act like urban prototypes in which we can test self-sufficiency and resilience in their physical context. Current studies commonly look for smart city indicators and how to demonstrate them on university campuses, but most of them do not offer resilient planning and design strategies. This paper focuses on proposing a resilient smart campus design index. The proposed research methodology involves the determination of the index by integrating resilience and smart city indicators, followed by a case study assessment with BIM and climate analysis simulation. Simulation and modeling tools, including computer simulations, 3D modeling, and digital twins as part of "Smart," is used to evaluate the effectiveness of existing campus masterplan design guidelines and strategies for disaster resilience. As a result, climate change adaptive design strategies were proposed of different typologies, capable of functioning for different types of hazards. The potential use of digital twin and smart city technologies in disaster-resilient university buildings and campus design is explored, and potential challenges and limitations are identified. Integrating smart city principles and resilient thinking is a major demand for the city's future sustainability. This research methodology contributes to the literature on adaptive and smart disaster-resilient urban design index. The proposed study can assist in climate change adaptation and help decision-makers support further comprehensive planning and design approaches.

Keywords: Smart City, Resilient Campus Design, Climate Change Adaptation, Building Information Modelling (BIM), City Information Modelling (CIM)

ENDOPLASMIC RETICULUM STRESS AND ALZHEIMER'S-LIKE PATHOLOGY

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Abstract

This paper aims to explain the relationship between endoplasmic reticulum (ER) stress and Alzheimer's-like pathology. For this purpose, the studies on ER stress and Alzheimer's-like pathology have been reviewed. The ER is an important organelle that regulates processes such as the protein folding and trafficking (Braakman and Bulleid, 2011). Conditions such as increased protein synthesis, energy imbalance, and inflammation cause an increase and accumulation of unfolded proteins, leading to unfolded protein response (UPR) and ER stress in the cell (Chaudhari et al., 2014). It is known that ER stress plays a role in the pathogenesis of not only neurodegenerative diseases but also diabetes and cancer (Hoozemans et al., 2005; Ozcan et al., 2004). Alzheimer's Disease is a type of dementia that significantly affects the daily life of a person with learning, memory and behavioral impairments. It also creates social, psychological and economic problems for individual and society. For these reasons, new diagnosis and treatment options continue to be investigated in order to make an early diagnosis, increase the quality of life, slow down the clinical course, and reduce the economic burden for the individual and society, apart from symptomatic treatment (Kelly, 2008). Important markers of Alzheimer's disease are senile plaques formed by A β accumulation and neurofibrillary tangles formed by hyperphosphorylation of tau protein (Long and Holtzman, 2019, Kadavath et al., 2015). ER stress has been shown to be important in the course and progression of Alzheimer's disease (Scheper & Hoozemans, 2015). It was observed that p-eIF2 α , one of the ER stress markers, increased in Alzheimer's patients and neurodegeneration has been found to be prominent in p-eIF2 α positive neurons (Hoozemans et al., 2005). In another study, it was found that increased levels of eIF2 α lead to increased formation of amyloid- β responsible for plaque formation (Devi and Ohno, 2014). ER stress also reduces the degradation of tau proteins and causes their accumulation (Sakagami et al., 2013). UPR can cause Alzheimer's-like pathology, and proteins that increase in Alzheimer's disease can also cause UPR. It has been shown that tau hyperphosphorylation and A β accumulation decrease by inhibiting the GSK-3 β signaling pathway in Alzheimer's patients (Bian et al., 2016; Leroy et al., 2017). ER stress plays a role in the pathogenesis of Alzheimer's disease. New approaches to reduce ER stress could provide alternative treatment options.

Keywords: Endoplasmic reticulum stress, Alzheimer's Disease

2013-2021 YILLARINDAKİ ADLİ TIP KURUMUNA AİT ÖLÜM İSTATİSTİKLERİNİN İNCELENMESİ VE NEGATİF OTOPSİ

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Özet

Adli Tıp Kurumuna ait ölü muayene istatistikleri ve ölüm şekline bağlı hızlar incelenerek adli tıp hizmeti ve toplum sağlığını geliştirme planlanmalarına yardımcı olmak, yıllar içerisindeki negatif otopsi oranlarını değerlendirmek amaçlandı. Her yıla özgü adli tıp kurumu şube müdürlüklerine başvuran ölümlerin hızları ilgili yıldaki nüfus büyüklüğü üzerinden değerlendirilerek 1.000.000 kişideki ölüm sayısı yani ölüm hızı [(ölüm şekline göre sayı/nüfus)*1.000.000] hesaplandı. Adli Tıp Kurumu tarafından yapılan ölü muayeneleri arasında trafik kazasına bağlı, ateşli silah yaralanmasına bağlı, doğal (kendisinde mevcut hastalık), künt travmatik (darp, yüksekten düşme vb.) ölümlerin ilk sıraları oluşturduğu, ölüm nedeni bilinmeyenlerin oranının yıllar içerisinde arttığı gözlemlendi (Tablo 1, Tablo 2). Adli Tıp Kurumu Şube Müdürlüklerinin yaptığı adli olaylara bağlı ölü muayene sayısının toplam kaba hızının yıllar içerisinde arttığı gözlemlendi. 2013-2021 yılları arasında ölüm nedeni tespit edilemeyen vakaların oranları ülkemizdeki negatif otopsi oranlarını göstermesi açısından anlamlıdır. Bu oranların, 2013 yılı ve sonraki birkaç yılda literatürde bildirilen negatif otopsi oranlarının çok altında olmasının; “ölüm nedeni tespit edilemedi” ifadesinden kaynaklanabilecek doğal bir çekince olduğunu; bu ölümlerin adli boyutunun olmadığını, doğal bir sebepten olduğunu belirtmek adına daha çok “Doğal ölüm, kendisinde mevcut hastalık” ya da “Diğer” şeklinde kayıt edilmiş olabileceğinden kaynaklandığını düşünmekteyiz. Yıllar içerisinde bu konudaki farkındalığın arttığı ve negatif otopsi tanısının daha çok ve yerinde kullanılmaya başlandığı artan oranlardan anlaşılmaktadır. Ateşli silah yaralanmasına bağlı ölümlerde hızın dalgalı ve yatay seyir izlemesi, kesici, delici, ezici aletlerle olan ölümlerin ise ılımlı artışlar göstermesi, bu iki durumun da halen toplum güvenliği ve sağlığı için önemli bir sorun olduğunu göstermektedir. Bu nedenle bireysel silahsızlanma yönündeki politikaların

güçlenerek sürdürülmesi ve kamu güvenliği sağlanmasında rol oynayan kurumların gerekli tedbir ve denetimleri artırması faydalı olacaktır. Uygulamada trafik kazası sonucu meydana gelen ölümlü olayların bir kısmı nöbetçi adli hekimler tarafından değerlendirildiğinden ülkedeki durumu tam yansıtmamaktadır. Ancak diğer adli nitelikli ölümlü olaylar Adli Tıp Kurumu yapılanması üzerinden değerlendirildiğinden ülke genelini yansıtmaktadır.

Tablo 1. Türkiye’de 2013-2021 yılları arasındaki adli ölü muayene sayıları ve yüzdeleri

Ölüm Şekli	2013	2014	2015	2016	2017	2018	2019	2020	2021
Trafik kazası	3.443 25,68%	3.692 2,26%	3.893 24,98%	3.820 22,73%	4.047 23,63%	4.498 22,57%	4.091 19,75%	3.729 16,84%	4.380 17,59%
Ateşli silah yaralanması	1.948 14,53%	2.218 13,97%	2.139 13,73%	2.677 15,93%	1.935 11,30%	1.890 9,48%	1.940 9,37%	2.013 9,09%	2.206 8,86%
Doğal (kendisinde mevcut hastalık)	843 6,29%	919 5,79%	1.115 7,16%	1.630 9,70%	1.528 8,92%	1.919 9,63%	2.523 12,18%	2.962 13,37%	2.874 11,54%
Kesici, delici, ezici aletlerle olan	324 2,42%	387 2,44%	357 2,29%	388 2,31%	416 2,43%	398 2,00%	438 2,11%	442 2,00%	487 1,96%
Künt travmatik (darp, yüksekte düşme v.b.)	910 6,79%	1.143 7,20%	1.205 7,73%	1.141 6,79%	1.216 7,10%	1.519 7,62%	1.750 8,45%	1906 8,61%	1.842 7,40%
Asfiktik ölümler	673 5,02%	931 5,87%	866 5,56%	758 4,51%	1.069 6,24%	1.149 5,76%	1.091 5,27%	1.000 4,52%	874 3,51%
Ölüm nedeni bilinmeyenler	29 0,22%	308 1,94%	303 1,94%	571 3,40%	974 5,69%	1.409 7,07%	1.816 8,77%	2.639 11,92%	3.530 14,18%
Diğer	3.880 28,94%	4.949 31,18%	4.158 26,68%	3.931 23,39%	4.499 2,27%	5.641 28,30%	5.565 26,87%	5.850 26,41%	7.126 28,62%
İş kazası	224 1,67%	249 1,57%	245 1,57%	282 1,68%	321 1,87%	367 1,84%	352 1,70%	338 1,53%	376 1,51%
Yanık	49 33,68%	454 2,86%	356 2,28%	323 1,92%	337 1,97%	277 1,39%	294 1,42%	248 1,12%	316 1,27%
Elektrik çarpması	140 1,04%	155 0,98%	124 0,80%	125 0,74%	137 0,80%	145 0,73%	135 0,65%	179 0,81%	154 0,62%
Donma	17 0,13%	5 0,03%	35 0,22%	3 0,02%	13 0,08%	2 0,01%	51 0,25%	68 0,31%	11 0,04%
Anafilaktik	1 0,01%	6 0,04%	95 0,61%	89 0,53%	14 0,08%	14 0,07%	16 0,08%	8 0,04%	6 0,02%
Enfeksiyona bağlı ölümler	46 0,34%	0 0,00%	20 0,13%	11 0,07%	15 0,09%	33 0,17%	17 0,08%	19 0,09%	15 0,06%
İlaç zehirlenmesi	92 0,69%	113 0,71%	116 0,74%	63 0,37%	65 0,38%	102 0,51%	66 0,32%	74 0,33%	92 0,37%
Kimyasal madde zehirlenmesi	64 0,48%	62 0,39%	59 0,38%	155 0,92%	162 0,95%	170 0,85%	171 0,83%	196 0,88%	303 1,22%
Gaz zehirlenmesi	79 0,59%	112 0,71%	101 0,65%	89 0,53%	88 0,51%	103 0,52%	117 0,56%	139 0,63%	119 0,48%
Göçük altında kalma	53 0,40%	33 0,21%	39 0,25%	68 0,40%	37 0,22%	47 0,24%	37 0,18%	52 0,23%	24 0,10%
Patlayıcı madde infilakı	79 0,59%	50 0,32%	242 1,55%	632 3,76%	221 1,29%	199 1,00%	220 1,06%	256 1,16%	133 0,53%
İşkence veya kötü muamele	1 0,01%	6 0,04%	10 0,06%	4 0,02%	10 0,06%	1 0,01%	3 0,01%	4 0,02%	4 0,02%
Doğum sırasında	67 0,50%	81 0,51%	104 0,67%	43 0,26%	21 0,12%	49 0,25%	20 0,10%	25 0,11%	28 0,11%
Toplam	13.406 100,00%	15.873 100,00%	1.582 100,00%	16.803 100,00%	17.125 100,00%	19.932 100,00%	20.713 100,00%	22.147 100,00%	24.900 100,00%

Tablo 2. Türkiye’de 2013-2021 yılları arasındaki adli ölüm hızları (1.000.000’da)

Ölüm Şekli	2013	2014	2015	2016	2017	2018	2019	2020	2021
Ateşli silah yaralanması	25,41	28,55	27,16	33,54	23,94	23,05	23,33	24,07	26,05
Kesici, delici, ezici aletlerle olan	4,23	4,98	4,53	4,86	5,15	4,85	5,27	5,29	5,75
Asfiktik ölümler	8,78	11,98	11,00	9,50	13,23	14,01	13,12	11,96	10,32
Künt travmatik	11,87	14,71	15,30	14,30	15,05	18,52	21,05	22,80	21,75
Trafik kazası	44,91	47,52	49,44	47,86	50,08	54,85	49,20	44,60	51,72
İş kazası	2,92	3,20	3,11	3,53	3,97	4,48	4,23	4,04	4,44
Yanık	6,43	5,84	4,52	4,05	4,17	3,38	3,54	2,97	3,73
Elektrik çarpması	1,83	1,99	1,57	1,57	1,70	1,77	1,62	2,14	1,82
Donma	0,22	0,06	0,44	0,04	0,16	0,02	0,61	0,81	0,13
Anafilaktik	0,01	0,08	1,21	1,12	0,17	0,17	0,19	0,10	0,07
Enfeksiyona bağlı ölümler	0,60	0,00	0,25	0,14	0,19	0,40	0,20	0,23	0,18
İlaç zehirlenmesi	1,20	1,45	1,47	0,79	0,80	1,24	0,79	0,89	1,09
Kimyasal madde zehirlenmesi	0,83	0,80	0,75	1,94	2,00	2,07	2,06	2,34	3,58
Gaz zehirlenmesi	1,03	1,44	1,28	1,12	1,09	1,26	1,41	1,66	1,41
Göçük altında kalma	0,69	0,42	0,50	0,85	0,46	0,57	0,44	0,62	0,28
Patlayıcı madde infilakı	1,03	0,64	3,07	7,92	2,73	2,43	2,65	3,06	1,57
İşkence veya kötü muamele	0,01	0,08	0,13	0,05	0,12	0,01	0,04	0,05	0,05
Doğal	11,00	11,83	14,16	20,42	18,91	23,40	30,34	35,42	33,94
Doğum sırasında	0,87	1,04	1,32	0,54	0,26	0,60	0,24	0,30	0,33
Ölüm nedeni bilinmeyenler	0,38	3,96	3,85	7,15	12,05	17,18	21,84	31,56	41,69
Diğer	50,61	63,70	52,81	49,25	55,67	68,79	66,92	69,96	84,15
Toplam	174,86	204,30	197,89	210,52	211,92	243,06	249,09	264,87	294,05

**BOYUNDA İKİ KESKİN KUVVET YARALANMASI; ÖLÜM ŞEKLİNİN
İNCELENMESİ**

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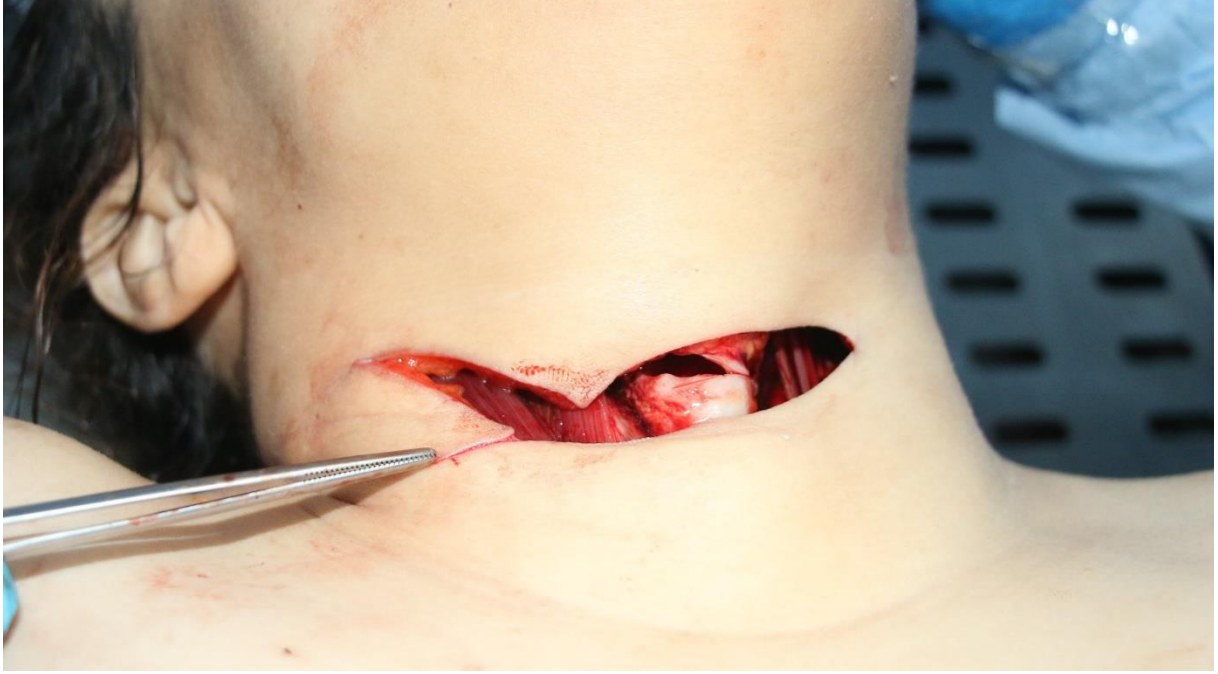
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Özet

Klasik otopsi bulguları ve olay yeri inceleme bulguları ile boyunda iki bıçak yaralanmasına bağlı ölüm vakası sunularak ölüm şeklinin (orijin) tartışılması amaçlandı. Olay yeri incelemesinde; 30 yaşında, psikiyatrik hastalık öyküsü tariflenen kadın olgunun mutfakta boynundan yaralanmış olarak yerde yattığı, yanında bıçak olduğu, ateşi yanan ocak üzerindeki tencerede yanmış yemek olduğu, olay yerinde boğuşma, dağınıklık bulguları olmadığı, cesedin boyun etrafında kan göllenmesi olduğu, bu göllenme dışında olay yerinde kan izi bulunmadığı, ellerinin kanlı olduğu, yalnızca kazağın boyna yakın yerlerinde kan bulaşlarının olduğu gözlemlendi. Boyunda iki adet kesici delici alet yaralanması olduğu, ilk yaralanmanın boyun orta hattın sol yanından başlayıp sağa ve hafif aşağı oblik uzandığı, boyun sol yanında daha derin seyrettiği, trakea kesisi ve solda vena jugularis interna kesisi oluşturduğu gözlemlendi (Resim). Diğer yaralanmanın ise boyun sağ tarafta yukarı doğru oblik uzandığı, alt ucunun ilk tarif edilen yara ile kesiştiği, yalnızca cilt ve kas seyirli olduğu gözlemlendi (Resim). Her iki akciğerde kan aspirasyonuna bağlı kaplan postu görünümü mevcuttu. İç organlar genel olarak soluk izlendi. Ölüm nedeni aşırı kan kaybı ve kan aspirasyonuna bağlı asfiksiydi. Boğazda tereddüt kesisi olmaması, iki tane kesici-delici alet yaralanması olması, ocakta yanmış yemek bulunması, genelde beklenen planlı intiharların olay örüntüsünden uzaklaştırarak, orijini cinayete doğru yaklaştırmaktadır. Bununla birlikte ilk yaralanmanın oblik seyri ve yara kuyruğu özelliği; yaralanmanın özelliği göz önünde bulundurulduğunda hareket kabiliyetinin bir süre devam edebileceği ön görülmesine rağmen olay yerinde boğuşmaya dair bulguya, cesedin bulunduğu yer dışında kan izine rastlanmaması; psikiyatrik hastalık öyküsü olması intiharı

düşündürmektedir. Tüm adli olaylarda olduğu gibi, ölümlü sonuçlanan adli olgularda da, tıbbi özgeçmiş, olay yeri incelemesi, yapılan adli ölü muayenesi ve otopsi işlemlerinin münferit değil, müşterek bir analizle değerlendirilmesi adli soruşturma süreçlerine katkı sunacaktır.



Resim: Boyunda iki keskin kuvvet yaralanması.

**HASTANELERDE BİLGİ GÜVENLİĞİ VE KALİTE SİSTEMİNİN HASTA
GÜVENLİĞİ ÜZERİNE ETKİSİ**

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Özet

Bir hastane bilgi sistemi, klinik bilgilere erişilebilirliği ve sağlık hizmetlerinin kalitesini iyileştirme potansiyeline sahiptir. Ancak, bu sistemin kullanımı, sağlık bilgilerinin güvenliği konusundaki endişeler gibi yeni zorluklarla sonuçlanmıştır. Araştırmamız Nisan 2022-Nisan 2023 12 aylık bir dönemini kapsamaktadır. Hastane bilgi güvenliğine ilişkin çalışanların ve hastaların görüş, öneri ve değerlendirmelerini tespit etmek amacıyla anket ve görüşmelerin kullanıldığı bu çalışmada ulaşılmıştır. Görüşmelerden elde edilen veriler analiz edilerek yorumlanmıştır. Bu doğrultuda uygulamada ortaya çıkan sorunlar ve çözüm önerileri bu görüşler doğrultusunda oluşturulmuştur. Araştırma sonucunda, katılımcıların yaygın olarak bilgi güvenliğinin önemini vurguladıkları ve bilgi güvenliği olgusunun öncelikle “hasta mahremiyeti” olgusuyla birlikte algılandığı tespit edilmiştir. Bilgi güvenliği yönetim sisteminin etkili işlemesi amacıyla, yöneticiler ve çalışanların işbirliği içinde olması araştırma sonuçlarına ilişkin geliştirilen önerilerden biridir. Başlarda zor ve anlamsız gözükten çalışmalar, sonrasında zamandan ve iş gücü bakımından tasarruf edildiği gözlemlenmiştir. Bir hastane bilgi sistemi, klinik bilgilere erişilebilirliği ve sağlık hizmetlerinin kalitesini iyileştirme potansiyeline sahiptir. Bu çalışmamız, üniversite hastanelerinde bilgi güvenliğinin durumunu idari, teknik ve fiziksel önlemler açısından değerlendirmeyi amaçlamaktadır.

Anahtar Kelimeler: bilgi güvenliği, bilgi güvenliği yönetimi, hastane bilgi sistemi

**ANESTEZİ VE REANİMASYON YOĞUN BAKIM ÜNİTESİNDE TRAVMA
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Özet

Çalışmamızda 2020-2022 yılları arasında Yoğun bakım üniteleri (YBÜ), potansiyel olarak yaşamı tehdit eden hastalıklarla uğraşan multidisipliner yapılardır. YBÜ’de tedavi edilen hastaların bir kısmını travma hastaları oluşturmaktadır. Çalışmada YBÜ’de tedavi ve takip ettiğimiz travma hastalarındaki mortalite nedenlerini inceledik. Bu çalışmada primer çıktı olarak travma nedeni ile kabul oranlarında ulusal ve uluslararası ölçekte farklılıklar ortaya çıkmış olup mortalite oranları düşük bulundu, travmatik yaralanmaların genç ve erkek cinsiyette daha fazla görüldüğü saptandı. Çalışmamızda; laktat düzeyi yüksekliği ile 27-95 günlük mortalitenin olumsuz olarak etkilendiği ve laktat düzeyi düşüklüğü ile hemodiyaliz ihtiyacının belirgin olarak azaldığı gösterildi. Erken enteral beslenmenin 27 ve 95 günlük mortalite üzerine olumlu etkisi ortaya konuldu. Travma hastalarının yoğun bakıma kabulü sırasında yüksek laktat, APACHE-2 ve düşük RTS düzeyi mortalite ile doğrudan ilişkilidir. Mortalitenin düşürülmesi açısından mekanik ventilasyonda kalış süresinin mümkün olduğunca kısaltılması hedeflenmelidir. Özellikle travma öyküsü olan ve periferik sinir bloğu yapılması planlanan hastalarda ameliyat öncesi nörolojik muayene hemen işlem öncesi hemen yapılmalı, ameliyat sonrası karşılaşılabilecek sinir hasarının ayırıcı tanısında bu çok önemlidir. Travmaya bağlı sinir hasarı görülen hastalarda erken dönemde nörolojik muayene normal iken, hastanın motor ve duyu muayenesinde değişiklikler olabilir ve bu durum gözden kaçabilir.

Anahtar Kelimeler: Travma, yoğun bakım, YBÜ mortalite

TRAVMATİK DAMAR YARALANMALARI VE TEDAVİ YAKLAŞIMI

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Özet

Travmatik damar yaralanmaları sadece harplerde değil, artık bugün sivil hayatta da sıklıkla karşılaştığımız, tedavisi özellikler isteyen bir konudur. Kliniğimizde tedavi edilen damar yaralanması olguların nedenleri, teşhis metodları, tedavisi ve sonuçlarına ait verileri tartışmaktır. 2014-2018 yılları arasında kliniğimize 31 damar yaralanması incelendi. 31 damar yaralanması incelendi. Bunlardan 30'u erkek, 1'i kadındı. 20 hasta kurşunlanma, 2 hasta camla kesi, 4 hasta bıçaklanma, 2 hasta saçma ile, 1 hasta silah namlusu parçası ile, 2 hasta taş ile yaralanmıştır. 23 vakada yaralanma alt extremitede, 8 vakada üst extremite- tede idi. 1 vakaya yaralanmadan 3 saat sonra, 1 vakaya 24 saat, 1 vakaya 5 gün sonra, ilk müdahale yapılmıştır. 8 tanesine yaralan- Badan hemen sonra ilk müdahale yapılmıştır. 12 tanesine ilk müdahale yapılmış fakat yaralanmadan ne kadar sonra olduğu belirsizdir. 8 vakanında ilk müdahale görüp görmediği tesbit edilememiştir. Periferik damar yaralanmalarında yaralanma şekli ve yeri, ek lezyon olup olmaması ve erken cerrahi girişim morbidite ve mortaliteyi belirleyen en önemli faktörlerdir.

Anahtar Kelimeler: arter, yaralanma, cerrahi

**RARE MUTATION IN ANDROJEN RECEPTOR GENE WITH A CASE OF
PRIMARY AMONERRHOEA**

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Abstract

Androgen insensitivity syndrome (AIS) is an X-linked recessive disorder associated with incompatible genotypes and phenotypes caused by mutations in the androgen receptor (AR) gene is located at Xq11-q12. We have detected a rare mutation in the AR gene that has not been reported in the literature. Clinical findings are female external genitalia at birth, abnormal secondary sexual development in puberty, infertility in individuals with a 46, XY karyotype as typically characterized AIS. In our case, a 17-year-old female phenotype presented with primary amenorrhoea and predominantly female external genitalia. The patient had 46, XY with female phenotype. We detected a missense rare mutation in the first exon as NM000044 c.5A>G variant was not found in ExAc or 1000 genome population database. Substituting at position 2 to glutamic acid exchange to glycine. Glutamic acid is a polar amino acid with a negative charge while glycine has stayed in a nonpolar hydrophobic group. So, we thought that the mutation may cause a physical defect in protein and the native three-dimensional structure of the AR gene

Keywords: Androgen receptor, primary amenorrhoea, sequence analysis

**A VARIANT OF C-KIT GENE IN VULVAR MELANOMA MAY BE A CHANCE OF
MOLECULAR THERAPY?**

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Abstract

Vulvar nodular melanoma is a rare type of vulvar cancer. In this research, a patient with vulvar nodular melanoma who had previously been operated on breast cancer was . The case was prepared to share pathological and medical genetic examinations and treatment of this case with professionals dealing with oncology. We studied somatic mutation panel on biopsy material by next gene DNA sequence technology. According to molecular genetics data, a pathogenic variant of the *c-KIT* gene was detected which had a therapeutic target in metastatic melanoma.

Keywords: Breast cancer, *c-KIT* gene, vulvar melanoma

**AESTHETIC REHABILITATION OF PATIENTS WITH ANTERIOR DIESTEMA
WITH PORCELAIN LAMINAS**

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Abstract

Introduction: Although the appearance of the smile has many factors, for a beautiful smile, the teeth, gums, lips and facial structure must be in harmony. The positive effect that the dentist will make on the appearance, outlook and general psychology of the prosthetic visits cannot be ignored. Diastema are spaces between two teeth due to various etiological factors. Polydiastema is the spaces between more than two teeth. Many methods are used in the aesthetic revision of polydiastema, from direct and indirect composite laminates and porcelain laminates to porcelain veneer crowns. Case description: The first of two patients who were admitted to our clinic had maxillary anterior polydiastema at the age of 19, the other had a large diastema between the maxillary central teeth at the age of 52, and both cases had aesthetic parts due to the female gingival level. Necessary treatment options were explained to our patients with good oral hygiene. Direct or indirect composite resins, which are aesthetic and easy to apply, guide their use in limited effects with enamel due to discoloration, microleakage, low elongation resistance and plaque uptake. Ceramic laminate coating; They are aesthetic, biocompatible, stable, predictable treatment results and minimal risk of gingival irritation. Both agreed on the porcelain laminate option. Conclusion: Gingival meeting was performed with Nd-YAG laser in both collections. Treatment of the maxillary anterior teeth with minimally invasive porcelain laminates was performed and 3-month follow-up photographs were taken.

Keywords; Lamina, Laser, Diastema

**BİR DEVLET HASTANESİNDE KAN TRANSFÜZYON MERKEZİNİN
İŞLEVSELLİĞİNİN DEĞERLENDİRİLMESİ**

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Özet

Giriş Transfüzyon Merkezi, kan veya kan bileşenine ihtiyacı olan hastaların kan tedariklerinin sağlandığı, kullanıma sunulmadan önce gerekli testlerinin yapıldığı hizmet birimidir. Transfüzyon, sağlık sorunu sebebiyle ihtiyacı olan hastaya tam kan ya da kan bileşeni nakli olarak tanımlanır. Kan ve kan bileşenlerinin tek kaynağı sağlıklı kan bağışçılardır. Transfüzyon, tam kan veya tam kanı oluşturan komponentlerin ayrı ayrı hazırlanmış ürünleri ile yapılır. Bu ürünlerden en çok kullanılanı eritrosit süspansiyonudur. Tam kanın trombosit zengin plazma kısmının ayrıştırılması (200-250 ml) ile elde edilir. Bu çalışmada Ocak 2018-Mart 2023 yılları arasında kan transfüzyon merkezinde yapılan işlemler incelenerek işlevselliğin değerlendirilmesi amaçlandı.

Yöntem Eskişehir Emre Devlet Hastanesi Kan Transfüzyon merkezinde Ocak 2018-Mart 2023 tarihleri arasında yapılan işlemler incelendi. Hastaların bu işlem öncesi serum hemoglobin düzeyleri kayıt altına alındı.

Bulgular Bu süreçte 35430 hastaya cross-match işlemi yapıp eritrosit süspansiyonu hazırlığı yapıldı. Bu işlem yapılmış olan hastalardan 21994' ne (%62,07) ise kan transfüzyonu yapıldı. Transfüzyon öncesi hastaların % 57 'de serum hemoglobin düzeyi <7 gr/dl, % 38'de serum hemoglobin düzeyi 7-10 gr/dl ve % 5'de serum hemoglobin düzeyi >10 gr/dl olarak saptandı. Hastalarda transfüzyon ilişkili hayatı tehdit edici reaksiyon gözlenmedi.

Sonuç: Her hastanın transfüzyon gereksinimi daha önceden belirlenmiş hemoglobin ve hematokrit değerine göre değil, hastanın klinik durumuna göre belirlenmelidir. Kan ürünü talep ederken hastanın kliniği ve işlemin riski gözönüne alınarak daha dikkatli talepte bulunulmalı. Bu durum hem iş gücü kaynağının daha etkin kullanılmasına hem de transfüzyon merkezinin işlevselliğinin artmasına katkı sağlayacaktır.

Anahtar Kelimeler: Transfüzyon, eritrosit süspansiyonu, transfüzyon merkezi, etkinlik

DELIVERY TIME PREDICTION USING SUPERVISED MACHINE LEARNING

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Abstract

Fast and reliable delivery in the e-commerce sector is becoming increasingly important with the growth of digital sales channels. Customers value delivery reliability and whether or not orders arrive on the stipulated day. Accurate prediction of delivery times in the e-commerce sector plays an important role in optimizing supply chain operations and customer experience. The aim of this study is to develop delivery time prediction models based on supervised machine learning algorithms. Prediction models have been developed using Extreme Gradient Boosting (XGBoost), Random Forest (RF) and Multi-Layer Perceptron (MLP). The dataset, which has been obtained from Kaggle, has 5113 rows and includes historical shipment data over the 16-month period between February 14th 2019 and June 13th 2020. The performance of the developed models has been evaluated using Mean Absolute Error (MAE) by utilizing 10-fold cross-validation on the dataset. Results show that the average MAE's of RF-based, XGBoost-based and MLP-based models are 3.50, 3.68 and 3.83, respectively.

Keywords: Delivery Time Prediction, Supervised Learning, E-commerce

**ORGANİZE SANAYİ BÖLGELERİNDE ENDÜSTRİYEL ATIKSULARIN GERİ
KAZANIMI**

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Özet

Su, insan hayatının ve canlılığın devam edebilmesi için temel unsurların başında gelmektedir. Günümüzde sanayileşmenin ve nüfusun fazla olmasıyla mevcut su kaynakları hızla tükenmekte ve kirlenmektedir. Küresel olarak çevre kirlenmesi devam ettikçe su sorunu artmaktadır. 2,3 milyar insan (küresel nüfusun %29'u) güvenli ve sağlık bir şekilde yönetilen suya erişimden yoksun olup 721 milyon insan ise yüksek ve kritik düzeyde su kıtlığı yaşayan ülkelerde yaşamaktadır. Diğer taraftan; sürekli olarak gelişen ve değişen sosyoekonomik faktörlerin, su kalitesinin bozulmasına ve su kıtlığı gibi zorluklarla dünyadaki su kaynakları üzerindeki baskıyı arttırmaktadır. Günümüzde küresel olarak su kaynaklarına yönelik talep önemli ölçüde artmaktadır. İnsanların çevre ile olan ilgilerinin artması sonucu küresel ekolojik çevre tüm dünya ülkelerinde daha fazla ilgi görmeye başlamış olup, bu durum toplumların atıksu geri kazanımına daha fazla önem vermesini sağlamaktadır. Atıksuların geri kazanımının artırılması, geri kazanılmış atıksuyu farklı alanlarda kullanım imkanlarının oluşturulması ve geri kazanımının teşvik edilmesi ile sağlanabilir. Geri kazanılmış suyun kullanımı, su kaynaklarının korunmasının önemli bir biçimi olup artan su talebinin karşılanması açısından büyük önem arz etmektedir. Her geçen gün toplumların ihtiyaçları sebebiyle endüstriyel üretim artmakta ancak atıksu arıtımı için kullanılan teknolojilerin pahalı olması sebebiyle işletmeler atıksularını kriterlere uygun şekilde arıtmamakta olup çevre doğrudan kirletilmektedir. Organize Sanayi Bölgeleri ise fabrikaların faaliyetlerinden kaynaklanan çevresel problemlerin en aza indirilmesi veya ortadan kaldırılması ve ekonomik açıdan geri kalmış bölgeler arası dengenin sağlanmasını amaçlayan bir sistemdir. Bu bağlamda çalışmada; organize sanayi bölgesi atıksu arıtma tesislerinin çıkış sularının yine organize sanayi bölgesi içindeki işletmelerde kullanım alternatifleri değerlendirilmiştir. Alternatiflerin değerlendirilmesi sürecinde çıkış sularının arıtılmış atıksuları kullanabilecek sektörlerin taleplerine göre ilave arıtma kademelerinden geçirilmesi düşünülmüştür. Böylece ilave arıtma kademelerinin maliyetleri ortaya konarak birim atıksu geri kazanım maliyeti belirlenmiştir.

Anahtar kelimeler: Atıksu, endüstriyel atıksu, su kıtlığı, geri kazanım, organize sanayi bölgesi

GÜL DEVRİMİ: EGZOTERİK KIRMIZI MI, ESOTERİK SİYAH MI, MAVİ MI?

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Özet

Tarih boyunca, fikirleri ve nitelikleri temsil etmek için semboller kullanılmıştır. Bazı şeylerin başka şeyleri temsil ettiği fikri oluşmuştur. Bir şeye, örneğin kırmızı gibi belirli bir renge bakılabilir ve bunun kırmızı rengin kendisini değil, onu aşan bir şeyi temsil ettiği sonucuna varılabilir. Örneğin kırmızı güller açısından tutkuyu, gerçek aşkı, romantizmi ve arzuyu sembolize eder. Kırmızı, ateş renginden dolayı sıcaklık anlamına gelir. Aynı şekilde, kanla kızardığında yüzün kızarıklığının artması nedeniyle öfke anlamına da gelebilir. Siyasi olarak, radikal bir değişimi veya devrimi ifade eder. Beyaz güller tipik olarak masumiyeti, sakinliği ve saflığı temsil eder ve ayrıca yeni bir başlangıcı da temsil edebilir. Beyaz gül, bir hatırlama sembolü olarak güven, sadakat ve saygı ile özdeşleştirilmiştir. Siyah güller neşeli anlamlarla ilişkilendirilmez ve bir dönemin bitişini, kapanmayı ve vedalaşmayı simgeler. Mavi aynı zamanda isyanın da rengidir. Gerçekte mavi güller doğal olarak yoktur; beyaz, gül renginde mavi, gerçekleştirilemez bir rüyayı, coşkuyu ve fanteziyi temsil eder. 2003 yılında Gürcistan muhalefeti Cumhurbaşkanı Şevardnadze'yi devirmiş ve bu iktidar değişikliği, siyasi muhalefet liderlerinin elinde kırmızı güller ile parlamentoda protesto gösterileri yapması nedeniyle 'Gül Devrimi' olarak tanımlanmıştır. Bu makale Gül Devrimi'nin gerçekten kırmızı mı, beyaz mı, siyah mı yoksa mavi mi olduğuna ışık tutacaktır.

Anahtar Kelimeler: Gürcistan, Devrim, Kafkasya, Rusya, Dış Politika

**INVESTIGATION OF RECYCLING METHODS OF POLYPROPYLENE FIBER
USED IN THE CARPET INDUSTRY**

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Abstract

Petroleum-based synthetic products are frequently used in both textile and other (plastic, packaging, construction, etc.) fields. The biodegradation time of these products takes centuries and the raw material is not renewable, which makes it necessary to recycle such products. Polypropylene fiber is a raw material that is preferred almost as much as polyester fiber in face-to-face carpet production due to its advantages such as lightness, cheapness and color fastness. Since polypropylene fiber has low resilience and static loading resistance, these carpets can be easily felted due to the traffic. Therefore beside these advantages the using life of polypropylene carpet is not very long. The amount of waste generated by petroleum-based polypropylene fiber, both after use and during production, is increasing day by day. Recycling the wastes released during the production process and during use will reduce the amount of petroleum to be used, thus reducing carbon emissions simultaneously. Polypropylene can be recycled in two ways as mechanical and chemical. The mechanical process can be done by converting the product back into fiber with a suitable opening machine, or by converting the products back into granules by extrusion. However, the products obtained in this way are not used as value-added products, but are generally used in the packaging industry or as textile filling material. The quality and market value of these products are equally low. With the recycling methods that can be provided by chemical means, polypropylene fiber is reused by converting it into raw material by pyrolysis process. Re-usability of these recycled fibers in the carpet industry by improving their mechanical properties with the necessary chemical treatments can make a significant contribution to the industry. In this study, the recycling methods of polypropylene fiber used in the carpet industry will be examined.

Keywords: Recycling, Polypropylene, Carpet

GEÇMİŞTEN GÜNÜMÜZE CAS... (CAS FROM PAST TO PRESENT...)

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Özet

Geleneksel mimaride, bölgenin yerel dokusunu oluşturan inşa malzemesi, malzemenin bulunabilirliğine bağlı, yakın çevrede mevcut halde olan doğal kaynaklardan temin edilmektedir. Dolayısı ile iklim koşullarına da bağlı olarak her bölgede farklılık göstermektedir. Ancak hala, diğer çağdaş yapı malzemeleriyle aynı düzeyde kullanılan en eski yapı malzemesi ve tekniklerinden biri kâgir duvardır. Yığma yapım tekniği, geleneksel olarak, yapıları kaplamak ve taşıyıcı sistem oluşturmak için popüler ve etkili bir yöntem olmuştur. Bugün, dünyadaki tarihsel ve kültürel açıdan önemli olan yapıların büyük bir bölümü bu teknik ile inşa edilmiştir. Taş, tuğla, kerpiç vb. yerel malzemeler ve yığma yapım tekniği ile inşa edilen kâgir duvarların örümünde bağlayıcı ya da dış duvarlarda sıva malzemesi olarak yine yerel malzemeye bağlı geliştirilen kâgir harçlar kullanılmaktadır. Dolayısı ile kâgir harçlar, evrensel kullanımı olan, özellikle de geleneksel yapılarda yapı elemanlarının inşasında ve farklı alanlarda uygulanan yerel bir inşa malzemesidir. Alçı-kireç ya da kil esaslı kâgir, hidrolik harçlar üretmek için doğal puzolanik agregaların yapılarda kullanımına, Roma döneminde keşfedildiğinden günümüze kadar sık rastlanılmaktadır. Bu harçların, tuğla inşa malzemesi ile örülen taşıyıcı duvarlarda bağlayıcı olarak kullanıldığı örnekler, dünyada çapında en çok kolonyal dönem yapılarında görülmektedir. Benzer şekilde moloz ve kesme taş ile inşa edilmiş geleneksel yapılarda da bu tür kâgir harç kullanımları yoğundur. Taş duvar-kâgir harç birlikteliği özellikle, 14.-19. y.y arasında inşa edilen yapılarda, farklı teknik ve uygulamalar ile karşımıza çıkmaktadır. Cas Evleri, Türkiye'nin Güneydoğu Anadolu Bölgesi'nde konumlu Siirt kentinde yer alan, çevrenin tüm zor etkilerine karşı direnmeyi başarıp günümüze kadar gelebilen, kentin tarihi dokusunu oluşturan yapılar arasında önemli bir değere sahip olan, yerli halk ve ustalar tarafından konut fonksiyonlu olarak inşa edilen, *cas*, *moloz taş* ve *yığma yapım tekniği* üçlü uyumunun birer örneğidir. Cas evleri, Siirt iline özgü, kendine has yapılarıdır. İki veya üç katlı olan bu evler, iklimsel konforu yüksek, çevreye zarar vermeyen, doğal, sürdürülebilir malzemelerden inşa edilen çevre dostu yapılarıdır. Günümüzde halen ayakta kalıp konut olarak kullanılan ya da hasar almaya başladığı için terk edilen evlerin örnekleri, hem kent merkezi hem de Siirt'e bağlı Aydınlar ilçe merkezinde bulunmaktadır. Bu evlerin inşa malzemesi olan cas harcı, alçı ve kireç taşlarının, moloz taşlardan arta kalan ufak taşlar ile birlikte önce fırınlarda (tandırda) pişirilmesi, daha sonra öğütülerek toz haline getirilmesi ile elde edilir.

Anahtar Kelimeler: Cas evler, geleneksel mimari, evrensel, kâgir, yığma, kireç-alçı taşı, kil

REGULARITY PROPERTIES FOR FRACTIONAL BOUSSINESQ EQUATIONS
AND APPLICATIONS

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Abstract

In this talk, we consider the Cauchy problem for the following fractional Boussinesq equation

$$u_t + \beta \Delta u + Au = f(u); x \in \mathbb{R}^n; t \in (0; T); \quad (1.1)$$

$u(x; 0) = \varphi(x), u_t(x; 0) = \psi(x); \quad (1.2)$

where β is a real number, A is a linear operator in a Banach space E , $u(x, t)$ is the E -valued unknown function, $f(u)$ is the given nonlinear function, $\varphi(x)$,

$\psi(x)$ are the given initial functions, and Δ denotes the Laplace operator in \mathbb{R}^n . Since the Banach space E is arbitrary and A is a possible linear operator,

by choosing E and A we can obtain numerous classes of generalized Boussinesq type equations which occur in a wide variety of physical systems,

The existence, uniqueness and regularity properties of solution of the Cauchy problem for the fractional abstract Boussinesq equation is obtained. First, we consider the linear Boussinesq equation and prove the existence, uniqueness and the regularity properties of solutions. It can be used to obtain the existence and uniqueness of the regular solution of corresponding nonlinear Boussinesq equation. By applying this result, the Cauchy problem for finite or infinite systems of Boussinesq equations are studied.

Keywords: Boussinesq equations, Semigroups of operators, Hyperbolic-operator equations; Cosine operator functions, Operator-valued multipliers

**EARLY USG AND DOPPLER FINDINGS IN CHILDREN OF MOTHERS WITH
HASHIMOTO'S DISEASE**

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AIM: Early diagnosis, treatment and follow-up are important in Hashimoto's thyroiditis. To detect early ultrasonography (USG) and Color Doppler (CDUSG) findings in children of mothers with Hashimoto's disease is to provide early diagnosis, treatment and follow-up.

METHODS: USG and CDUSG analyzes were performed using GE Logiq 730 pro, GE Logiq 9, GE Logiq S7 expert devices and 4-15MHz, 5-13MHz linear transducers. Both thyroid lobes and isthmus were examined in different planes. Vascularization characteristics were evaluated. In the presence of nodules, TI-RADS scoring was performed. In our study, USG and CDUSG examinations were performed on 34 mothers diagnosed with Hashimoto's disease and their 42 children in total, and the findings were investigated retrospectively.

RESULTS: The age range of the children is 4-13, the average is 7.5. 22 of them are girls and 20 of them are boys. Normal USG findings were observed in 11 (22.2%) of 42 children. In 16 (38.1%) children, TI-RADS 1 nodules not exceeding the millimeter size were found to be few in number. The gland in these children showed normal size and echopattern. Early-stage Hashimoto's findings were detected in 9 (21.4%) children. These findings can be summarized as diffuse heterogeneous pattern in the gland, patchy hypoechoic areas, pseudonodular infiltration areas, and hyperechogenic fibrous septal structures. No expansion or hypervascularization of the gland was detected in any of these cases. In 6 (14.3%) children, TI-RADS 1 micronodules were detected in addition to early Hashimoto findings.

DISCUSSION: Hashimoto's thyroiditis, also known as chronic autoimmune thyroiditis or chronic lymphocytic thyroiditis. Although it is most common in middle-aged women, it is the most common thyroiditis in childhood and is the main cause of acquired hypothyroidism. Hashimoto's disease affects about 1% of children. It is characterized by the destruction of thyroid follicles due to various cell and antibody-mediated immune processes and lymphocytic infiltration. It is thought to occur with the effect of environmental factors in individuals with

etiologically genetic predisposition. In undiagnosed hypothyroid children, slow growth rate can be seen. Additional symptoms include weakness, pallor, dry and itchy scalp, increased sensitivity to cold, and constipation. If left untreated, it can have devastating consequences such as physical growth retardation and mental retardation. Hypothyroidism can occur in children of any age, even infants, with thyroid problems. In addition, the most common endocrine disorder among school-age children is thyroid-related. It is known that Hashimoto's disease can progress asymptotically for years. This further increases the importance of early diagnosis.

CONCLUSION: Early stage findings can be detected by using USG + RDUSG, which is a noninvasive method, for screening purposes in children of mothers diagnosed with Hashimoto's. Thus, the cases have a chance to be treated and followed up in the early period.

Keywords; Hashimoto, Ultrasonography, Doppler, Children

FULL TEXT

EXPRESSING GENES of CANOLA (*Brassica napus* L.): A REVIEW

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Abstract

Canola is one of the most important oilseed crops worldwide. Over the last few decades, research focusing on canola seed oil content and composition has expanded. Identifying genetic variation that increases crop yields is a primary objective in plant breeding. Genetic engineering, to some extent, can overcome the limitations of genetic exchange in conventional breeding. Here reader may find a review of molecular mechanisms underlying the canola plant's response to biotic and abiotic stress factors and yield and oil quality in brief.

Keywords: Genes, expression, canola, rapeseed, *Brassica napus* L., biotechnology

Introduction

Brassicaceae includes numerous vital oils, vegetables, feed crops, and attractive horticultural plants, making it a very significant genus (Wang et al., 2020). *Brassica napus* ($2n=38$, AACC) is a significant oilseed crop in the globe. Breeding programs for *B. napus* (canola, rapeseed) have a primary goal of increasing oil yield. Oil yield in canola is measured by seed yield and oil content at the same time. A great deal of effort has gone into finding a germplasm and hybrid cross with a higher seed oil content (Qu et al., 2013). Rapeseed is a major oil crop in many parts of the world. It is critical to develop new varieties with higher seed output and increased stress tolerance for better response to abiotic challenges caused by global climate change for present production. To some extent, genetic engineering can overcome the restrictions of genetic exchange in traditional breeding. As a result, it is regarded as a viable strategy for improving modern canola crop breeding. Because crop stress resistance is a polygenic complex trait, the only way to acquire comprehensive stress resistance in crops is through multi-gene synergistic effects (Wang et al., 2018).

MicroRNAs (miRNAs) and small interfering RNAs are important regulators of plant development and seed formation. Increasing numbers of small RNAs have been identified as regulatory RNAs that modulate gene expression at both the transcriptional and posttranscriptional levels (Zhao et al., 2012). Small RNAs include two main types of small non-coding RNAs, microRNAs (miRNAs) and small interfering RNAs (siRNAs). The recently published genome of *Brassica napus* offers for the first time the opportunity to gain insights into the genomic organization and the evolution of miRNAs in oilseed rape. 12 small RNA libraries from two *B. napus* cultivars and their four double-haploid lines were sequenced, employing the newly sequenced *B. napus* genome, together with genomes of its progenitors *Brassica rapa* and *Brassica oleracea* by Shen et al., (2015). A total of 645 miRNAs including 280 conserved and 365 novel miRNAs were identified. Comparative analysis revealed a high level of genomic conservation of MIRNAs (75.9%) between the subgenomes of *B. napus* and its two progenitors' genomes, and MIRNA lost/gain events (133) occurred in *B. napus* after its speciation.

Yield and oil quality

Identifying genetic variation that increases crop yields is a primary objective in plant breeding. Miller et al., (2019) used association analyses of oilseed rape accessions to identify genetic variation that influences seed size, lipid content, and final crop yield. Variation in the promoter region of the HECT E3 ligase gene BnaUPL3.C03 made a major contribution to variation in

seed weight per pod, with accessions exhibiting high seed weight per pod having lower levels of BnaUPL3.C03 expression. Researchers defined a mechanism in which UPL3 mediated the proteasomal degradation of LEC2, a master transcriptional regulator of seed maturation. Accessions with reduced UPL3 expression had increased LEC2 protein levels, larger seeds, and prolonged expression of lipid biosynthetic genes during seed maturation. Natural variation in BnaUPL3.C03 expression appears not to have been exploited in current *B. napus* breeding lines and could therefore be used as a new approach to maximize future yields in this important oil crop.

Well-developed seedlings lead to a higher yield stability even under suboptimal growing conditions like reduced nutrient input or drought stress. An optimal seedling development of *Brassica napus* plants leads to a higher yield stability even under suboptimal growing conditions and has therefore a high importance for plant breeders. Körber et al., (2015) examined the expression levels of candidate genes in seedling leaves of *B. napus*, correlated these with seedling development and detected genome regions associated with gene expression levels and seedling development traits in *B. napus* by genome-wide association mapping. The candidate genes GER1, AILP1, PECT, and FBP were strongly correlated with the seedling development traits. They detected a total of 63 associations between single nucleotide polymorphisms (SNPs) and the seedling development traits and 31 SNP-gene associations for the candidate genes. The results suggested that the studied genes ribulose 1,5-bisphosphate carboxylase/oxygenase small subunit (RBC) on the chromosomes A4 and C4 and fructose-1,6-bisphosphatase precursor (FBP) on the chromosomes A9 and C8 are cis-regulated.

Over the last few decades, research focusing on canola (*Brassica napus* L.) seed oil content and composition has expanded. Oil production and accumulation are influenced by genes participating in embryo and seed development (Elahi et al., 2016).

Developing yellow-seeded rapeseed with improved qualities is a major breeding goal. The intermediate and final metabolites of the phenylpropanoid and flavonoid pathways affect not only oil quality but also seed coat colour of *B. napus*. The accumulation of phenolic compounds was analysed in the seed coats of black-seeded (ZY821) and yellow-seeded (GH06) *B. napus* by Qu et al., (2013). Two and 13 unique flavonol derivatives were detected in ZY821 and GH06, respectively. Quantitative real-time PCR analysis revealed significant differences between ZY821 and GH06 in the expression of common phenylpropanoid biosynthetic genes (BnPAL and BnC4H), common flavonoid biosynthetic genes (BnTT4 and BnTT6), anthocyanin- and proanthocyanidin-specific genes (BnTT3 and BnTT18), proanthocyanidin-

specific genes (BnTT12, BnTT10, and BnUGT2) and three transcription factor genes (BnTTG1, BnTTG2, and BnTT8) that function in the flavonoid biosynthetic pathway.

Fatty acid desaturase 2 (FAD2), which resides in the endoplasmic reticulum (ER), plays a crucial role in producing linoleic acid (18:2) through catalyzing the desaturation of oleic acid (18:1) by double bond formation at the delta 12 position. FAD2 catalyzes the first step needed for the production of polyunsaturated fatty acids found in the glycerolipids of cell membranes and the triacylglycerols in seeds. Four FAD2 genes from amphidiploid *Brassica napus* genome were isolated by PCR amplification, with their enzymatic functions predicted by sequence analysis of the cDNAs by Lee et al., (2013). Fatty acid analysis of the FAD2 genes showed that whereas BnFAD2-1, BnFAD2-2, and BnFAD2-4 are functional enzymes, and BnFAD2-3 is nonfunctional. The BnFAD2-3 gene of *B. napus*, a nonfunctional pseudogene mutated by multiple nucleotide deletions and insertions, was inherited from *B. rapa*. All BnFAD2 isozymes except BnFAD2-3 localized to the ER. Nonfunctional BnFAD2-3 localized to the nucleus and chloroplasts.

Biotic factors

Canola is susceptible to infection by the biotrophic protist *Plasmodiophora brassicae*, the causal agent of clubroot. To understand the roles of microRNAs (miRNAs) during the post-transcriptional regulation of disease initiation and progression, Verma et al., (2014) have characterized the changes in miRNA expression profiles in canola roots during clubroot disease development and have compared these to uninfected roots. *P. brassicae* responsive miRNAs were identified and validated. Putative target genes identified in this study were transcription factors (TFs), hormone-related genes, as well as genes associated with plant stress response regulation such as cytokinin, auxin/ethylene response elements.

Brassica napus is one of the most important oil crops in the world, and stem rot caused by the fungus *Sclerotinia sclerotiorum* results in major losses in yield and quality. To elucidate resistance genes and pathogenesis-related genes, genome-wide association analysis of 347 accessions was performed by Wei et al., (2016). Researchers identified 17 significant associations for stem resistance on chromosomes A8 and C6, five of which were on A8 and 12 on C6. Transcriptome analysis suggested that *S. sclerotiorum* infection activates the immune system, sulphur metabolism, especially glutathione (GSH) and glucosinolates in both R and S genotypes. Genes found to be specific to the R genotype related to the jasmonic acid pathway, lignin biosynthesis, defence response, signal transduction and encoding transcription factors.

Twenty-four genes were identified in both the SNP-trait association and transcriptome sequencing analyses, including a tau class glutathione S-transferase (GSTU) gene cluster.

Verticillium longisporum is host specific to members of the family *Brassicaceae*, including oilseed rape. The fungus infects through the roots and causes stunting and early senescence of susceptible host plants and a marked decrease in crop yield. Singh et al., (2012) showed that *V. longisporum* reacts to the presence of *B. napus* xylem sap with the production of six distinct upregulated and eight downregulated proteins visualized by two-dimensional gel electrophoresis. Identification of 10 proteins by mass spectrometry revealed that all upregulated proteins are involved in oxidative stress response. The *V. longisporum* catalase peroxidase (VICPEA) was the most upregulated protein. Catalase peroxidase was found to play a role in protecting the fungus from the oxidative stress generated by the host plant at an advanced phase of the disease.

Abiotic factors

To investigate genes that are involved in response to abiotic stresses in *Brassica napus*, a comprehensive survey of genes induced by high-salinity and drought stresses was done by Chen et al., (2010). In total, 536 clones were identified to be putative high-salinity- or drought-responsive genes. Among them, 172 and 288 clones are detected to be putative high-salinity- and drought-inducible genes, whereas 141 and 189 are candidates for high-salinity- and drought-suppressed genes, respectively. The functional classification of these genes are indicated that belonged to gene families encoding metabolic enzymes, regulatory factors, components of signal transduction, hormone responses, some abiotic stresses-related proteins, and other processes related to growth and development of *B. napus*.

The WRKY gene family is one of the most extensively studied transcription-factor gene families in plants. WRKY transcription factors play important roles in responses to environmental stress stimuli. Using a genome-wide domain analysis, He et al., (2016) identified 287 WRKY genes with 343 WRKY domains in the sequenced genome of *Brassica napus*, 139 in the A sub-genome and 148 in the C sub-genome. These genes were classified into eight groups based on phylogenetic analysis. In the 343 WRKY domains, a total of 26 members showed divergence in the WRKY domain, and 21 belonged to group I. This finding suggested that WRKY genes in group I are more active and variable compared with genes in other groups. Most of the genes were induced by low temperature, salinity and drought stress, indicating that the WRKYs play important roles in *B. napus* stress responses. Further, three *BnaWRKY* genes were strongly responsive to the three multiple stresses simultaneously, which suggests that

these 3 WRKY may have multi-functional roles in stress tolerance and can potentially be used in breeding new rapeseed cultivars.

Flavonoids with antioxidant effects confer many additional benefits to plants. Evidence indicates that flavonoids, including anthocyanins, protect tissues against oxidative stress from various abiotic stressors. Kim et al., (2017) determined whether increases in anthocyanins increased abiotic stress tolerance in *Brassica napus*. Increased dihydroflavonol-4-reductase (DFR) transcript levels for AtDFR-OX *B. napus* shoots correlated with higher anthocyanin accumulation. The AtDFR gene can be effectively manipulated to modulate salinity and drought stress tolerance by directing to high accumulation of anthocyanins in oilseed plants.

MADS-box transcription factors are important for plant growth and development, and hundreds of MADS-box genes have been functionally characterized in plants. Wu et al., (2018) identified 307 potential MADS-box genes (BnMADSs) in the *B. napus* genome and categorized them. Promoter cis-element analyses indicated that BnMADSs may respond to various stressors (drought, heat, hormones) and light. Expression analyses showed that homologous genes in a given subfamily or sister pair are highly conserved, indicating widespread functional conservation and redundancy.

GRAS proteins are an important family of transcription factors (TF) in plants. Genome-wide identification, classification, expression analyses, and functional characterization of GRAS genes in oil crop, *Brassica napus*, indicate their importance in root development and stress response. GRAS proteins are a plant-specific transcription factor gene family involved in tissues development and stress response. Guo et al., (2019) classified 87 putative GRAS genes in the *Brassica napus* genome (BnGRASs) into 13 subfamilies by phylogenetic analysis. A total of 868 pairs of interaction proteins were predicted, the primary of which were transcription factors involved in transcriptional regulation and signal transduction. Most BnGRASs were widely expressed in different tissues/organs at different stages in *B. napus*, and 24 BnGRASs were highly/specifically expressed in roots. Results from a qRT-PCR analysis suggested that two BnGRASs belonging to SCR and LISCL subfamilies potentially have important roles in the stress response of roots.

L-Cysteine desulphydrase (DES; EC 4.4.1.1) is the most important enzyme that catalyzes the decomposition of L-cysteine to pyruvate, ammonia, and hydrogen sulfide (H₂S), the latter of which has recently been recognized as the third gasotransmitter for multiple signaling events in plants. A rapeseed DES gene was isolated and sequenced by Xie et al., (2013). This protein predominantly catalyzes the breakdown of L-cysteine with the side reaction of L-cysteine

synthesis [O-acetyl-L-serine(thiol)lyase activity], and was designated as BnDES1. Molecular evidence showed that BnDES1 mRNA was widely expressed, but with the higher expression level in flowers. Further results showed that the BnDES1 transcripts were differentially up-regulated by several plant growth regulators and chemicals. Overall, the above findings provide evidence showing that BnDES1 is a potentially important enzyme responsible for the H₂S production, and may play an important role in plant growth regulators and chemical stimuli responses.

Transcription factors (TFs) regulate gene expression by recognizing and combining cis-acting elements on the promoter regions of target genes. Transcription factors GATAs are involved in plant developmental processes and respond to environmental stresses through binding DNA regulatory regions to regulate their downstream genes. The release of the reference genome of *B. napus* provides a good opportunity to perform a genome-wide characterization of GATA family genes in rapeseed. 96 GATA genes randomly distributing on 19 chromosomes were identified in *B. napus*, which were classified into four subfamilies based on phylogenetic analysis and their domain structures by Zhu et al., (2020). BnGATAs showed different expression patterns in various tissues and under diverse abiotic stresses. Single nucleotide polymorphisms (SNPs) distributions of BnGATAs in a core collection germplasm are probably associated with functional disparity under environmental stress condition in different genotypes of *B. napus*.

Catalase (CAT) is an antioxidant enzyme expressed by the CAT gene family and exists in almost all aerobic organisms. Environmental stresses induce the generation of reactive oxygen species (ROS) that eventually hinder plant growth and development. The CAT enzyme translates the hydrogen peroxide (H₂O₂) to water (H₂O) and reduce the ROS levels to shelter the cells' death. A genome-wide comprehensive analysis was conducted to classify the CAT genes in the rapeseed genome by Raza et al., (2021). They identified 14 BnCAT genes in the rapeseed genome. They identified five hormone-correlated responsive elements and four stress-related responsive elements. Further, six putative bna-miRNAs were also identified, targeting three genes (BnCAT4, BnCAT6, and BnCAT8). BnCAT genes were largely related to cellular organelles, ROS response, stimulus response, stress response, and antioxidant enzymes. Almost 10 BnCAT genes showed higher expression levels in different tissues, i.e., root, leaf, stem, and silique. The expression analysis showed that BnCAT1–BnCAT3 and BnCAT11–BnCAT13 were significantly upregulated by cold, salinity, abscisic acid (ABA), and gibberellic acid (GA)

treatment, but not by drought and methyl jasmonate (MeJA). Notably, most of the genes were upregulated by waterlogging stress, except BnCAT6, BnCAT9, and BnCAT10.

Phosphate (Pi) transporters play critical roles in Pi acquisition and homeostasis. In total, 49 PHT1 family members were identified in *B. napus*, including 27 genes in the A subgenome and 22 in the C subgenome by Li et al., (2019). Most of the PHT1 proteins were predicted to localize to the plasma membrane. Broad range of expression patterns of individual BnaPHT1 genes occurred in response to phosphorus (P) deficiency. The expression levels of BnaPHT1 genes can be regulated by different nutrient stresses, including nitrogen (N), potassium (K), sulfur (S) and iron (Fe) stresses. Moreover, salt and drought stresses can regulate the transcript abundances of BnaPHT1s, as well as phytohormones including auxin and cytokinin. The results indicate that BnaPHT1s might be involved in cross-talk for sensing the external status of P, N, K, S and Fe, as well as salt and drought stresses. Moreover, these processes might be mediated by phytohormones.

Calmodulin (CaM) and calmodulin-like (CML) proteins are primary calcium (Ca²⁺) sensors and are involved in the regulation of plant development and stress responses by converting calcium signals into transcriptional responses, protein phosphorylation, or metabolic changes. 25 BnaCaM and 168 BnaCML genes were identified in *B. napus* by He et al., (2020). BnaCaMs genes are highly and ubiquitously expressed in all of the organs and tissues examined, while distinct BnaCMLs are expressed specifically in particular organs and tissues. In total, 129 BnaCaM/CML were induced by abiotic stress and phytohormones. BnaCMLs from group IV, VI, VIII, and X were strongly induced by freezing treatment, but were not or just slightly induced by chilling treatment.

References

- Chen, L., Ren, F., Zhong, H., Jiang, W., & Li, X. (2010). Identification and expression analysis of genes in response to high-salinity and drought stresses in *Brassica napus*. *Acta Biochim Biophys Sin*, 42(2), 154-164.
- Elahi, N., Duncan, R. W., & Stasolla, C. (2016). Modification of oil and glucosinolate content in canola seeds with altered expression of *Brassica napus* LEAFY COTYLEDON1. *Plant physiology and Biochemistry*, 100, 52-63.
- Guo, P., Wen, J., Yang, J., Ke, Y., Wang, M., Liu, M., ... & Du, H. (2019). Genome-wide survey and expression analyses of the GRAS gene family in *Brassica napus* reveals their roles in root development and stress response. *Planta*, 250(4), 1051-1072.
- He, X., Liu, W., Li, W., Liu, Y., Wang, W., Xie, P., ... & Hua, W. (2020). Genome-wide identification and expression analysis of CaM/CML genes in *Brassica napus* under abiotic stress. *Journal of Plant Physiology*, 255, 153251.
- He, Y., Mao, S., Gao, Y., Zhu, L., Wu, D., Cui, Y., ... & Qian, W. (2016). Genome-wide identification and expression analysis of WRKY transcription factors under multiple stresses in *Brassica napus*. *PloS one*, 11(6), e0157558.
- Kim, J., Lee, W. J., Vu, T. T., Jeong, C. Y., Hong, S. W., & Lee, H. (2017). High accumulation of anthocyanins via the ectopic expression of *AtDFR* confers significant salt stress tolerance in *Brassica napus* L. *Plant Cell Reports*, 36(8), 1215-1224.
- Körber, N., Bus, A., Li, J., Higgins, J., Bancroft, I., Higgins, E. E., ... & Stich, B. (2015). Seedling development traits in *Brassica napus* examined by gene expression analysis and association mapping. *BMC plant biology*, 15(1), 1-21.
- Lee, K. R., Sohn, S. I., Jung, J. H., Kim, S. H., Roh, K. H., Kim, J. B., ... & Kim, H. U. (2013). Functional analysis and tissue-differential expression of four FAD2 genes in amphidiploid *Brassica napus* derived from *Brassica rapa* and *Brassica oleracea*. *Gene*, 531(2), 253-262.
- Li, Y., Wang, X., Zhang, H., Wang, S., Ye, X., Shi, L., ... & Ding, G. (2019). Molecular identification of the phosphate transporter family 1 (PHT1) genes and their expression profiles in response to phosphorus deprivation and other abiotic stresses in *Brassica napus*. *PLoS One*, 14(7), e0220374.
- Miller, C., Wells, R., McKenzie, N., Trick, M., Ball, J., Fatihi, A., ... & Bevan, M. W. (2019). Variation in expression of the HECT E3 ligase UPL3 modulates LEC2 levels, seed size, and crop yields in *Brassica napus*. *The Plant Cell*, 31(10), 2370-2385.
- Qu, C., Fu, F., Lu, K., Zhang, K., Wang, R., Xu, X., ... & Li, J. (2013). Differential accumulation of phenolic compounds and expression of related genes in black-and yellow-seeded *Brassica napus*. *Journal of experimental botany*, 64(10), 2885-2898.
- Raza, A., Su, W., Gao, A., Mehmood, S. S., Hussain, M. A., Nie, W., ... & Zhang, X. (2021). Catalase (CAT) gene family in rapeseed (*Brassica napus* L.): Genome-wide analysis, identification, and expression pattern in response to multiple hormones and abiotic stress conditions. *International journal of molecular sciences*, 22(8), 4281.
- Shen, E., Zou, J., Hubertus Behrens, F., Chen, L., Ye, C., Dai, S., ... & Fan, L. (2015). Identification, evolution, and expression partitioning of miRNAs in allopolyploid *Brassica napus*. *Journal of Experimental Botany*, 66(22), 7241-7253.
- Singh, S., Braus-Stromeyer, S. A., Timpner, C., Valerius, O., von Tiedemann, A., Karlovsky, P., ... & Braus, G. H. (2012). The plant host *Brassica napus* induces in the pathogen *Verticillium longisporum* the expression of functional catalase peroxidase which is required for the late phase of disease. *Molecular plant-microbe interactions*, 25(4), 569-581.

- Verma, S. S., Rahman, M. H., Deyholos, M. K., Basu, U., & Kav, N. N. (2014). Differential expression of miRNAs in Brassica napus root following infection with Plasmodiophora brassicae. *PLoS One*, 9(1), e86648.
- Wang, T., Hu, J., Ma, X., Li, C., Yang, Q., Feng, S., ... & Song, X. (2020). Identification, evolution and expression analyses of whole genome-wide TLP gene family in Brassica napus. *BMC genomics*, 21(1), 1-14.
- Wang, Z., Yang, C., Chen, H., Wang, P., Wang, P., Song, C., ... & Wang, D. (2018). Multi-gene co-expression can improve comprehensive resistance to multiple abiotic stresses in Brassica napus L. *Plant Science*, 274, 410-419.
- Wei, L., Jian, H., Lu, K., Filardo, F., Yin, N., Liu, L., ... & Li, J. (2016). Genome-wide association analysis and differential expression analysis of resistance to Sclerotinia stem rot in Brassica napus. *Plant Biotechnology Journal*, 14(6), 1368-1380.
- Wu, Y., Ke, Y., Wen, J., Guo, P., Ran, F., Wang, M., ... & Du, H. (2018). Evolution and expression analyses of the MADS-box gene family in Brassica napus. *PLoS One*, 13(7), e0200762.
- Xie, Y., Lai, D., Mao, Y., Zhang, W., Shen, W., & Guan, R. (2013). Molecular cloning, characterization, and expression analysis of a novel gene encoding L-cysteine desulfhydrase from Brassica napus. *Molecular biotechnology*, 54(3), 737-746.
- Zhao, Y. T., Wang, M., Fu, S. X., Yang, W. C., Qi, C. K., & Wang, X. J. (2012). Small RNA profiling in two Brassica napus cultivars identifies microRNAs with oil production-and development-correlated expression and new small RNA classes. *Plant Physiology*, 158(2), 813-823.
- Zhu, W., Guo, Y., Chen, Y., Wu, D., & Jiang, L. (2020). Genome-wide identification, phylogenetic and expression pattern analysis of GATA family genes in Brassica napus. *BMC Plant Biology*, 20(1), 1-12.

**SILAGE NOTES: FERMENTATION & MYCOTOXIN ECOLOGY AND
SEQUENCING TOOLS**

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Abstract

The evaluation of silage quality is frequently dependent on identifying the characteristics of fermentation and changes in microbial compositions. Silage dry matter content, water soluble carbohydrate concentration, and bacterial counts are typical indicators. However, this evaluation procedure is time-consuming and occasionally unreliable. To increase the nutrient content of these feeds, it is important to describe the microbial populations that are present in silage and comprehend how they change throughout ensiling. Mycotoxins in feed are subject to rules and regulations in almost 100 different nations. The bacterial microbiota of silages can be measured using real-time polymerase chain reaction analysis.

Keywords: Silage, ensilage, fermentation, mycotoxin, sequencing

1. Introduction

Ensilage is a fermentative technique that uses a number of different types of microorganisms to preserve animal feed (forage, cereal grains, and byproducts) (Carvalho et al., 2021). Forage crops can be preserved as silage using a fermentation process that lowers the pH and maintains the fresh crop nutritional content. The primary mechanism is the lactic acid bacteria's synthesis of lactic acid as a byproduct of the fresh crop's water-soluble carbohydrate digestion. However, a variety of fermentations may take place in the silo environment, and this depends on the substrate availability, the microbial populations, the moisture level, and the crop's ability to act as a buffer during ensiling. As it influences both the animal performance and the nutritional quality of the silage, fermentation is a significant step in the ensiling process. If the fermentation does not take place as instructed and undesired fermentations develop, the feed will be completely spoiled and could provide a health concern to both humans and animals. Ruminant animals can consume well-fermented silage in their feeds without any risk to their health or reduction in performance (da Silva et al., 2017).

Knowledge of the variety of prokaryotes and eukaryotes in silage has increased as a result of improvements in microorganism identification techniques. Such information has improved our understanding of how fermentation works in forage crops with various properties and how to optimise the procedure to improve silage quality. Insufficient fermentation might allow undesirable microorganisms to flourish in silage. There is still a lack of information regarding the effects of these metabolites on the health of animals who ingest silage, despite the possibility that these microorganisms are pathogenic and/or produce hazardous metabolic chemicals. Main goal with ensilages is to provide high-quality feed that is hygienic, nutritious, stable, and has a high dry matter recovery rate while requiring no intervention during fermentation and having a wide range of substrate properties. Every substrate has unique characteristics, and we can only improve fermentation if we thoroughly understand microbial variety (Avila & Carvalho, 2020).

Since mycotoxins in feed might result in the presence of their metabolic products in dairy products, which will eventually have an impact on human health, primarily infants, the problem of fungus and mycotoxins in silage goes beyond animal diseases or production losses. Another issue is that, while many of the fungi found in silos are opportunist infections, some of them, like *A. fumigatus*, are epidemiologically significant and provide a significant danger of contamination to agricultural workers who handle them poorly. More information will reveal

the impacts of these microbiota on the production and/or degradation of the mycotoxins found in silage (Alonso et al., 2013).

2. Silage fermentation

When compared to a fresh crop, silage is intended to offer a steady diet with a high recovery of dry matter, energy, and highly digestible nutrients. Numerous end products are produced by microbial fermentation in the silo, which also alters several fodder nutritional characteristics. Silage of high quality should be free of unfavourable substances that can harm the environment, farm income, or animal performance. Forages' soluble carbohydrates ferment in the absence of oxygen, producing a range of byproducts that ultimately lead to the silage preservation of a forage crop. Evaluations of silage fermentations are mostly based on measuring pH and estimating the synthesis of organic acids and alcohols. Other elements that are frequently measured in silages include mycotoxins and various nitrogenous compounds, if required. Although it was widely believed that the chemical reactions taking place in a silo quickly reach a steady state after a few weeks of fermentation, it is now evident that some components continue to undergo relatively minor but significant changes for months, and these changes can have an impact on the quality of the silage. In general, information from analyses of silage fermentation can be utilised to identify whether an excellent, average, or bad fermentation has taken place. Based on these analyses, good assumptions can be made that can be used to explain various outcomes. For example, parameters like moisture level, buffering capacity, sugar content, and the types of organisms that predominated the process can often be used to describe the fermentation that a crop experiences. Silage fermentation and subsequent quality can also be impacted by management parameters as additive type, packing speed, covering management, pack density, chop length, and silo management during feed-out. In rare instances, fermentation analyses can provide a qualitative explanation for low intakes or inadequate nutritive value. The easiest technique to assess the quality of silage is to take a suitable sample and contact an approved analytical laboratory to perform both fermentative and nutritional evaluations. The amounts of organic acids, alcohols, and $\text{NH}_3\text{-N}$, as well as the size of different microbial populations, are the most typical metrics used to assess silage fermentation. An ensiled sample's pH is an indicator of how acidic it is. After being chopped, whole-plant maize and alfalfa have pH values that vary from about 5.5 to 6. Since it is about 10 to 12 times stronger than any of the other major acids present in silages, such as acetic acid (pKa of 4.75) and propionic acid (pKa of 4.87), during ensiling, lactic acid (pKa of 3.86),

produced by lactic acid bacteria (LAB), is typically the acid found in the highest concentration in silages (Kung Jr et al., 2018).

Epiphytic lactic acid bacteria (LAB) utilize water-soluble carbohydrates present in ensiled plants and metabolize them into lactic acid, with a lesser extent of acetic acid which can lower the pH of the silage and prevent undesirable microbial growth, allowing them to be stored for a long time (Soundharajan et al., 2021). Lactic acid concentrations typically range from 2 to 4% of the DM in frequently fed silages, although they can be significantly higher in silages with low DM concentrations (30%). Lactic acid from silage is transformed to propionic acid in the rumen under typical feeding circumstances. The amount of lactic acid present and the crop's ability to act as a buffer are the two parameters most closely related to the final pH of silage. Maize silages have a lower final pH (3.7–4.0) than legume silages (4.3–5.0). Because clostridial organisms can flourish under moist environments (30-35% DM) and convert lactic to butyric acid, the concentration of lactic acid in legumes may drop as silage DM falls below 35 to 40%. As opposed to legumes, which have a higher pH, maize silages have a lower pH, which inhibits the formation of clostridia. Not all wet legume silages, as previously mentioned, succumb to clostridial fermentations, though the likelihood of this occurrence increases when the moisture level is above 70%. Thus, the recommended values for lactic acid for crops below 30 to 35% DM. Silages with higher-than-average pH levels can be triggered by a wide range of sources. A higher than expected pH may be caused by, for instance, an exceptionally high buffering capacity (found, for instance, in bean silages with extremely high protein and ash contents) or a restricted fermentation (found, for instance, under cold climatic circumstances). The second-highest concentration of acids in silage, typically between 1% and 3% of DM, is acetic acid. Similar to lactic acid, the relationship between acetic acid concentration and DM level is often inverse. When a ruminant consumes silage, the acetic acid can either be absorbed from the rumen and used as energy or it can be converted to milk or body fat. Because yeasts are inhibited by moderate levels of acetic acid in silage, the stability of the product when exposed to air is improved. In fact, when exposed to air, silages with extremely low acetic acid contents may become unstable. Because of the previously mentioned conversion of lactic to acetic acid, silages treated with *L. buchneri* frequently have acetic acid concentrations that are moderately higher than normal (about 3-4%). Because acetic acid has potent antifungal properties, an increase in acetic acid results in an improvement in aerobic stability. Due to protracted fermentations, legume silages with high ash contents (>15%) can occasionally have extremely high acetic acid levels. In healthy silages, propionic acid is typically undetectable or present in

extremely low amounts (0.1%). Although propionibacteria have been discovered in silages that convert glucose and lactic acid to propionic and acetic acid, it is unlikely that natural populations can thrive in most silages. Propionic acid is more frequently discovered in high amounts (>0.3–0.5%) in clostridial fermentations, most likely as a result of *Clostridium propionicum*. When given at a rate of 1 to 2 kg/t of wet (35% DM) fodder, propionic acid-containing additives can enhance the concentration of silages during ensiling by 0.15 to 0.30% (DM basis), however this depends on the amount of the acid in the additive. In properly fermented silages, butyric acid shouldn't be found. Some species of clostridia are extremely proteolytic, while others have the ability to ferment carbohydrates into butyric acid (saccharolytic) or change lactic acid into butyric acid. Clostridial silages are frequently characterised by a higher than normal pH, higher than normal quantities of acetic acid, NH₃-N, and soluble protein, as well as the presence of butyric acid and lower than normal concentrations of lactic acid. Ironically, because butyric acid has potent antifungal properties, silages containing this acid tend to be stable when exposed to air. The type of alcohol most frequently detected in silages is ethanol. It can be produced by a number of microbes, including yeasts, enterobacteria, and heterolactic acid bacteria, but it is typically low in whole-plant silages made from maize and legumes (0.5-1.5%). Numerous microbes are capable of generating 1,2-PD. However, in typical silages, 1,2-PD is probably the end product of *L. buchneri*'s lactic acid metabolism. Low quantities of 1,2-PD (0.1–0.3%) in silages can occasionally be produced by naturally existing populations of *L. buchneri*, especially if they are stored for an extended period of time (>6–8 mo). Due to incomplete activation of the lactic acid degradation process prior to 30 to 60 days of fermentation, 1,2-PD is typically not detectable in silages infected with this organism. Although concentrations as high as 3% have been seen, silages infected with *L. buchneri* to increase aerobic stability may contain between 0.25 and 1.5% 1,2PD (Kung Jr et al., 2018).

The ratio of lactic acid to acetic acid is a good indicator of the type of fermentation undergone by the silage. A ratio of at least 2:1 indicates strong homolactic fermentation (Zhang et al., 2010). It is usual practise to utilise the ratio of lactic acid to acetic acid as a qualitative indicator of fermentation. The ratio of these acids in healthy silage fermentations is typically between 2.5 and 3.0. Because low concentrations of acetic acid may not be enough to suppress lactate-assimilating yeasts, silages with very high lactic acid:acetic acid ratios may occasionally be more aerobically unstable than those with normal ratios. Low lactate-to-acetic acid ratios are typically a sign of inappropriate fermentations. Proteolytic reactions between plants and

microbes alter the nitrogenous molecules in silages. Wet legume silages typically contain higher than average concentrations of soluble N and NH₃-N due to proteolytic activity by clostridia. Since high numbers of yeasts in silages are frequently inversely correlated with the aerobic stability of silages and are typically associated with high ethanol concentrations, counting the yeasts and moulds in silages may be helpful. This is especially true for crops based on maize. Although anecdotal evidence from the field suggests that high numbers of yeasts in silage are associated with poor animal performance, an exact link of cause and effect has not been made. Silages that have undergone extensive spoilage may have very low numbers of yeasts and moulds because these organisms have died due to the lack of substrate. Finally, especially in warm weather, the number of yeasts and moulds might significantly rise between the time of sampling and arrival at the laboratory. It might be expensive to perform a thorough examination of a silage sample's chemical and nutritional characteristics. The silage's appearance and aroma provide some hints as to what transpired throughout the fermenting process. Well-fermented silages should not have a strong, particular odour because lactic acid—the main organic acid from the fermentation—is nearly odourless. Since acetic acid is produced in the second highest proportion after lactic acid and is quite volatile, the majority of silages do, however, have a moderate vinegar smell. Smelling silages with very high concentrations of acetic acid will often leave a burning sensation in one's eyes and nose. Wet silage with high acetic acid also smells like vinegar and has a yellow color, particularly towards the bottom of a silo where compaction will further increase the moisture content. It's a common misconception that silages with a fruity, sweet aroma are a stable, well-fermented feed. These odours are actually typically caused by high alcohol (ethanol) concentrations, which are mostly produced by yeasts but also by several microorganisms. Additionally, the alcohols may produce esters when they interact with the acids in the silage, enhancing the fruity scent. Some stable, well-fermented maize silages have been reported to have an acetone-like aroma and smell like nail polish remover or nail polish, with no symptoms of fungus infestation. According to the scant research that is currently available, these odours are correlated with the concentrations of ethyl and propyl esters of lactate and acetate, as well as perhaps phenyl acetic acid. Bacilli are found in soil rather than in the fresh plant material, and their number of spores can increase if manure is used as fertiliser. One of the first types of microorganisms that appear in silages after yeasts start the aerobic spoiling process is bacilli. This kind of material experiences an alternative form of aerobic spoiling that involves intense heating caused by the development of thermogenic bacilli. A silage that smells earthy is likely to have bacillus growth and a high pH level. In addition to

having a musty or mouldy smell, silages that are aerobically unstable may also exhibit visible mould development. Silage that has mould on it should not be consumed since it may contain mycotoxins. Typically found in silage, saccharolytic clostridia (*Clostridium tyrobutyricum* and *Clostridium butyricum*) use soluble sugars or organic (lactic) acids to generate acetic acid and butyric acid, which has a distinct, unpleasant rancid-butter odour. Other clostridia species, including *Clostridium sporogenes*, can ferment both proteins and carbohydrates, with the latter resulting in the production of ammonia and biogenic amines. Excessive proteolysis may produce an unpleasant, fishy, or ammonia-like smell (Kung Jr et al., 2018).

Extremely high temperatures have started to have a significant impact on the quality of silage as a result of global warming because they speed up the fermentation process and aerobic deterioration in tropical and subtropical areas. However, the ideal temperature for lactic acid bacteria to develop and reproduce is usually not higher than 45°C (Bernardes et al., 2018; Guan et al., 2020). The production of heat is a normal occurrence during silage fermentation. The average temperature of the forage mass shouldn't rise more than 5 to 8°C above ambient at filling if silage is tightly packed and sealed immediately. Although, if a forage mass is left overnight in warm weather for several days due to equipment failures or packing delays brought on by inclement weather, temperatures in the topmost layers (top 5–10 cm) may reach as high as 45–60°C. These high temperatures are the result of aerobic bacteria oxidising the extra air trapped in the forage mass. The key is that these temperatures should decrease quickly as further packing removes air from the mass and fermentation takes place. As previously mentioned, extended exposure to high temperatures above 45 to 50°C can result in heat-damaged proteins and a rise in ADIN (acid detergent insoluble nitrogen). Many lactic acid bacteria, which are essential for a successful fermentation, may suffer from temperatures in this range. To remove and keep air from the forage mass, forage should be properly cut, packed fast, and sealed tightly as soon as possible. Temperatures in the silo's core typically progressively drop to 25 to 30°C once the fermentation's active phase is over. Large bales and bag silos are examples of small silos that should cool more quickly than larger silos. Rarely, especially after several months of storage, should retained heat reach above 35°C. Due to the massive fodder mass acting as insulation and producing a very slow heat dissipation, core silage temperatures in large silos frequently remain high for extended periods of time. Silages can occasionally still be quite warm (>30–35°C) even after 4–6 weeks in the silo. This discovery might be more typical in silages that were poorly packed and harvested dry (>40–45% DM). In certain situations, a gradual fermentation or aerobic oxidation may be the cause of the prolonged heat. Dry silages

have a tendency to be more porous when packed, and because delayed fermentation prolongs overall microbial activity and the pH is quite high, it is unable to block the metabolism of yeasts and moulds. If the silo is being used for feeding, this could make the issue worse because the silo face is continually being jostled, allowing air to enter the mass. Silages may occasionally include potentially harmful substances such nitrates, prussic acid, and mycotoxins. Silage's chemical, microbiological, and organoleptic components can be utilised to determine the sort of fermentation that took place. When these components vary significantly from the norm, poor animal performance when fed to ruminants may also be explained or predicted. Farms' environmental concerns may include measuring VOC from silages as well as odour, ammonia, and particle matter. Chemical data must be used more predictably, and new quantifiable indicators that could be used to better understand animal performance must be found (Kung Jr et al., 2018).

3. Mycotoxins in silage

Across the world, dairy cow diets contain a significant amount of ensiled fodder, mainly maize silage. Several mycotoxins can infect forages before harvest, during storage, or after ensiling during feed-out. Mycotoxins in feed have a negative impact on livestock's performance and health, and they also pose a risk to human health. Numerous research and surveys suggest that ruminants are frequently exposed to mycotoxins through the silage they eat, including aflatoxins, fumonisins, trichothecenes, ochratoxin A, zearalenone, and many other fungal secondary metabolites. Preventing fungal growth before and after ensiling can help reduce issues related to mycotoxins in silage. Mycotoxin contamination of dairy cow feeds must be reduced by proper silage management, but it can also be decreased through the use of mold-inhibiting chemical additives called microbial inoculants. To lower mycotoxin levels, a number of sequestering substances can also be added to diets, however their effectiveness varies depending on the type and degree of mycotoxin contamination. Aflatoxin exposure causes dairy cows to produce less milk; decreased milk quality and safety due to carry-over of toxin from contaminated feed; decreased growth rate and feed efficiency in cattle cows; immunological and ruminal system dysfunction; a malfunctioning liver; T-2 immunosuppressive in cattle due to decreased synthesis of antibodies, neutrophil activity, and lymphocyte blastogenesis; late-gestation abortion and bovine infertility. The amount of translocation into ruminant milk is very little. "Deoxynivalenol" causes gastrointestinal issues and decreased performance, perhaps as a result of feed refusal. There is no proof that ruminant carryover is present in milk. "Zearalenone" causes hyperestrogenism, decreased milk output, and infertility in cattle. The

amount of translocation of it into ruminant milk is very little. "Fumonisin" decrease performance, perhaps as a result of feed rejection; make a little hepatic illness. But there is very little toxic carryover of it in ruminant milk. When fed alone at naturally occurring amounts, ochratoxin has no discernible harm to cattle. There is very little toxic carryover of it into milk. "Roquefortine" causes paralytic effects, feeding reluctance, and reproductive problems. But there is no proof that ruminants transmit it with their milk. There is a lack of study on the effects of mycophenolic acid in cattle. There is no proof that ruminants transmit it with their milk. Preventing fungal growth before and after ensiling can help reduce issues related to mycotoxins in silage. Therefore, to reduce mycotoxin contamination of livestock feeds, effective silage management and the use of mold-inhibiting chemical additives or microbial inoculants are crucial (Ogunade et al., 2018).

4. Sequencing tools for microbial ecology of silages

Ensiling of forages was recognised as a microbial-driven process as early as the late 1800s, when it was associated with the production of "sweet" or "sour" silage. Traditional microbiological plating methods identified the epiphytic microbial communities linked to fresh forage, the crucial function played by lactic acid-producing bacteria throughout the ensiling process, and the part played by clostridia, bacilli, yeast, and moulds in the deterioration of silage. Numerous of these traditional investigations concentrated on identifying and characterising a small number of microbial species that were easily isolated on particular conditions. Evidence revealed that many of these microbial populations' members were alive but unable to be cultured, which enabled traditional research to underestimate the true microbial diversity related to ensiling. The initial molecular techniques to analyse silage microbial populations use polymerase chain reaction-based approaches, such as length heterogeneity PCR, terminal RFLP, denaturing gradient gel electrophoresis, and automated ribosomal intergenic spacer analysis. These techniques have been replaced by recent developments in complete comparative genomic, metagenomic, and metatranscriptomic sequencing, allowing for the detailed definition of microbial communities during ensiling that is not achievable using conventional microbiology. These techniques have helped to define changes in microbial communities associated with forage type and composition, ensiling technique, and responses to aerobic exposure in addition to identifying new microbial species in silage. In order to monitor the persistence and contribution of silage inoculants to the ensiling process as well as the function of particular species of yeast and fungi in silage spoiling, strain-specific and species-specific primers have been developed. Results can be significantly influenced by sampling and

the techniques employed to separate genetic material for additional molecular analysis. Biases in the interpretation of sequence data can also result from the choice of PCR primers and the presence of inhibitors. Low taxonomic resolution and the integrity of sequence data inside existing databases are two factors that can affect bioinformatic analyses. Despite these drawbacks, molecular biology developments have the potential to completely transform how we currently understand the microbial ecology of silage. By describing the function of epiphytic populations in silage quality and how silage additives might produce microbiomes more suited to the production of high-quality silage, these methodologies have provided new insight into the intricacy of the microbial ecology of ensiling. During ensiling and feed out, quantitative PCR (qPCR) can be used to specifically measure and document the persistence of particular phylogenies, species, or even strains of bacteria and fungus. Since implanted bacteria can now be distinguished from their epiphytic counterparts in terms of growth and survival, it is clearer how these particular strains affect the ensiling process. These methods could offer original ideas for keeping undesired microorganisms out of silage by identifying mycotoxin-producing fungal communities or possible pathogens like *Listeria* spp. in silage. Currently, the majority of research has been limited to studying the phylogeny of microorganisms utilising internal transcribed spacer (ITS) or 16S rRNA sections for the classification of bacterial and fungal populations, respectively. Although these studies offer a plethora of knowledge regarding the microbial ecology of silage, they only offer scant details regarding the role played by the various microbial species during the ensiling process. The expression of genes encoding for enzymes involved in silage acid generation and metabolism, proteolysis, or the development of mycotoxins during silage rotting could be better understood in the future by using metatranscriptomics to define the ensiling process. The sample and purity of the nucleic acids that are extracted from the forage determine the scientific integrity of the information generated, even if molecular techniques are poised to transform our understanding of the role of microbes in ensiling. The type of data produced can be influenced by the type of primers chosen for amplifying genetic regions of interest, the presence of PCR inhibitors, and the chosen sequencing platform. Predicted results can be impacted by the breadth and depth of the bioinformatic pipelines and the constraints of the gene databases utilised in the interpretation of data after sequence information has been gathered. The emergence of extraction and purification kits by a number of for-profit businesses has streamlined the processes of DNA/RNA extraction. It can be difficult to choose the best commercial kits for nucleic acid extraction from silage because there are so many available from so many different

manufacturers (including Qiagen, MoBio, MP Biomedicals, and Zymo Research). A variety of PCR inhibitors are present in both silage and fresh fodder, which obstruct amplicon and shotgun sequencing. Consequently, kits that have specific steps aimed at removing PCR inhibitors such as those used in the extraction of nucleic acids from soil or stools tend to be most suitable for fresh forages and silages. By producing forward and reverse primers that border the region of interest, amplicon-based PCR amplifies a specific DNA segment. PCR-based molecular amplification techniques have a wide range of applications because they can be used to quantify a specific species or overall bacterial populations as well as to identify a specific species and distinguish between multiple microbial species (conventional PCR in combination with Sanger sequencing of PCR products) (real-time or qPCR). Real-time or qPCR enables the elimination of laborious post-amplification steps such as the use of gel electrophoresis to visualise amplified products following conventional PCR. Overall, sensitivity, repeatability, speed, and quantitative ability are advantages of qPCR over conventional PCR. These applications, however, call for specially crafted primers that are suitable for the desired target. The effectiveness of PCR can be influenced by elements like primer specificity and the size of the fragment that needs to be amplified. Based on the physical separation of distinctive nucleic acid sequences, the advent of molecular fingerprinting techniques offered a pattern or profile of the genetic diversity in a microbial community. All of these methods still rely on amplifying the target genes using PCR, then using different techniques to separate the amplicons that arise. The study of microbial ecology has been completely transformed by developments in NGS. NGS-based metagenomics investigations typically fall into one of two categories: 1) "Metaprofiling" or amplicon-based profiling, more accurately known as single/marker-gene amplification metagenomics (e.g., 16S rRNA gene in prokaryotes), and 2) whole shotgun metagenomics. These techniques enable profiling of the entire microbial population, including uncultivable species, and at a reasonable cost can produce an extensive description of microbial diversity in different habitats. In comparison to whole shotgun metagenomics, marker gene-based metaprofiling produces taxonomic and phylogenetic classification of microorganisms in complex environments with a smaller time and computational capital investment (50,000 reads/sample). The lower cost of sequencing and the absence of (eukaryotic) contamination with host DNA due to target-specific amplification of conserved areas are further benefits of metaprofiling over total metagenomics (e.g., 16S rRNA gene, CPN60 gene). The resolution is frequently insufficient to identify bacteria to the strain or even species level, and primer selection might result in biases towards specific members of microbial communities. No flag

genes are available to amplify and distinguish individuals within the virome, and various primers are needed for multi-domain communities that contain bacteria, archaea, and eukaryotes. Our knowledge of the microbial ecology of ensiling and aerobic degradation is about to undergo a revolution as a result of next-generation sequencing tools. Techniques for sampling, storing, nucleic acid extraction, sequencing, and bioinformatics can all have an impact on how the content and purpose of microbial communities participating in ensiling are interpreted. Therefore, it is important to use caution when extrapolating results from silage experiments using diverse techniques. The consistency and sophistication of the technologies used to research microbiomes in various contexts are constantly improving. Consequently, the databases that are so important for annotation will undoubtedly continue to become more robust. Metagenomics research on silage has the ability to enhance the ensiling process by improving the quality, safety, and uniformity of additives as well as silage (McAllister et al., 2018).

References

- Avila, C. L. S., & Carvalho, B. F. (2020). Silage fermentation—updates focusing on the performance of micro-organisms. *Journal of Applied Microbiology*, 128(4), 966-984.
- Alonso, V. A., Pereyra, C. M., Keller, L. A. M., Dalcerro, A. M., Rosa, C. A. R., Chiacchiera, S. M., & Cavaglieri, L. R. (2013). Fungi and mycotoxins in silage: an overview. *Journal of Applied Microbiology*, 115(3), 637-643.
- Bernardes, T. F., Daniel, J. L. P., Adesogan, A. T., McAllister, T. A., Drouin, P., Nussio, L. G., ... & Cai, Y. (2018). Silage review: Unique challenges of silages made in hot and cold regions. *Journal of dairy science*, 101(5), 4001-4019.
- Carvalho, B. F., Sales, G. F. C., Schwan, R. F., & Ávila, C. L. S. (2021). Criteria for lactic acid bacteria screening to enhance silage quality. *Journal of Applied Microbiology*, 130(2), 341-355.
- da Silva, T. C., da Silva, L. D., Santos, E. M., Oliveira, J. S., & Perazzo, A. F. (2017). Importance of the fermentation to produce high-quality silage. *Fermentation processes*, 1-20.
- Guan, H., Shuai, Y., Yan, Y., Ran, Q., Wang, X., Li, D., ... & Zhang, X. (2020). Microbial community and fermentation dynamics of corn silage prepared with heat-resistant lactic acid bacteria in a hot environment. *Microorganisms*, 8(5), 719.
- Kung Jr, L., Shaver, R. D., Grant, R. J., & Schmidt, R. J. (2018). Silage review: Interpretation of chemical, microbial, and organoleptic components of silages. *Journal of dairy Science*, 101(5), 4020-4033.
- McAllister, T. A., Dunière, L., Drouin, P., Xu, S., Wang, Y., Munns, K., & Zaheer, R. (2018). Silage review: Using molecular approaches to define the microbial ecology of silage. *Journal of Dairy Science*, 101(5), 4060-4074.
- Ogunade, I. M., Martinez-Tupia, C., Queiroz, O. C. M., Jiang, Y., Drouin, P., Wu, F., ... & Adesogan, A. T. (2018). Silage review: Mycotoxins in silage: Occurrence, effects, prevention, and mitigation. *Journal of dairy science*, 101(5), 4034-4059.
- Soundharrajan, I., Park, H. S., Rengasamy, S., Sivanesan, R., & Choi, K. C. (2021). Application and future prospective of lactic acid bacteria as natural additives for silage production—a review. *Applied Sciences*, 11(17), 8127.
- Zhang, Y. G., Xin, H. S., & Hua, J. L. (2010). Effects of treating whole-plant or chopped rice straw silage with different levels of lactic acid bacteria on silage fermentation and nutritive value for lactating Holsteins. *Asian-Australasian journal of animal sciences*, 23(12), 1601-1607.

POSTHARVEST HANDLING of CUT FLOWERS

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Abstract

A wide variety of plant materials are grown and harvested worldwide for their ornamental value including Tulips, Chrysanthemums, Gerbera, Freesia, Lilies, Carnations, Alstroemeria, Eustoma russellianum, Hypericum, Gypsophila, Paeonia, Limonium, Zantedeschia, Anthurium, Hippeastrum, Hydrangea, Gladioli, Iris, Snapdragons, Delphinium, Orchids, Lisianthus and Cymbidium. Post-harvest handling and operations are very important to maintain quality during marketing and export. Both pre-harvest and post-harvest conditions and practices are effective in the vase life of cut flowers. This include genetics, growth conditions, flower maturity, stage of harvest, time of harvest, harvesting method, precooling, grading, cleaning, bunching, conditioning, floral preservatives, packing, aging, wilting, shattering, growth tropism, mechanical damage, water quality, light, temperature, humidity, carbon dioxide, water content, refrigerated storage and transport. Some of the selected aspects is the subject of this article.

Keywords: Cut flower, post-harvest handling, pre-harvest conditions

1. Introduction

Such as ferns, lycopodium, gymnosperms (pines, firs, podocarps, etc.), and angiosperms (the flowering plants) a variety of plants get produced and harvested because of their ornamental value. Flowers and cut foliage produced all over the world are offered for sale in the form of arrangements and bouquets. Dormant ornamental nursery plants and propagules, such as rooted and unrooted cuttings, bulbs, corms, tubers, and rhizomes, are also fragile and need to be handled very carefully. Ornamentals have complicated plant organs that can be rejected from the market if the quality of their stems, leaves, or flower sections deteriorate, whether they are cut or left intact (Reid, 2009).

Post-harvest applications are very important for flowers to maintain their quality during sales and export. The end-user vase life of cut ornamentals can be significantly impacted by handling techniques starting from harvest on (Idirisinghe et al., 2013). Flowers continue their metabolic processes long after they get separated from the parent plant, which depletes their supply of carbohydrates and raises their temperature and respiration. Any mechanical injury to a flower will reduce its visual appeal, increase the risk of bacterial infections, and cause the flower to turn black and decompose. Each plant species needs to be harvested at the proper stage in order to guarantee acceptable quality and proper postharvest behavior of cut flowers. Precooling is crucial to remove the field heat after harvesting flowers, which should be harvested in the morning or evening. Cutting equipment and storage containers should also be cleaned and disinfected (Muraleedhran et al., 2022). For cut flowers, important factors include grading, packing, and transportation. Pre-harvest factors include genetics, growth conditions, light, temperature, humidity, and carbon dioxide. Post-harvest factors include temperature, humidity, water content, conditioning, pre-cooling, floral preservatives, and cold storage (Verma & Singh, 2021).

The floriculture industry has enormous potential to increase farmer incomes, generate jobs, and bring in foreign currency through increased exports in many under developed countries. However, the increase is still far below a desirable level due to several technological and infrastructure limitations. Production and productivity are impacted by a poor cultural package, a lack of planting seed and other materials of improved types, and numerous diseases. Large post-harvest losses occur as a result of improper handling, grading, packaging, and storage. These post-harvest losses can be decreased by using proper harvesting and post-harvest handling practices, managing storage temperature, and implementing tight hygienic standards in the grading and packaging rooms. Furthermore, with careful usage of flower preservative,

vase life can be increased. Cut flower quality and longevity are influenced by both pre and post harvest management practices (Abbasi et al., 2005).

2. Postharvest problems

The industry must provide postharvest handling and disease management the attention they deserve in order to meet the growing demand for high quality ornamental crops worldwide. Flowers and foliage plants are subject to significant postharvest losses due to their high rate of perishability. Flowers are more susceptible to numerous biotic and abiotic conditions during and after harvest because of their hardness and softness. Postharvest diseases result in the loss of between 10 and 30 percent of the world's total crop production of cut flowers. Several preharvest and postharvest conditions have an impact on the postharvest life of cut flowers. Using fungicide or bactericide applications, preharvest and postharvest disease management for floricultural crops is generally done. In contrast, using standard chemical treatments for diseases increases the risk of pathogen resistance. Concern among the general public regarding fungicide use in relation to environmental and human risk is also rising. These factors led to develop unique preharvest and postharvest disease management solutions for cut flowers and ornamental plants. The commonly used safe host defense inducers may provide an alternative to conventional chemical substances, which are less desirable from a social and environmental standpoint. Additionally, there are several biological substances and microbes that influence disease development through antagonistic interactions and frequently support integrated disease management strategies (Dhiman et al., 2021).

To identify the production and postharvest issues in the cut flower sector in South and Central America, with a focus on Colombia and Ecuador, Loyola et al. (2019) conducted a survey. Total 51 answers were submitted and 62% of establishments had 100 or more workers. Rose (*Rosa* hybrids), carnation (*Dianthus caryophyllus*), chrysanthemum (*Chrysanthemum grandiflorum*), alstroemeria (*Alstroemeria* cultivars), gerbera (*Gerbera jamesonii*), and hydrangea (*Hydrangea* species) were the most frequently grown or handled crops, in that order. Insect management, disease management, and crop timing were the three most production problems, respectively. The pathogen, leaf miner (Lepidoptera, Symphyta, or Diptera), thrips, and phytosanitary concerns were the most significant species-specific production issues (Thysanoptera). Temperature control was the primary postharvest issue, followed by hydration, floral food management, and botrytis (*Botrytis cinerea*). The most frequently stated problem with on-farm postharvest processing related to flower damage. Temperature control, air

transport, damage, and botrytis were the main issues for the post-harvest storage and shipping period. Damage, botrytis, and phytosanitary issues were consumer complaints.

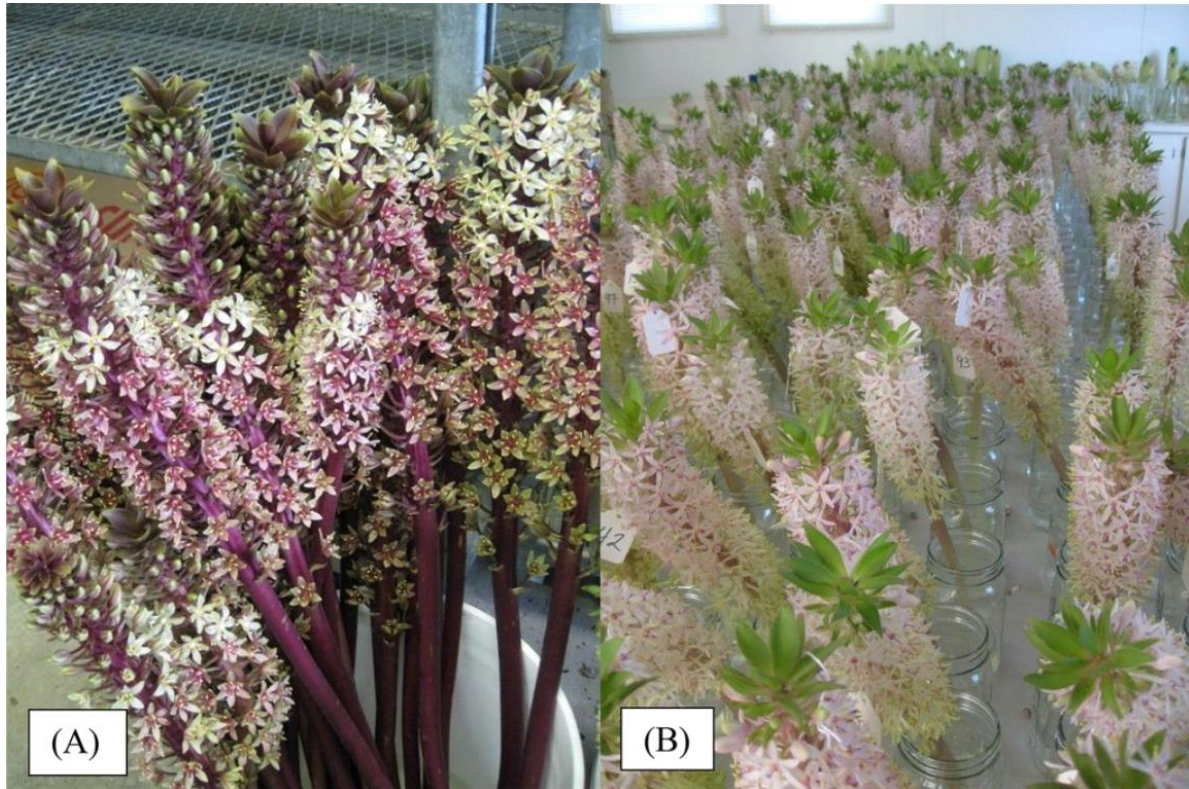


Fig. 1. A) Cut ‘Sparkling Burgundy’ pineapple lily inflorescences; (B) cut ‘Coral’ pineapple lily inflorescences (Carlson & Dole, 2014).

Stems, leaves, flowers, and occasionally bracts and fruit are all components of commercial cut flowers, which frequently have intricate, complicated structures. Following harvest, each of these components could develop and age differently. There is no single flow chart that works for all flowers due to their enormous variability. It's critical for those working in post-harvest activities to understand the nature of the managed items. Personnel training is desired in this situation. Sound production procedures lead to quality, which includes longevity. Healthy and vigorous growth can be obtained by using the right amounts of water, fertilizer, pesticides, and management. During production, it is especially crucial to minimize pest and disease infestation. Cut flowers are mostly harvested at various bud development stages. Flowers at the bud stage must be mature enough horticulturally so that they have the innate potential to open in the vase. The best time to harvest flowers is cold period of the day when their metabolic rate is low and easier to eliminate field heat (Joyce & Faragher, 2012).

3. Genetics

The flower is a unique feature of flowering plants. According to recent molecular biology research, the expression and interaction of numerous genes acting in a sequence results in the development of a flower. At least four factors, including gibberellin, light quality, photoperiod, and temperature (including vernalization and ambient routes), cause floral evocation. Several genes regulate the development of various floral organs as well as the determination of their boundaries (Krishnamurthy & Bahadur, 2015). Several flower characteristics that determine floral quality, including as repeated flowering, double flowers, petal colors, and scent, were chosen during the domestication stages. Understanding the genetic and molecular mechanisms that regulate these traits is not just a fascinating question of basic biology, but will also help understand how these traits have important implications for the rational manipulation of flower quality (Bendahmane et al., 2013).

New genetic combinations yielded an assortment of new shapes and colors. According to Kamenetsky & Dole, (2012), peonies' ability to sprout and bloom is dependent on temperature and the length of the chilling period, but their ability to bloom early or late appears to be a genetic feature unaffected by temperature.

According to reports, cell death which is genetically programmed can regulate the senescence of flower petals. Ichimura et al. (2009) divided petal senescence for six plants into three types based on nuclear morphology and DNA degradation, which are indicators of programmed cell death. During petal senescence, significant DNA degradation was seen in all plants with the exception of *Prunus yedoensis*. Nuclear fragmentation occurred during programmed cell death in *Argyranthemum frutescens*, morning glory, and petunia. On the other hand, carnation and snapdragon blooms showed evidence of chromatin fragmentation in the nuclei. However, *P. yedoensis* did not exhibit nuclear or chromatin fragmentation. It was demonstrated that ethylene has a strong regulatory effect on the programmed cell death linked to petal senescence in carnation flowers. Cut flowers retain their freshness better when transported wet than when transported dry, although wet transport does not significantly extend the vase life of cut flowers. The vase life of rose flowers was enhanced by treatment with sucrose and antibacterial substances before to shipping and during wet transport.

4. Growth conditions

Numerous physiological investigations into the flowering transition have been conducted since the discovery of photoperiodic floral induction. The physiological analysis and dissection of floral induction were made by introducing an experimental system based on the

understanding that an external controllable stimulus can cause flowering when applied to a specific plant. As an example, grafting induced leaves (donor) onto recipient non-induced plants causes the recipient to blossom earlier in *Perilla frutescens* and *Chrysanthemum*. Plants have particular receptors that can detect the duration of light exposure and distinguish between different light wavelengths, and both the quantity (length of light exposure) and the quality of light are necessary signals for blooming. Temperature has an impact on flowering as well. Increases in day duration must be followed by exposure to cold temperatures for vernalization. A plant must pass through a number of developmental thresholds before it can blossom. The induction of flowers is influenced by the intrinsic signals that communicate growth status, such as nutrient flow, hormones, and plant size. Different studies proved an endogenous floral inductive pathway's existence wherein a plant variety flowers only after producing leaves of a predictable number. Short day plants begin to flower as the day length decreases; long day plants begin to flower as the day length increases; and day-neutral plants begin to flower regardless of changes in day length. Within the day length responses, the plants are further divided into facultative and obligatory groups. For obligatory plants, absolute inductive photoperiods are necessary; otherwise, these plants stay in a vegetative phase. In contrast, facultative plants show accelerated flowering under inductive conditions and undergo normal flowering even in noninductive photoperiod (Peer et al., 2021). In a protected environment, Chauhan et al. (2014) investigated the effects of several media on gerbera (*Gerbera jamesonii* Bolus) cv. Alcochete growth, flowering, and cut flower production. The results showed that the medium amended with regular soil with rice husk, coco peat, castor cake, and vermicompost (1:1:1:1) performed better for maximum plant height and spread at first flower appearance and pick blooming stage, as well as highest number of leaves and suckers per plant. The same pattern was seen for other flowering characteristics, including the shortest time between the emergence of the first flower bud and its opening, the longest flowering period, the width and thickness of the flower as well as the number of ray florets that each flower contains. In case of yield parameters, the same treatment was also found better for fresh and dry weight of cut flower, number of flowers per plant, per square meter and yield of flowers. While, the normal soil as control found for poorest response in all parameters.

Biofertilizers are ready-to-use live formulations of beneficial microorganisms that, when applied to seeds, seedlings, or soil, mobilize the availability of nutrients, particularly through their biological activity, and aid in the development of the microflora, which in turn improves the health of the soil. They contribute significantly to agricultural productivity and

are environmentally beneficial. It was once mostly used for field crops, but today it is also utilized for floral crops. Numerous biofertilizers, including *Azotobacter*, *Azospirillum*, phosphorus-solubilizing bacteria, and AM fungus, demonstrate their potential for use in a variety of flower crops, including rose, tuberose, carnation, marigold, aster, jasmine, and others. Biofertilizers can fix 20–200 kg N/ha/year, solubilize 30–50 kg P/ha/year, and to variable degrees mobilize P, Zn, Fe, and Mo. These products not only help in improving the nutrient uptake by the plants, releasing of growth hormones and antibiotics but also improve the quality of produce along with reduced cost of production (Anop et al., 2013).

5. Harvest Stage

For field-grown cut flowers, it can be especially crucial to know when to cut the stems and how to handle the flowers throughout processing. In addition to having less handling and shipping damage, stems harvested at an early stage of development may also have a longer vase life. The quality of the stems and their capacity to withstand dry handling are also determined by how the stems are handled just after harvest, whether in water or dry (Ahmad & Dole, 2014). Every species has a different harvesting process. Chrysanthemums, gerberas, zinnias, and other Asteraceae species, for example, should be fully mature, whilst inflorescences with many buds are harvested at 25–50% open blooms (Dole & Wilkins, 2005). The harvest stage had no effect on the vase life of *Leucocoryne coquimbensis* (Elgar et al., 2003) or *Viburnum tinus* (Darras et al., 2010) inflorescences, demonstrating that various genotypes have varied reactions (Darras, 2021). Different cut flower species' vase life were greatly impacted by stem length, leaf number, and harvest time (Fanourakis et al., 2013).

7. Hydration

One of the most crucial elements in extending the vase life of cut flowers is water uptake. Water is drained from the flowers through the xylem as the leaves transpire. Transpiration will exceed uptake if there is a vascular obstruction, and stomatal opening will rise if this process is accelerated. This will result in water deficiency (Moody et al., 2014). The most common initial action following flower harvesting is to submerge the cut stems in water or a postharvest liquid. But as an example, dry handling rose flowers is associated with reduced transportation-related damage and maintenance of optimal water relations during vase life highlight the potential of this alternative postharvest strategy for maximizing flower quality and longevity. The use of dry handling in conjunction with maintaining the cool-chain represents an excellent opportunity to improve the postharvest performance of selected cut flowers due to the higher volume and weight of flowers transported after hydration, which translates into higher costs of

transportation and handling (Macnish et al., 2009). Cut flowers often experience short or long periods without hydration (Xue et al., 2019). The cut flower supply chain typically uses the dry management technique to decrease transportation and handling expenses (Ahamd et al., 2012). Since climatic conditions are rarely controlled, excessive transpiration is the main source of cut flower weight depression (In et al., 2016). When the separate contribution of leaves, stem, and flowers on the whole-cut flower transpiration becomes available, a more comprehensive knowledge of the determination of this trait is obtained, aiding breeding and selection efforts (Fanourakis et al., 2021).

8. Cooling

A major problem with postharvest losses in vulnerable horticultural commodities is physiological problems during long-term cold storage (Antunes et al., 2022). Cut flowers benefit from quick cooling to their ideal keeping temperature due to their comparatively high metabolic rates (Kader, 2002). Due to the risk of freezing and damage, sub-zero temperatures are frequently avoided during the cultivation and post-harvest handling of perishable cut flowers. Previous studies, however, indicated that employing sub-zero temperatures during storage might have a favorable impact on the quality and subsequent vase life of cut flowers. Because storage enables species with limited production to extend their growing season, it provides greater supply flexibility, and it may even reduce production costs, storage is an essential part of the supply chain for cut flowers. Due to their high value, seasonal but global production, resistance to subzero temperatures, and capacity to keep cut stems without water, cut *Paeonia lactiflora* (peony) hybrids were primarily utilized to investigate the utilization of sub-zero temperatures for long-term storage (dry storage) in the study of Jahnke, (2020). The best flower quality preservation range for cut *Paeonia lactiflora* (peony) hybrids was between 0 and 1°C. However, characteristics of cut flowers, such as vase life and blossom size, frequently deteriorate after four or more weeks of storage. Although the use of sub-zero temperatures is discouraged in the cut flower industry due to concerns about freeze damage, sub-zero temperatures may enable cut flowers to be stored for longer periods of time. Due to their inherent cold tolerance, susceptibility to spring freezes prior to harvest, and limited seasonal availability, peonies are a candidate for sub-zero storage. It was found that peony and other cold-tolerant cut flower species may benefit from longer periods of dry storage at storage temperatures between 0 and -2 °C.

9. Grading

Grading flowers is a big task because it makes the managing of flowers in greenhouses and markets much easier. Flower grading is the process of classifying flowers into different grades depending on their quality and aesthetic appeal. Grading flowers has emerged as an interdisciplinary topic in botany and computer vision due to the development of computer vision. Grading flowers is seen as a difficult process because there aren't any clear disparities between the grades. In particular, medium grade flowers resemble high or low grade flowers in terms of shape and color (Sun et al., 2017). Identification of flower quality grade is a crucial and difficult duty during the flower sales process. Fresh cut flower grading and classification have always relied on manual labor, which is inefficient and inaccurate. Manual categorization and grading cannot keep up with the market demand, the expanding transportation industry, and the insurance period for fresh flowers. Additionally, manual classification is subjective, laborious, and requires employees who have undergone professional training (Sun et al., 2021).



Fig. 2. Dendrobium flower packaging (Maitra et al., 2020)

The initial packinghouse process is frequently the culling, which involves removing damaged flowers (such as stems that are bent). Although other quality factors must also be taken into account, length is typically the grading standard. Maturity, bud and flower morphology, leaf condition, and pest and disease damage are some of these characteristics. Mechanical and electrical tools like photocell-based stem length graders can help in grading. Bunching of one or more species may consist of either mixed or single types. Typically, length-graded flowers are grouped according to the number of stems (e.g. five- or tenstem bunches). It can also be utilized by weight, either by itself or in combination with stem numbers. The uniformity of bunches is a crucial factor. Numerous mixed-flower bunches can be prepared by

using conveyors on a regular basis. The bunch is gradually augmented with flowers as it travels along the packing line. To check bunch weights, balances may be mechanical or computerized. Rubber bands are frequently used to secure bundles. Elastic string tying machines are also employed. Bundles are cut to the proper length with a saw or guillotine. Bunches are frequently sleeved, especially for expensive flowers and mixed bouquets. Sleeves are typically made of printed plastic and occasionally have perforations. Usually, they are utilized with a chute feed-type dispenser (Joyce & Faragher, 2012).

10. Light

It has been suggested that light plays a beneficial function in maintaining the quality of flowers with photosynthetic leaves, such as rose, chrysanthemum, and protea, during postharvest storage (Rajapakse and Kelly, 1994; Ranwala and Miller, 2000). Nowadays, horticulture makes extensive use of light emitting diodes (LED) lighting technologies. It is feasible to apply particular wavelengths to plant material using LEDs. Cut flowers continue to respond to environmental cues like light spectrum even after being harvested. The 380 to 750 nm region of the light spectrum has an impact on a number of plant functions (Aliniaiefard et al., 2020). Spectrum is one of the aspects of light that has a big impact on how plants react. Along with photosynthesis, light quality also affects a plant's cellular health, water relations, color, carbohydrate content, and antioxidant status (Bayat et al., 2018; Hosseini et al., 2018).

11. Conclusions

Both pre-harvest and post-harvest conditions and applications are important for cut flowers' vase life. Important aspects related to this include genetics, growth conditions, flower maturity, stage of harvest, time of harvest, harvesting method, precooling, grading, cleaning, bunching, conditioning, floral preservatives, packing, aging, wilting, shattering, growth tropism, mechanical damage, water quality, light, temperature, humidity, carbon dioxide, water content, refrigerated storage and transport. Each plant species needs to be harvested at the proper stage in order to guarantee acceptable quality and proper postharvest behavior of cut flowers. Precooling is crucial to remove the field heat after harvesting flowers, which should be harvested in the morning or evening. Cutting equipment and storage containers should also be cleaned and disinfected. Production and productivity are impacted by a poor cultural package, a lack of planting seed and other materials of improved types, and numerous diseases. Large post-harvest losses occur as a result of improper handling, grading, packaging, and storage. Implementing tight hygienic standards in the grading and packaging rooms and careful usage of flower preservative can increase vase life.

References

- Abbasi, N. A., Ahmad, T., & Hafiz, I. A. (2005). Harvesting postharvest handling and packaging of flowers for consumers satisfaction and better marketing. In *The National Seminar on Streamlining: Production and Export of Cut-Flowers and House Plants*, March 2nd to 4th, 2005, Islamabad, Pakistan. HFP.
- Ahmad, I., & Dole, J. M. (2014). Optimal postharvest handling protocols for *Celosia argentea* var. *cristata* L. 'Fire Chief' and *Antirrhinum majus* L. 'Chantilly Yellow'. *Scientia Horticulturae*, 172, 308-316.
- Ahmad, I., Dole, J. M., Amjad, A., & Ahmad, S. (2012). Dry storage effects on postharvest performance of selected cut flowers. *HortTechnology*, 22(4), 463-469.
- Aliniaiefard, S., Falahi, Z., Dianati Daylami, S., Li, T., & Woltering, E. (2020). Postharvest spectral light composition affects chilling injury in anthurium cut flowers. *Frontiers in plant science*, 11, 846.
- Anop, K., Mahesh, C., & Satpal, B. (2013). Biofertilizers and their application in flower crops- a review. *Annals of Agri Bio Research*, 18(2), 195-205.
- Antunes, M. D., Gago, C., & Guerreiro, A. (2022). Postharvest Handling of Horticultural Products. *Horticulturae* 2022, 8, 726. Postharvest Handling of Horticultural Crops.
- Bayat, L., Arab, M., Aliniaiefard, S., Seif, M., Lastochkina, O., & Li, T. (2018). Effects of growth under different light spectra on the subsequent high light tolerance in rose plants. *AoB Plants*, 10(5), ply052.
- Bendahmane, M., Dubois, A., Raymond, O., & Bris, M. L. (2013). Genetics and genomics of flower initiation and development in roses. *Journal of experimental botany*, 64(4), 847-857.
- Carlson, A. S., & Dole, J. M. (2014). Postharvest handling recommendations for cut pineapple lily. *HortTechnology*, 24(6), 731-735.
- Chauhan, R. V., Varu, D. K., Kava, K. P., & Savaliya, V. M. (2014). Effect of different media on growth, flowering and cut flower yield of gerbera under protected condition. *Asian Journal of Horticulture*, 9(1), 228-231.
- Darras, A. (2021). Overview of the Dynamic Role of Specialty Cut Flowers in the International Cut Flower Market. *Horticulturae* 2021, 7, 51.
- Darras, A. I., Akoumianaki-Ioannidou, A., & Pompodakis, N. E. (2010). Evaluation and improvement of post-harvest performance of cut *Viburnum tinus* inflorescence. *Scientia horticulturae*, 124(3), 376-380.
- Dhiman, M. R., Kumar, R., & Kumar, S. (2021). Postharvest Handling and Disease Management of Cut Flowers. In *Postharvest Handling and Diseases of Horticultural Produce* (pp. 415-430). CRC Press.
- Dole, J. M., & Wilkins, H. F. (2005). *Floriculture principles and species*. by prentice Hall, inc. Simon and Areview, *Annals of Botany*, 104.
- Elgar, H. J., Fulton, T. A., & Walton, E. F. (2003). Effect of harvest stage, storage and ethylene on the vase life of *Leucocoryne*. *Postharvest biology and technology*, 27(2), 213-217.
- Fanourakis, D., Papadopoulou, E., Valla, A., Tzanakakis, V. A., & Nektarios, P. A. (2021). Partitioning of transpiration to cut flower organs and its mediating role on vase life response to dry handling: A case study in *chrysanthemum*. *Postharvest Biology and Technology*, 181, 111636.
- Fanourakis, D., Pieruschka, R., Savvides, A., Macnish, A. J., Sarlikioti, V., & Woltering, E. J. (2013). Sources of vase life variation in cut roses: a review. *Postharvest Biology and Technology*, 78, 1-15.

- Hosseini, A., Zare Mehrjerdi, M., & Aliniaiefard, S. (2018). Alteration of bioactive compounds in two varieties of basil (*Ocimum basilicum*) grown under different light spectra. *Journal of Essential Oil Bearing Plants*, 21(4), 913-923.
- Ichimura, K., Yamada, T., & Shimizu-Yumoto, H. (2009). Recent breakthroughs in postharvest physiology research and cut flower handling in Japan. *Horticulture Environment and Biotechnology*, 50(6), 539-545.
- Idirisinghe, I. M. S. P., Rathnayake, R. H. M. K., & Edirisinghe, J. C. (2013). Current status of postharvest handling of cut flowers and foliage in the retail sites of western and north western provinces of Sri Lanka. *Proceedings of 12th Agricultural Research Symposium (2013)* 117-121.
- Jahnke, N. J. (2020). *Impacts and Use of Sub-Zero Temperatures During Cut Flower Production and Postharvest Handling*. North Carolina State University.
- Joyce, D., & Faragher, J. (2012). Cut flowers. *Crop postharvest: Science and technology. Perishables*. Wiley-Blackwell. Ames, EUA, 414-438.
- Kader, A. A. (2002). *Postharvest technology of horticultural crops (Vol. 3311)*. University of California Agriculture and Natural Resources.
- Kamenetsky, R., & Dole, J. (2012). Herbaceous peony (*Paeonia*): genetics, physiology and cut flower production. *Floriculture Ornamental Biotechnology*, 6, 62-77.
- Krishnamurthy, K. V., & Bahadur, B. (2015). Genetics of flower development. In *Plant Biology and Biotechnology* (pp. 385-407). Springer, New Delhi.
- Loyola, C. E., Dole, J. M., & Dunning, R. (2019). South and Central America cut flower production and postharvest survey. *HortTechnology*, 29(6), 898-905.
- Macnish, A. J., De Theije, A., Reid, M. S., & Jiang, C. Z. (2009). An alternative postharvest handling strategy for cut flowers--Dry handling after harvest. *Proc. IXth Int'l Symp. on Postharvest Quality of Ornamental Plants. Acta Hort.* 847, ISHS.
- Maitra, S., Sairam, M., Shankar, T., & DJ, G. (2020). *Growing of Dendrobium Orchids in Greenhouse. Protected cultivation and smart agriculture*. Edited by Maitra, S., Galkwad DJ, and Shankar T. New Delhi Publishers, New Delhi, 270-277.
- Moody, E. P., Dole, J. M., & Barnes, J. (2014). Refining postharvest handling procedures increased cut rose vase life. *HortTechnology*, 24(6), 676-685.
- Muraleedhran, A., Kousika, S., Subasri, S., Kumar, C. P. S., Joshi, J. L., & Karthikeyan, P. K. (2022). *Post-Harvest Handling of Cut Flowers and Its Application*. Practices Research, 155, 57.
- Peer, L. A., Bhat, M. Y., Ahmad, N., & Mir, B. A. (2021). Floral induction pathways: Decision making and determination in plants to flower-A comprehensive review. *Journal of Applied Biology and Biotechnology*, 9(2), 7-7.
- Rajapakse, N. C., & Kelly, J. W. (1994). Influence of spectral filters on growth and postharvest quality of potted miniature roses. *Scientia horticultrae*, 56(3), 245-255.
- Ranwala, A. P., & Miller, W. B. (2000). Preventive mechanisms of gibberellin4+ 7 and light on low-temperature-induced leaf senescence in *Lilium* cv. Stargazer. *Postharvest biology and technology*, 19(1), 85-92.
- Reid, M. S. (2009). Handling of cut flowers for export. *Proflora bulletin*, 1-26.
- Sun, X., Li, Z., Zhu, T., & Ni, C. (2021). Four-Dimension Deep Learning Method for Flower Quality Grading with Depth Information. *Electronics*, 10(19), 2353.

- Sun, Y., Zhu, L., Wang, G., & Zhao, F. (2017). Multi-input convolutional neural network for flower grading. *Journal of Electrical and Computer Engineering*, 2017.
- Verma, J., & Singh, P. (2021). Post-harvest Handling and Senescence in Flower Crops: An Overview. *Agricultural Reviews*, 42(2).
- Xue, J., Tang, Y., Wang, S., Xue, Y., Liu, X., & Zhang, X. (2019). Evaluation of dry and wet storage on vase quality of cut peony based on the regulation of starch and sucrose metabolism. *Postharvest Biology and Technology*, 155, 11-19.

**GAP KOŞULLARINDA İNCİ DARI POPÜLASYONLARIN OT KALİTESİ VE
KALİTE İLE İLİŞKİLİ ÖZELLİKLERİNİN BELİRLENMESİ**

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Özet

Ülkemiz hayvancılığın kaliteli kaba yem açığının kapatılması için birim alanda yüksek biyokütle verimi ve yem kalitesine sahip yeni yem bitkisi tür ve çeşitlerine gereksinim duyulmaktadır. Kurağa ve yüksek sıcaklığa diğer türlere göre daha toleranslı olan inci darısı, Dünya’da olduğu gibi ülkemizde de yem bitkisi olarak değerlendirilebilmek için de üzerinde durulması gereken önemli bir türdür. Çalışmada, yurt dışından temin edilen 225 adet inci darısı (*Pennisetum glaucum* (L.) R. Br.) popülasyonunun, GAP bölgesi ikinci ürün koşullarında bazı tarımsal özellikleri saptanmıştır. Araştırma, Akçakale/Şanlıurfa’da 2021 yılında, ikinci ürün koşullarında, Alfa Latis deneme deseninde (15 x 15) 2 tekrarlamalı olarak yürütülmüştür. Biçimler, başaktaki tanelerin süt-hamur olum döneminde yapılmıştır. İncelenen özellikler bakımından popülasyonlar arasında önemli derecede istatistiksel farklılıklar saptanmıştır. Ot

kalitesi ile ilişkili özellikler popülasyonlara göre değişmekle birlikte; ham protein (HP) oranının %6.45-14.75, nötr deterjan lif (NDF) %47.19-66.85, asit deterjan lif (ADF) %34.33-46.89, sindirilebilir kuru madde (SKM) oranı %52.37-62.16, kuru madde tüketimi (KMT) %1.80-2.54, nispi yem değeri (NYD) 74.66-122.52 ve net enerji (NE) laktasyon 1.23-1.41 mcal/kg KM arasında değiştiği saptanmıştır. Ayrıca mineral elementlerden kalsiyum (Ca) %0.01-0.400, potasyum (K) %2.48-4.33, magnezyum (Mg) % 0.04-0.255 ve fosfor (P) %0.290-0.540 arasında değiştiği saptanmıştır. İncelenen özellikler arası ilişkilerde ham protein oranı ile NDF, ADF, Mg, P, SKM oranı, KMT, NYD ve NE arasında da olumlu ve önemli ilişkiler saptanmıştır. Ülkemiz GAP koşullarında inci darısı popülasyonlarının saptanan bazı kalite özellikleri ile inci darısının ülkemizde kaba yem açığının kapatılması için üretimi yapılabilecek potansiyel yem bitkisi olduğu görülmektedir.

Anahtar Kelimeler: İnci darısı (*Pennisetum glaucum*), kalite, korelasyon, popülasyon

**DETERMINATION OF FORAGE QUALITY AND ITS RELATED
CHARACTERISTICS OF SOME PEARL MILLET POPULATIONS UNDER GAP
CONDITIONS***

Abstract

There is a need for new feed crop species and cultivars with a high biomass yield and feed quality to meet the quality roughage deficit of stockbreeding operations of Turkey. Pearl millet, which is more tolerant to drought and high temperatures than other species, is an important species that should be considered as a forage crops in our country as in the World. In this research, some agricultural characteristics of the 225 Pearl millet (*Pennisetum glaucum* (L.) R. Br.) accessions/populations obtained from abroad were determined in the second crop conditions of the GAP region. This research was carried out as second crop under Akçakale/Şanlıurfa conditions during the second crop growing season of 2021. Experimental design was Alfa Latis experimental design (15 * 15) with 2 replications. The harvest were made during the milk-dough stage of the grains in the spike. Significant statistical differences were found among the populations in terms of the examined characteristics. Neutral detergent fiber (NDF) contents of the populations varied between 47.19 and 66.85%, acid detergent fiber (ADF) between 34.33 and 46.89%, crude protein (CP) rates between 6.45 and 14.75%, digestible dry matter (DDM) ratios between 52.37 and 62.16%, dry matter Intake (DMI) between 1.80 and 2.54%, relative feed values (RFV) between 74.66 and 122.52 and net energy (NE) lactation between 1.23 and 1.41 mcal kg⁻¹ DM. It was determined that calcium content varied between 0.01 and 0.40%, potassium between 2.48 and 4.33%, magnesium between 0.04 and 0.26% and phosphorus values varied between 0.29 and 0.540%. Significant and positive relationships were found between hay yield per plant and crude protein ratio, NDF, ADF, Mg, P, DDM ratio, DMI, RFV and NE. It was seen that pearl millet is a potential forage crop that can be produced in order to close the roughage deficit in our country, with some quality characteristics of pearl millet populations determined in GAP regions.

Keywords: Pearl millet (*Pennisetum glaucum*), forage quality, correlation, population

GİRİŞ

Türkiye’de yaklaşık olarak 18 milyon büyük baş hayvan biriminin (BBHB) kaliteli kaba yem ihtiyacının 82 milyon ton olması gerektiği hesaplanmaktadır. Hayvanların kaba yem gereksinimi, doğal çayır-mera alanlarından ve tarla tarımı içerisinde yer alan yem bitkileri üretiminden karşılanmaya çalışılmaktadır. Tarla tarımı içerisinde yapılan yem bitkileri ekim alanı 2.27 mil. ha olarak belirlenmiştir. Bu ekim alanın, ekilebilir alanların %12’ine karşılık geldiği görülmektedir (TUİK, 2021). Yem bitkileri ekiminden yaklaşık 60.7 milyon ton yeşil ot veya eşdeğeri 15-16 milyon ton kuru ot üretiminin gerçekleştiği, çayır mera alanlarından ise yılda yaklaşık 12-15 milyon ton kuru ota eşdeğer yem elde edildiği bildirilmektedir (Altın ve ark., 2005). Ülkemizde doğal çayır-meralar ve yem bitkileri ekim alanlarından yaklaşık 30-32 milyon ton kaliteli kaba yem üretimi olduğu kabul edildiğinde, hala yaklaşık 50 milyon ton kaliteli kaba yem açığı bulunduğu ortaya çıkmaktadır. Ülkemizin en önemli kaba yem kaynağını oluşturan çayır mera alanlarının önemli bir kısmının, bitki örtüsünden yoksun ve verimlerinin düşük olması nedeniyle, kaba yem açığının kısa sürede kapatılmasında tarla tarımı içerisinde yetiştirilecek yem bitkileri önemli rol oynayacaktır. Bundan dolayıdır ki birim alanda yüksek verim potansiyeli ve yem kalitesine sahip yeni yem bitkisi tür ve çeşitlerine gereksinim duyulmaktadır. Bu türlerin başında da “darılar” gelmektedir. Darılar (millet) terimi birçok türü kapsar. Bunların arasında en önemli olanı İnci darısıdır (*Pennisetum glaucum* (L.) R. Br.). Darılar, kuraklığa dayanıklı/toleranslı en önemli bitkiler olup, dünya tarımsal üretimi açısından 6. sırada yer almaktadırlar. Ayrıca, önemli tahıllarla kıyaslandığında hastalık ve zararlılara dayanıklılığı, kısa yetiştirme mevsimine sahip olması ve kuraklık sorunu olan koşullardaki verimliliği ile dikkat çekmektedirler (Devi ve ark., 2011). İnci darının, sıcaklığa, kuraklığa ve tuzluluğa diğer ürünlere göre daha toleranslı olması, özellikle marjinal alanlarda yetiştirilecek olmasının yanı sıra, tarımının düşük girdilerle yapılması, hastalık ve zararlılar bakımından daha avantajlı olması nedeniyle önümüzdeki yıllarda tüm dünyada olduğu gibi ülkemizde ve özellikle de Ege, Akdeniz ve GAP bölgesinde önemli bir tür olarak karşımıza çıkacağı tahmin edilmektedir (Yücel ve Yücel, 2022). Sıcak iklim bitkisi olan İnci darı C4 bitkisi olup, kuraklığa dayanıklı tahılların başında yer almaktadır (Taylor ve ark., 2006; Lee ve ark., 2012), ancak susuz koşullarda yetiştirilmesi mümkün değildir. İnci darı, dik büyüyen, tek yıllık, 3-5 m’ye kadar boylanan, çok sap oluşturan bitki yapısına sahiptir. İnci darı, kısa gün bitkisi olup çiçeklenmesini kısa günde tamamlamaktadır. Gün uzunluğunun 12 saat ve günlük ortalama 28-30 °C sıcaklığın, bitki büyümesi için uygun olduğu bildirilmektedir (Bidinger ve Rai, 1989). İnci darı özellikle iklim değişikliği etkilerine karşı yüksek dirençleri ve kabul edilebilir

üretkenlik ve besin değerleri nedeniyle popülerlik kazandığı ifade edilmektedir (Jukanti ve ark., 2016). Aynı zamanda besin içeriği bakımından Sorgum ve Sudan otuna göre üstünlük sağlayan, söz konusu türlerin içerdiği hidrosiyanik ve prusik asit içermeyen bir türdür (Hassan ve ark., 2014).

Bu çalışma ile İnci darısının ülkemizin kurak ve sıcak iklim koşullarına sahip GAP bölgesinde, ot kalitesi ile ilişkili özelliklerin saptanmasının yanı sıra özellikler arasındaki ilişkilerde saptanmıştır.

MATERYAL VE YÖNTEM

Tarla Denemelerinin Yürütülmesi

Projede, toplam 225 inci darı popülasyonu bitki materyali olarak kullanılmıştır. Tarla denemeleri, GAP Tarımsal Araştırma Enstitüsü (GAPTAEM) Talat Demirören İstasyonunda (Akçakale/Şanlıurfa), 15 x 15 Alfa Latis deneme deseninde iki tekerrürlü olarak kurulmuştur. Her popülasyon, sıra arası 70 cm ve uzunluğu 4 m olan sıralara, sıra üzeri 25 cm olacak şekilde, 1'er sıra olarak ekilmiştir.

Deneme Alanı Toprak ve İklim Özellikleri

Toprak Özellikleri: GAP Lokasyonu denemeleri, bölgede geniş yayılım alanına sahip GAP toprak serisinde yer alan GAP Tarımsal Araştırma Enstitüsü Müdürlüğüne ait Talat Demirören Araştırma İstasyonunda (Akçakale) yürütülmüştür. Bu seri toprakları, alüvyon ana materyalli, düz ve düze yakın eğimli, derin profil topraklardır. Tipik kırmızı profilleri killi tekstürlü ve tüm profil çok kireçlidir. A,B,C horizonlu topraklar olup, pH 7,3 ile 7,8 arasında değişmekte, organik madde içeriği düşük, kation değişim kapasitesi yüksektir. KDK kil içeriğine bağlı olarak alt katmanlara doğru artmaktadır (Anonim, 2021 a).

İklim Özellikleri: Tarla denemelerinin yürütüldüğü Şanlıurfa ilinde Temmuz-Ekim döneminde ortalama sıcaklık 28.88 °C, ortalama maksimum sıcaklık 35.50 °C ve minimum ortalama sıcaklık 22.5 °C, nispi nem %30.48 ve toplam yağış ise 10 mm olarak saptanmıştır (Anonim, 2021 b).

Denemelerin Yürütülmesi

Deneme ekilecek alanı, buğdayları hasat edildikten sonra sulanıp, ikinci toprak işleme aletleri ile sürülüp markör çekilerek, deneme alanı ekime hazır hale getirilmiştir. Sulamadan sonra çıkan yabancı otlar deneme alanında temizlenmiştir. Ekimler, daha önce hazır hale getirilen sıralara sıra üzeri 3-5 cm olacak şekilde elle 2-3 Temmuz 2021 de yapılmıştır. Ekimden sonra 2-3 gün aralıklarla sürekli yağmurlama sulama yapılarak, sıra üzerinde istenilen bitki sayısı sağlanmıştır. Çıkiştan sonra sıra üzeri 25 cm olacak şekilde önce tekleme, daha sonra da

seyreltme yapılarak istenilen sıra üzeri sağlanmıştır. Ekimden önce toprak analizi sonuçlarına göre N ve P₂O₅ 8 kg/da'a tamamlanacak şekilde 20:20:0 kompoze gübre atılmıştır. Ağustos ayının ilk haftasında üst gübre olarak üre formunda 4 kg/da saf N, sıra arasına verilmiştir. Yağmurlama sulamanın dışında, 4 kez salma sulama yapılmıştır. Bazı genotiplerin geçi olması ve hasatlarının gecikmesi nedeniyle Eylül ayı içerisinde bir sulama daha yapılmıştır.

Kuru ot örneklerin analize hazırlanması ve yöntemler

Her genotipin ot hasadı, salkımdaki tanelerin süt-hamur olum dönemine denk gelen dönemde hasat edilmiş ve her sıradan 3'er bitki alınmıştır. Her bitkide alınan 500 g yaş ot örneği (mümkün olduğunca salkım, sap ve yapraklara sahip birer sap), 10-15 cm olacak şekilde parçalanarak kurutma dolabında 60-65 °C'de 3-4 gün (suca zengin olduğu için) kurutulmuş ve ağırlıkları sabitlendiğinde tartılmış ve kuru ot oranları saptanmıştır.

Bu kuru ot örnekleri, özel tasarlanmış değirmende öğütülüp 2 mm elekten geçirilerek ve kalite analizine tabi tutulmuştur. Kalite özelliği olarak ham protein (HP) oranı, nötral deterjan lif (NDF), asit deterjan lif (ADF), mineral elementler (P, K, Mg ve Ca), Doğu Akdeniz Tarımsal Araştırma Enstitüsü'ne ait kalite analiz laboratuvarında NIRS (Near Reflectance Spectroscopy) ve Foss XDS Rapid Content Analyser cihazında saptanmıştır. Sindirilebilir kuru madde (SKM) oranı ve kuru madde tüketimi (KMT), Schroeder (1994) tarafından açıklanan formüle göre hesaplanmıştır. Buna göre, sindirilebilir kuru madde oranı (SKMO)=88.9-(0.779 x %ADF); kuru madde tüketimi (KMT)=120/%NDF, nispi yem değeri (NYD) = (%SKM X %KMT)/1.29 eşitliğine göre hesaplanmıştır. Net Enerji (NE) Laktasyon (Mcal/kg)=1.892-(0.0141*ADF) formülünden hesaplanmıştır (Anononymous, 2018).

ARAŞTIRMA BULGULARI

GAP lokasyonunda 2021 yılında 225 genotipten elde edilen verilere Latis deneme deseninde (15 * 15) varyans analizi uygulanmış ve elde edilen varyan analizi sonuçlar, Çizelge 1'de verilmiştir.

İncelenen özelliklerle ilgili olarak popülasyonlarda saptanan en düşük, en yüksek, ortalama değerleri ve F değerleri (genotip) Çizelge 2'de verilmiştir. İncelenen özellikler bakımından genotipler arasında istatistiki olarak önemli farklılıklar saptanmıştır. Fosfor bakımından genotipler, P≤0.05 hata sınırları içinde istatistiki olarak önemli bulunmuştur. Diğer özelliklerin tamamı P≤0.01 hata sınırları içinde istatistiki olarak önemli bulunmuştur.

Çizelge 1. Populasyonların bazı kalite özelliklerine ilişkin varyans analizi sonuçları

Varyasyon Kaynağı	S D	HP (%)	NDF (%)	ADF (%)	Ca (%)	K (%)	Mg (%)	P (%)	SKM O (%)	KMT (%)	NYD (%)	NEL (Mcal/kg)
Tek	1	1.939	138.82**	29.088*	0.001	0.8436**	0.0001	0.0216**	0.0333	0.0104	26.899	0.0001
Blok/Tek	28	5.586**	105.84**	26.229**	0.097**	0.2744**	0.0285**	0.0069**	3.9397	0.0202	88.069	0.0013
Genotip	224	1.679**	14.21**	7.696**	0.015**	0.1375**	0.0045**	0.0006*	5.7417	0.0304**	122.467**	0.0019**
Hata	196	1.182	8.95	4.898	0.009	0.0859	0.0028	0.0004	3.4097**	0.0199	77.796	0.0011
CV (%)		13.2	5.08	5.58	14.2	9.43	13.98	9.08	3.26	6.64	9.42	2.55

**) $P \leq 0.01$ hata sınırları içinde önemli ; *) $P \leq 0.05$ hata sınırları içinde önemli

Asit Deterjan Lif (ADF); Kalsiyum (Ca); Potasyum (K); Magnezyum (Mg); Nötr Deterjan Lif Ham (NDF); Ham Protein Oranı (HPO); Sindirilebilir KM Oranı (SKMO); Kuru Madde Tüketimi (KMT); Nispi Yem Değeri (NYD); Net Enerji Laktasyon (NEL)

Ham Protein (HP) Oranı (%): Çizelge 1’de görüleceği üzere HP bakımından genotipler $P \leq 0.01$ hata sınırları içinde istatistiki olarak önemli bulunmuştur. Çalışmada genotiplerin HP oranlarının %6.45-14.75 arasında değiştiği ve ortalamasının ise %10.23 olduğu saptanmıştır (Çizelge 2). Farklı ekolojilerde, uygulamalarda ve genotiplerle yapılan çalışmalarda; Abd El-Lattief (2011) Benin’de yürüttüğü araştırmada HP oranının biçim dönemine göre %7.4-9.6 arasında değiştiğini bildirmiştir. Sheahan (2014), inci darısının HP oranının %12-14 arasında değiştiğini ve bu değer mısır silajından daha yüksek olduğunu saptamıştır. Ayrıca, ham protein içeriğinin Pakistan şartlarında %6.73-10.35 arasında değiştiği (Hassan ve ark., 2014), Brezilya şartlarında %20.35-22.53 aralığında (Buso ve ark., 2014), Sudan koşullarında %6.6-17.0 aralığında (Babiker ve ark., 2015; Heuze ve ark., 2015), Meksika şartlarında %14 olarak saptandığı bildirilmiştir (Morales ve ark., 2015). Salama ve ark. (2020), Mısır’ın Alexandria koşullarında inci darısı popülasyonunun, HP oranının 61.2-113.3 g/kg arasında değiştiğini bildirmişlerdir. Saygıdar (2021) GAP koşullarında HP oranının %8.54-10.87 arasında değiştiğini bildirilmektedir.

Nötr Deterjan Lif (NDF) (%):Yapılan varyans analiz sonuçlarına göre NDF bakımından genotipler $P \leq 0.01$ hata sınırları içinde istatistiki olarak önemli bulunmuştur (Çizelge 1). Genotiplerin, NDF oranlarının %47.19-66.85 arasında değiştiği ve ortalamasının ise %56.78 olduğu saptanmıştır (Çizelge 2). Farklı ekoloji ve genotiplerde yapılan çalışmalarda; Buso ve ark. (2014) Brezilya şartlarında NDF değerinin %56.3-60.1 aralığında olduğunu, Heuze ve ark. (2015) %46.1-64.8 arasında, Salama ve ark. (2020), Mısır’ın Alexandria koşullarında inci darısı

popülasyonunun NDF oranının 616.0683.3 g/kg arasında değiştiğini bildirmişlerdir. Ülkemiz koşullarında yürütülen çalışmalarda; Dağtekin (2019) Çukurova koşullarında NDF ortalamalarının %78.3-87.5 arasında değiştiğini; Saygıdar (2021) GAP koşullarında çeşitlere göre değişmekle birlikte NDF oranlarının %63.98-74.24 arasında olduğunu bildirmişlerdir.

Asit Deterjan Lif (ADF) (%): Yapılan varyans analiz sonuçlarına göre ADF bakımından genotipler $P \leq 0.01$ hata sınırları içinde istatistiki olarak önemli bulunmuştur (Çizelge 1). Çizelge 2’de görüleceği üzere genotiplerin ADF oranları %34.33-46.90 arasında değişmiş ve ortalamasının ise %41.35 olduğu saptanmıştır. Farklı ekolojilerde ve farklı genotiplerle yapılan önceki çalışmalarda ADF oranının; Brezilya şartlarında %30.2-32.0 aralığında (Buso ve ark., 2014), Sudan koşullarında %30.7-45.1 aralığında değiştiği (Heuze ve ark., 2015), Salama ve ark. (2020), Mısır’ın Alexandria koşullarında inci darısı popülasyonunun, ADF oranının 305.2-358.9 g/kg arasında değiştiğini bildirmişlerdir. Ülkemiz koşullarında yapılan çalışmalarda ADF oranının; Çukurova koşullarında %42.6-51.5 aralığında değiştiği (Dağtekin, 2019), GAP koşullarında %35.28-39.71 arasında olduğu bildirilmiştir (Saygıdar, 2021).

Kalsiyum (Ca) (%): Çizelge 1’den görüleceği üzere Ca bakımından genotipler, %1’e göre istatistiki olarak önemli bulunmuştur. Çizelge 2’de görüleceği üzere genotiplerin Ca içerikleri %0.01-0.40 arasında değişmiş ve ortalamasının ise %0.15 olduğu saptanmıştır. Kalsiyumun özellikle hayvanların iskelet ve dişlerin yapı taşları için önemli olduğu bildirilmektedir (Kirchgesner, 1985). Hayvanların düzenli ve rasyonel bir şekilde beslenmeleri için, yemlerin yapısında %0.31 oranında Ca bulunması gerektiği bildirilmektedir (Kidambi ve ark., 1989). Farklı bölgelerde, uygulamalarda inci darısı genotipleri ile yapılan çalışmalarda Ca değerlerinin; Weichenthal ve ark. (2003) Nebraska sulu koşullarında Ca içeriğini %0.51 olarak bulmuştur. Heuze ve ark. (2015) Ca içeriğinin %0.29-0.85 arasında değiştiğini bildirmişlerdir. Saygıdar (2021) GAP koşullarında Ca içeriğinin %0.128-0.38 arasında değiştiğini bildirmiştir.

Potasyum (K) (%): Çizelge 1’den görüleceği üzere K bakımından genotipler, %1’e göre istatistiki olarak önemli bulunmuştur. Genotiplerin K içeriklerinin %2.48-4.33 arasında değiştiği ve ortalamasının ise %3.42 olduğu saptanmıştır. Hayvan beslemede ve yem rasyonlarının hazırlanmasında dengeli beslenme için diğer mineral madde içerikleri kadar K içeriği ve oranı da önemlidir. Hayvanların düzenli ve rasyonel bir şekilde beslenmeleri için, yemlerin yapısında %0.65 K bulunması gerektiği bildirilmektedir (Kidambi ve ark., 1989). Çalışmamızda elde edilen değerlerin bu değerlerin çok üzerinde olduğu görülmektedir. Ayrıca K vücuttaki asit baz dengesini sağlamakta önemli rol oynadığı bildirilmiştir (Kirchgesner, 1985). Weichenthal ve ark. (2003)’ün Nebraska koşullarında inci darısı kuru maddesinde K

değerini %4.3 olarak saptamışlar. Heuze ve ark. (2015) K içeriğinin %0.16-0.419 arasında değiştiğini bildirmişlerdir. Saygıdar (2021) GAP koşullarında potasyum içeriğinin %3.043-3.530 arasında olduğunu bildirmiştir.

Magnezyum (Mg) (%): Çizelge 1'den görüleceği üzere Mg bakımından genotipler, %1'e göre istatistiki olarak önemli bulunmuştur. Genotiplerin Mg içerikleri %0.040-0.255 arasında değiştiği ve ortalamasının ise 0.158 olduğu saptanmıştır (Çizelge 2). Hayvanların düzenli ve dengeli şekilde beslenmeleri için, yemlerin yapısında %0.1 Mg bulunması önerilmektedir (Kidambi ve ark., 1989). Çalışmamızda elde edilen değerlerin bu değerlerin çok üzerinde olduğu görülmektedir. Bu mineral maddelerden, Mg iskelet ve dişlerin yapı taşlarında önemli olduğu bildirilmektedir (Kirchgesner, 1985). Weichenthal ve ark. (2003) inci darısı otunun kuru maddesinde Mg değerinin %0.330 olduğunu, Heuze ve ark. (2015) Mg içeriğinin %0.24-0.45 arasında değiştiğini bildirmişlerdir. Dağtekin (2019) Çukurova koşullarında inci darısı genotiplerinde Mg oranının %0.201-0.343 arasında değiştiğini, Saygıdar (2021) GAP koşullarında yürütmüş olduğu araştırmada çeşitlere göre değişmekle birlikte Mg içeriğinin %0.256-0.343 arasında olduğunu bildirmişlerdir.

Fosfor (P) (%): Çizelge 1'den görüleceği üzere P bakımından genotipler, %5'e göre istatistiki olarak önemli bulunmuştur. Genotiplerin P içeriklerinin %0.29-0.54 arasında değiştiği ve ortalamasının ise %0.37 olduğu saptanmıştır (Çizelge 2). Hayvanların düzenli ve dengeli şekilde beslenmeleri için, yemlerin yapısında %0.21 oranında P bulunması önerilmektedir (Kidambi ve ark., 1989). Bu mineral maddelerden P, iskelet ve dişlerin yapı taşları için önemli olduğu bildirilmektedir (Kirchgesner, 1985). Weichenthal ve ark. (2003) Nebraska'da inci darısı kuru maddesinde P değerini %0.240 olarak saptamışlardır. Heuze ve ark. (2015) inci darısı otunun P içeriğinin %0.04-0.45 arasında değiştiğini bildirmişlerdir. Dağtekin (2019) Çukurova koşullarında P oranının %0.27-0.434 arasında, Saygıdar (2021) GAP koşullarında %0.27-0.30 arasında değiştiğini bildirmiştir.

Sindirilebilir Kuru Madde (SKM) Oranı (%): Yapılan varyans analiz sonuçları göre SKM oranı bakımından genotipler arasında istatistiki olarak önemli farklar saptanmamıştır (Çizelge 1). Sindirilebilir KM oranlarının %52.37-62.16 arasında değiştiği ve genotiplerin ortalamasının ise %56.69 olduğu saptanmıştır. Saygıdar (2021) GAP koşullarında sindirilebilir kuru madde (SKM) oranının %57.97-61.42 arasında olduğunu bildirmiştir.

Kuru Madde Tüketimi (KMT) (%): Yapılan varyans analiz sonuçlarına KMT bakımından genotipler, %1'e göre istatistiki olarak önemli bulunmuştur (Çizelge 1). İnci darı genotiplerin KMT %1.80-2.54 arasında değiştiği ve genotiplerin ortalamasının ise %2.13 olduğu

saptanmıştır (Çizelge 2). Saygıdar (2021) GAP koşullarında yürütmüş olduğu araştırmada, çeşitlere göre değişmekle birlikte kuru madde tüketimi (KMT) oranının %1.624-1.890 arasında olduğunu bildirmiştir.

Nispi Yem Değeri (NYD): Yapılan varyans analiz sonuçlarına göre NYD bakımından genotipler arasından %1'e göre istatistiki olarak önemli farklılıklar saptanmıştır. İnci darısı genotiplerin NYD 74.66-122.52 arasında değiştiği ve genotiplerin ortalamasının ise 93.59 olduğu saptanmıştır. Yem bitkilerinin önemli kalite parametrelerinden olan NYD'nin yem kalitesi ve hayvan beslenmesi açısından yüksek olması istenmektedir. Nispi yem değeri, sindirilebilir kuru madde oranı ve kuru madde tüketimi değerlerinden hesaplanan bir yem kalite göstergesi olup, temelinde NDF ve ADF değerleri baz alınmaktadır. Nötral deterjan lif ve ADF değerlerinin düşük olması nispi yem değerinin yüksek olmasını sağlamaktadır. Nispi yem değeri ile ADF ve NDF arasında önemli ve olumsuz, KMT ve SKM arasında önemli ve olumlu ilişkiler bulunduğu Saygıdar (2021) tarafından belirtilmiştir. Saygıdar (2021) GAP koşullarında yürütmüş olduğu araştırmada, çeşitlere göre değişmekle birlikte nispi yem değerinin 73.13-90.29 arasında değiştiğini bildirmişlerdir.

Net Enerji (NE) Laktasyon (Mcal/kg): Yapılan varyans analiz sonuçlarına göre NE bakımından genotipler, %1'e göre istatistiki olarak önemli bulunmuştur (Çizelge 1). Çizelge 2'de görüleceği üzere genotiplerin NE içerikleri %1.231-1.408 arasında değişmiş ve genotiplerin ortalamasının ise %1.309 olduğu saptanmıştır.

Çizelge 2. Genotiplerin incelenen özelliklere ait en düşük, en yüksek, ortalama değerler ve F değerleri (n=1350)

İncelenen Özellikler	Birim	Min.	Max.	Ort.	F (Genotip)
Ham Protein Oranı	%	6.45	14.75	10.229	1.2547*
Nötr Deterjan Lif	%	47.19	66.85	56.776	1.5576**
Asit Deterjan Lif	%	34.33	46.89	41.35	1.6838**
Kalsiyum	%	0.01	0.40	0.149	1.3298**
Potasyum	%	2.48	4.33	3.416	1.0054
Magnezyum	%	0.04	0.255	0.158	1.2419
Fosfor	%	0.290	0.540	0.370	
		1.2740*			
Sindirilebilir KM Oranı	%	52.37	62.16	56.69	1.684**
Kuru Madde Tüketimi	%	1.80	2.543	2.125	1.5273**
Nispi Yem Değeri	%	74.66	122.52	93.59	1.5742**
Net Enerji Laktasyon	Mcal/kg	1.231	1.408	1.309	1.6840**

***) P≤0.01 hata sınırları içinde önemli ; *) P≤0.05 hata sınırları içinde önemli

İncelenen özellikler Arasındaki İlişkiler

İnci darısı türünde incelenen özellikler arasındaki ikili ilişkiler için saptanan korelasyon katsayıları, Çizelge 3.3'de verilmiştir.

Çizelge 3. İnci Darısı Bitkisinde İncelenen Özellikler Arasındaki Korelasyon Katsayıları

	<u>Ca</u>	<u>K</u>	<u>Mg</u>	<u>NDF</u>	<u>P</u>	<u>HPO</u>	<u>SKMO</u>	<u>KMT</u>	<u>NYD</u>	<u>NEL</u>
ADF	-0,1635**	-0,0513	-0,1990**	0,7571**	-0,1155*	-0,4075**	-1,0000**	-0,7610**	-0,8876**	-1,0000**
Ca		-0,0986*	0,2670**	-0,1147*	0,0882	0,0580	0,1635**	0,1125*	0,1351**	0,1636**
K			-0,3726**	0,2443**	0,1211*	0,0631	0,0513	-0,2347**	-0,1421**	0,0520
Mg				-0,2217**	-0,2911**	-0,2414**	0,1990**	0,1932**	0,1973**	0,1985**
NDF					-0,0766	-0,4030**	-0,7571**	-0,9935**	-0,9640**	-0,7570**
P						0,6072**	0,1155*	0,0809	0,0968*	0,1156*
HPO							0,4075**	0,4053**	0,4293**	0,4078**
SKMO								0,7610**	0,8876**	1,0000**
KMT									0,9734**	0,7610**
NYD										0,8877**

**) P≤0.01 hata sınırları içinde önemli ; *) P≤0.05 hata sınırları içinde önemli

Asit Deterjan Lif (ADF); Kalsiyum (Ca); Potasyum (K); Magnezyum (Mg); Nötr Deterjan Lif Ham (NDF); Ham Protein Oranı (HPO); Sindirilebilir KM Oranı (SKMO); Kuru Madde Tüketimi (KMT); Nispi Yem Değeri (NYD); Net Enerji Laktasyon (NEL)

Çizelge 3'den görüleceği gibi ADF ile NDF arasında önemli ve olumlu ilişki, ADF ile Ca, Mg, P, HPO, SKMO, KMT, NYD ve NE arasında önemli ve olumsuz ilişkiler saptanırken, K arasında ise önemsiz ve olumsuz ilişkiler saptanmıştır. Kalsiyum ile NDF ve P arasında önemli ve olumlu ilişkiler saptanırken; Mg, KMT ve NDF arasında ise önemli ve olumsuz ilişkiler saptanmıştır. K ile NDF ve P arasında önemli ve olumlu ilişkiler saptanırken; Mg, KMT ve NDF arasında ise önemli ve olumsuz ilişkiler saptanırken, diğer özellikler (HPO, SKMO ve NE) arasında ise önemsiz ilişkiler saptanmıştır. Mg ile SKMO, KMT, NYD ve NE arasında önemli ve olumlu; NDF, P ve HPO arasında önemli ve olumsuz ilişkiler saptanmıştır. NDF ile HPO, SKMO, KMT, NYD ve NE arasında önemli ve olumsuz ilişkiler saptanırken, P arasında ise önemsiz ilişkiler saptanmıştır. P ile HPO, SKMO, NYD ve NE arasında önemli ve olumlu ilişkiler saptanırken, KMT arasında ise önemsiz ilişkiler saptanmıştır. HPO ile SKMO, KMT, NYD ve NE arasında önemli ve olumlu ilişkiler saptanmıştır. SKMO ile KMT, NYD ve NE değeri arasında olumlu ve önemli ilişkiler saptanmıştır. KMT ile NYD ve NE arasında önemli ve olumlu ilişkiler saptanırken saptanmıştır. NYD ile NE arasında önemli ve olumlu ilişkiler saptanmıştır.

SONUÇ

Özellikle son yıllarda etkisinin daha da belirgin olduğu iklim değişiklikleri nedeniyle, değişmekte olan ürün deseni içerisinde, yüksek sıcaklığa ve kurağa toleranslı inci darısının ot kalite değerleri de dikkate alındığında, GAP bölgesi gibi çok sıcak ve yarı kurak bölgelerde, kaliteli kaba yem açığının kapatılması için önemli bir tür olacağı görülmektedir. İncelenen

özellikler arası ilişkiler incelendiğinde, ot kalitesi bakımından yapılacak seleksiyonlarda NDF ve ADF içerikleri düşük ve HP içeriği yüksek genotiplerin seçilmesi önemli olacaktır.

Teşekkür

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Kaynaklar

- Abd El-Lattief, E.A. 2011. Growth and fodder yield of forage pearl millet in newly cultivated land as affected by date of planting and integrated use of mineral and organic fertilizers. *Asian Journal of Crop Science*, 3(1):35-42.
- Altın, M., Gökkuş A., Koç A. 2005. Çayır Mera Islahı. Tarım ve Köyişleri Bakanlığı, Tarımsal Üretim ve Geliştirme Gen. Müd., Çayır Mera Yem Bitkileri ve Havza Geliştirme Daire Başkanlığı, 468s., Ankara.
- Anonim, 2021a. GAP Tarımsal Araştırma Enstitüsü Laboratuvarı, Toprak Analiz Sonuçları, Haziran-2022, Şanlıurfa.
- Anonim, 2021b. T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı, Meteoroloji Genel Müdürlüğü, Şanlıurfa İli İklim Parametreleri. <https://mgm.gov.tr/?il=%C5%9Ean%C4%B1urfa>.
- Anonymous, 2018. Anonymous (2018). SGS Agrifood laboratories. feed/ forages calculations. http://www.agtest.com/articles/feed%20and%20forages%20calculations_new.pdf. (Accessed 26.12.2018).
- Babiker, S.A., Khair, M.A.M., Tahir, I.S.A., Elhag, F.M.A. 2015. Forage quality variations among some Sudan pearl millet (*Pennisetum glaucum* (L.) R.Br.) collection. *Annual Research & Review in Biology*, 5(4): 293-298.
- Bidinger, F.R., Rai, K.N. 1989. Photoperiodic response of paternal lines and F1 hybrids in pearl millet. *Indian Journal of Genetics and Plant Breeding*, 49:257-264.
- Buso, W.H.D., França, A.F.S., Miyagi, E.S. 2014. Bromatological composition and dry matter digestibility of millet cultivars subjected to nitrogen doses. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*, 66 (3):887-893.
- Dağtekin, Z. 2019. Çukurova koşullarında bazı bir yıllık sıcak mevsim buğdaygil yem bitkilerinin adaptasyonu üzerine bir araştırma. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri ABD, Yüksek Lisans Tezi, 141 s.
- Devi, P.B., Vijayabharathi, R., Sathyabama, S., Malleshi, N.G. Priyadarisini, V.B. 2011. Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: a review. *Journal of Food Science and Technology* DOI: [10.1007/s13197-011-0584-9](https://doi.org/10.1007/s13197-011-0584-9). Available from Springer [<http://www.springerlink.com>].
- Hassan, M.U.I., Ahmad, A.U.H., Zamir, S.I., Haq, I., Khalid, F., Rasool, T., Hussain, A. 2014. Growth, yield quality performance of pearl millet (*Pennisetum glaucum* L.) varieties under Faisalabad conditions, Pakistan. *American Journal of Plant Sciences*, 5:2215-2223.
- Heuzé, V., Tran, G., Hassoun, P., Sauvant, D. 2015. Pearl millet (*Pennisetum glaucum*), forage Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. <https://www.feedipedia.org/node/399>. Last updated on September 30, 2015, 14:02
- Jukanti, A.K., Gowda, C.L., Rai, K.N., Manga, V.K., Bhatt, R.K. 2016. Crops that feed the world 11. Pearl millet (*Pennisetum glaucum* L.): an important source of food security, nutrition and health in the arid and semi-arid tropics. *Food Security*, 8:307-329.
- Kidambi, S.P., Matches, A.G., Gricgs, T.C., 1989. Variability for Ca, Mg, K, Cu, Zn, and K/(Ca +Mg) ratio among 3 wheatgrasses and sainfoin on the southern high plains. *Journal of Range Management*, 42: 316-322
- Kirchgesner, M., 1985. Hayvan Besleme, TÜBİTAK Fotoğraf Klişe Laboratuvarı ve Ofset Tesisleri, Ankara.
- Lee, D., Hanna, W., Buntin, G.D., Dozier, W., Timper, P., Wilson, J.P. 2012. Pearl millet for grain. College of Ag. and Env. Sci., Univ. of Georgia Cooperative Extension. Bulletin #B 1216. <http://extension.uga.edu/publications/detail.cfm?number=B1216> (accessed 30 Jul. 2014).

- Morales, J.U., Alatorre, J.A.H., Nieto, C.A.R., Becerra, J.F.C. 2015. Forage production and nutritional content of silage from three varieties of pearl millet (*Pennisetum glaucum*) harvested at two maturity stages. *Journal of Animal & Plant Sciences*, 27 (1):4161-4169.
- Salama, H.S.A, Shaalan, A.M., Nasser. M.E.A. 2020. Forage performance of pearl millet (*Pennisetum glaucum* [L.] R.Br.) in arid regions: Yield and quality assessment of new genotypes on different sowing dates. *Chilean Journal of Agricultural Research*, 80(4) October-December, 572-584.
- Saygıdar, M.N. 2021. GAP koşullarında inci darısının ot verimi ve yem kalitesinin belirlenmesi üzerine bir araştırma. Şırnak Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri ABD, Yüksek Lisans Tezi, 49 s.
- Schroeder, J. W. 1994. Interpreting forage analysis. Extension Dairy Specialist (NDSU). AS-1080, North Dakota State University.
- Sheahan, C.M. 2014. Plant guide for pearl millet (*Pennisetum glaucum*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center, Cape May, NJ. Published 08/2014.
- Taylor, J.R, Schober, T.J Bean, S. 2006. Novel and non-food uses for sorghum and millets. *Journal of Cereal Science*, 44, 252-271.
- TÜİK, 2021. Türkiye İstatistik Kurumu. <http://www.tuik.gov.tr>. Tarımsal İstatistikler, Erişim 23.03.2021
- Weichenthal, Burt A., Baltensperger, David D., Vogel, K. P., Masterson, S.D., Blumenthal, J. M., Krall, J.M., 2003. G03-1527 Annual Forages for the Nebraska Panhandle (2003). Historical Materials from University of NebraskaLincolnExtension.236.<https://digitalcommons.unl.edu/extensionhist/236>.
- Yücel, C., Yücel, D. 2022. Tarımda değişen yapılar ve beklentiler. İnci darı (*Pennisetum glaucum* (L.) R.Br.). Ed. Serap Doğan ve Nazlı Kalender. İksad publishing house, ISBN: 978-625-8323-16- 0, S: 3-46.

**GAP KOŞULLARINDA İNCİ DARISI (*Pennisetum Glaucum* (L.) R.Br.)
POPULASYONLARININ HASIL VERİMİ VE VERİMLE İLİŞKİLİ
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ÖZET

Artan sera gazları nedeniyle meydana gelen iklim değişiklikleri sonucu abiyotik strese toleranslı yeni türlerin üretime alınması ve yeni çeşitlerinin geliştirilmesi her geçen gün daha fazla önem kazanmaktadır. Darıların, kurağa ve yüksek sıcaklığa diğer ürünlere göre daha toleranslı olmaları ve çok amaçlı (gıda, yem ve enerji) kullanılmaları nedeniyle, üzerinde durulması gereken bitki türlerinin başında gelmektedir. Çalışmada, yurt dışından temin edilen 225 adet inci darısı (*Pennisetum glaucum* (L.) R. Br.) popülasyonunun, GAP bölgesi ikinci ürün koşullarında bazı tarımsal özellikleri saptanmıştır. Araştırma, Akçakale/Şanlıurfa'da 2021 yılında Alfa Latis deneme deseninde (15 *15) 2 tekrarlamalı olarak yürütülmüştür. Biçimler, baştaki tanelerin süt-hamur olum döneminde yapılmıştır. İncelenen özellikler bakımından popülasyonlar arasında istatistiksel olarak önemli farklılıklar saptanmıştır. Popülasyonlara bağlı olarak; çiçeklenme gün sayısının 67.5-88.0 gün, bitki boyunun 146.5-344.0 cm, salkım uzunluğunun 15.34-40.34, ana saptaki yaprak sayısının 7.67-17.0 adet, fertil sap sayısının 1.50-6.33 adet/bitki, vejetatif sap sayısının 0.00-2.33 adet/bitki, toplam sap sayısının 2.33-7.50 adet/bitki, yaş ot veriminin 438.0-2803.3 g/bitki, kuru ot veriminin ise 146.4-1054.2 g/bitki arasında değiştiği saptanmıştır. Bitki başına kuru ot verimi ile çiçeklenme gün sayısı, bitki boyu, sap sayısı, yaprak sayısı ve yaş ot verimi arasında önemli ve olumlu ilişkiler saptanmıştır. GAP koşullarında inci darısı popülasyonları ile yürütülen bu çalışmanın sonuçlarına dayanılarak, inci darısının ülkemizde kaba yem açığının kapatılması için üretimi yapılabilecek potansiyel yem bitkisi olabileceği sonucuna varılmıştır.

Anahtar Kelimeler: İnci darısı (*Pennisetum glaucum*), popülasyon, ot verimi, korelasyon

**DETERMINATION OF FORAGE YIELD AND ITS RELATED CHARACTERISTICS
OF SOME PEARL MILLET (*Pennisetum glaucum* (L.) R.Br.) POPULATIONS
UNDER GAP CONDITIONS**

ABSTARCT

As a result of climate changes caused by increasing greenhouse gases, putting into production of new species that are tolerant to abiotic stress and the development of their new varieties are gaining more and more importance day by day. Due to the fact that millets are more tolerant to drought and high temperatures than other crops and they are used for multiple purposes (food, feed and energy), they are the most important plant species that should be emphasized in our country in the future. This research was carried out as second crop under Akçakale/Şanlıurfa conditions during the second crop growing season of 2021. Experimental design was Alfa Latis experimental design (15 * 15) with 2 replications. The harvest were made during the milk-dough stage of the grains in the spike. Significant statistical differences were found among the populations in terms of the examined characteristics. Depending on the populations, days to flowering varied between 68.0 and 84.0 days, plant height between 248.5 and 306.16 cm, the number of leaves on the main stem between 9.83 and 16.0 number, the total number of stems per plant between 3.5 and 7.16 number/plant, the dry matter ratio between 17.66 and 45.17%. forage yield between 798.16 and 2569.83 g/plant and hay yield between 272.12 and 1054.18 g/plant. Significant and positive relationships were found between the hay yield per plant and days to flowering, plant height, number of stems per plant, number of leaves on the main stem and green herbage yield per plant. From the results of this study, it was concluded that pearl millet is a potential forage plant that can be produced to close the roughage deficit in our country.

Keywords: Pearl millet (*Pennisetum glaucum*), population, forage yield, correlation,

GİRİŞ

Özellikle son yıllarda artan sera gazları nedeniyle meydana gelen iklim değışikleri sonucu, abiyotik strese toleranslı yeni bitki türlerin üretime alınması ve yeni çeşitlerinin geliştirilmesi her geçen gün daha fazla önem kazanmaktadır. Darıların, kurağa ve yüksek sığağa diğerk ürünler göre daha toleranslı olmaları ve çok amaçlı (gıda, yem ve enerji) kullanılmaları nedeniyle, ileriki yıllarda ülkemizde de üzerinde durulması gereken en önemli bitki türlerinin başında gelmektedir (Yücel ve Yücel, 2022). İnci darısı (*Pennisetum glaucum* (L.) R. Br.), *Poaceace* familyasına bağılı, diploid (2n) ve 14 kromoza sahip, yabancı döllen ve yüksek oranda heterosis gösteren, küçük taneli bir sıcak iklim C4 bitkisidir. İnci darısı dik büyüyen tek yıllık, 3-5 m'ye kadar boylanan, kökleri 3 m'ye kadar ulaşan, çoklu kök sitemine sahiptir. İnci darısı, kısa gün bitkisi olup çiçeklenmesini kısa günde tamamlamaktadır. Gün uzunluğunun 12 saat olduğı ve 28-30 °C sıcaklığın bitki büyümesi için uygun olduğı bildirilmektedir (Bidinger ve Rai, 1989; Gill, 1991; Andrews ve Kumar, 1992; Upadhyaya ve ark., 2008). Derin kök sistemi ve kısa yaşam döngüsü, hızlı tane dolumu ve olağanüstü kurağa dayanımı nedeniyle yıllık yağışı 200-600 mm arasında değışen alanlarda yetişen ve mısır, sorgum gibi diğerk tahıllar için uygun olmayan alanlarda rahatlıkla yetiştirilebilen bir bitkidir (Burton, 1983; Panaud, 2006). İnci darısı, kumlu ve hafif yapılı verimli olmayan ve pH 6.2-7.7 arasındaki topraklarda yetişen, düşük girdilere iyi cevap veren, optimum büyüme sıcaklığının 33 °C (12 ila 45 °C) olduğı bir bitkidir (Kumar, 1989; Andrews ve Kumar, 1992; Fribourg, 1995). İnci darısının, asidik kumlu toprakları tolere ettiğı ve tuzlu topraklarda yetiştigi bilinmektedir (Heuze ve ark., 2015).

Türkiye hayvancılığı yıllardan beri süregelen popülasyon, sağıık, yeterli ve dengeli beslenememe gibi birçok sorunla karşı karşıya olmakla birlikte, bu sorunlardan en önemlisini yem girdileri oluşturmaktadır. Ülkemiz hayvancılığı ekonomik olarak beslenememekte ve bunun sonucunda yeterli ve kaliteli hayvansal ürün elde edilemediğı için, insanlarımız yeterli ve sağııklı beslenememektedir. İnci darısı gibi düşük girdilerle birim alanda yüksek ot verimine sahip bitkilerin tarımının yaygınlaşması ile bu sorunların çözümüne katkı sağlayacaktır.

Bu çalışma ile ülkemizin yarı kurak ve sıcak iklim koşullarına sahip GAP bölgesinde, bazı inci darısı popülasyonlarının (*Pennisetum glaucum* (L.) R.Br.), ot verimi ve verimle ilişkili özelliklerin ortaya konulmasının yanı sıra, incelenen özellikler arası ilişkiler saptanmıştır.

MATERYAL VE YÖNTEM

Projede, 225 inci darı popülasyonu bitki materyali olarak kullanılmıştır. Araştırma ile ilgili tarla denemesi 2021 yılında GAP Tarımsal Araştırma Enstitüsü (GAPTAEM) Talat Demirören İstasyonunda (Akçakale/Şanlıurfa) yürütülmüştür. Deneme, 15 x 15 Alfa Latis deneme desenine uygun olarak 2 tekerrürlü olarak kurulmuştur. Her popülasyon, sıra arası 70 cm ve uzunluğu 4 m olan sıralara, sıra üzeri 25 cm olacak şekilde, 1'er sıra olarak ekilmiştir.

Deneme Alanın Toprak ve İklim Özellikleri

Toprak Özellikleri: Tarla denemesi, bölgede geniş yayılım alanına sahip GAP toprak serisi topraklara sahip GAP Tarımsal Araştırma Müdürlüğüne ait Talat Demirören Araştırma İstasyonunda (Akçakale) yürütülmüştür. Bu seri toprakları, alüvyon ana materyalli, düz ve düze yakın eğimli, derin profil topraklardır. Tipik kırmızı profilleri killi tekstürlü ve tüm profil çok kireçlidir. A, B, C horizonlu topraklar olup, pH 7.3 ile 7.8 arasında değişmekte, organik madde içeriği düşük, katyon değişim kapasitesi (KDK) yüksektir. KDK kil içeriğine bağlı olarak alt katmanlara doğru artmaktadır (Anonim, 2021 a).

İklim Özellikleri: Tarla denemelerinin yürütüldüğü Temmuz-Ekim döneminde ortalama sıcaklığın 28.88 °C, ortalama maksimum sıcaklığın 35.50 °C ve minimum ortalama sıcaklığın ise 22.5 °C olduğu, nispi nemin %30.48 ve toplam yağışın ise 10 mm olduğu saptanmıştır (Anonim, 2021 b).

Tarla Denemelerin Yürütülmesi: Ekimler, 2-3 Temmuz 2021'de elle yapılmıştır. Ekimden önce toprak analizi sonuçlarına göre dekara 8 kg N ve P₂O₅ olacak şekilde 20:20:0 kompoze gübre uygulanmıştır. Ağustos ayının ilk haftasında üst gübre olarak üre formunda 4 kg/da saf N, sıra arasına verilmiştir. Yağmurlama sulamanın dışında, 4 kez salma sulama (karık usulü) yapılmıştır. Yabancı ot mücadelesi, üst gübre uygulamasına kadar mekanik olarak, sonrasında ise el ile yapılmıştır. 10 Eylül 2021 tarihinde proje kapsamında yapılması gereken gözlem ve ölçümler yapılmaya başlanmıştır. Her genotipin ot hasadı, salkımdaki tanelerin süt-hamur olum dönemine denk gelen dönemde hasat edilmiş ve her popülasyondan 3'er bitki hasat edilmiştir. Hasat edilen bitkilerde, Upadhyaya ve ark. (2008), Upadhyaya ve Gowda (2009) ve Kameswara ve Bramel (2000) tarafından açıklanan yöntemlere göre; bitki boyu (cm), salkım uzunluğu (cm), ana saptaki yaprak sayısı (adet/bitki), fertil sap sayısı (adet/bitki), vejetatif (steril) sap sayısı (adet/bitki), toplam sap sayısı (adet/bitki), yaş ot verimi (g/bitki), kuru ot verimi (g/bitki) ve kuru ot oranı (%) gibi özellikler saptanmıştır. Ayrıca, her parselde bitkilerin % 50'sinin çiçeklendiği tarih kaydedilmiş ve her parsel için bitki çıkışından çiçeklenmeye kadar geçen süre hesaplanmıştır.

ARAŞTIRMA BULGULARI

GAP lokasyonunda 2021 yılında 225 popülasyonda saptanan verilere Latis deneme desenine (15 * 15) uygun olarak varyans analizleri uygulanmış ve incelenen her özellik için varyans analiz tablosunda varyans kaynaklarının kareler ortalaması verilmiştir (Çizelge 1).

Yapılan varyans analizi sonuçları, kuru ot oranı ve ana sapta yaprak sayısı bakımından incelenen popülasyonlar arasında istatistiki olarak önemli bir fark bulunmadığını göstermiştir. Çiçeklenme gün sayısı, bitki boyu, fertil sap sayısı, toplam sap sayısı, salkım uzunluğu, yaş ve kuru ot verimi bakımından popülasyonların $P \leq 0.01$ hata sınırları içinde istatistiki olarak birbirinden önemli derecede farklı olduğunu göstermiştir (Çizelge 1). Popülasyonların incelenen özelliklerle ilgili en düşük, en yüksek, ortalama değerleri ve F değerleri Çizelge 2’de verilmiştir.

Çizelge 1. Populasyonların verim ve verimle ilişkili özelliklerine ilişkin varyans analizi sonuçları

Varyasyon Kaynağı	S D	ÇGS (gün)	BB (cm)	KOO (%)	SU (cm)	AYS (adet/sap)	FSS (%)	TSS (Adet/bit)	YOV (g/bitki)	KOV (g/bitki)
Tek	1	92.480**	7697.2**	0.00259	0.2497	0.2823	0.4940	8.9888	1007703	196466*
Blok/Tek	28	9.899	732.9	0.00235	8.1058	3.9449	0.7979	1.6276	214436	28032
Genotip	224	43.388**	1603.0**	0.00219	28.0035**	5.8339	1.8553**	1.9410**	319615**	46346**
Hata	196	11.895	525.2	0.00228	12.4870**	4.8796	0.8401	1.1334	163215	25327
CV (%)		4.55	8.55	13.167	14.712	17.662	24.405	22.21	27.67	30.134

*) $P \leq 0.01$ hata sınırları içinde önemli ; *) $P \leq 0.05$ hata sınırları içinde önemli

ÇGS: Çiçeklenme Gün Sayısı; BB: Bitki Boyu; KOO: Kuru Ot Oranı; SU: Salkım Uzunluğu; AYS: Ana Saptaki Yaprak Sayısı; FSS: Fertil Sap Sayısı; SSS: Steril Sap Sayısı; TSS: Toplam Sap Sayısı; YOV: Yaş Ot Verimi; KOV: Kuru Ot Verimi

Çiçeklenme Gün Sayısı (Gün): Yapılan varyans analiz sonuçlarına göre çiçeklenme gün sayısı bakımından popülasyonlar %1 önem düzeyinde istatistiki olarak önemli derecede birbirilerinden farklı oldukları saptanmıştır. Çiçeklenme sürelerine ilişkin en düşük, en yüksek, ortalama ve F değerleri, Çizelge 2’de verilmiştir. Popülasyonların çiçeklenme gün sayılarının 67.5-88.0 gün arasında değiştiği ve ortalamasının ise 75.5 gün olduğu saptanmıştır. Farklı ekolojilerde ve farklı popülasyonlarla yapılan çalışmalarda yıllara ve uygulamalara göre değişmekle birlikte popülasyonların %50 çiçeklenme gün sayısının; Nijerya’nın Kuzeydoğu

koşullarında 53.5 ile 129 gün arasında (Izge ve ark., 2007; Angarawai ve ark., 2016), Hindistan koşullarında 33-159 gün arasında (Khairwal ve ark., 2007; Govindaraj ve ark., 2011; Upadhyaya ve ark., 2013; Athoni ve ark., 2016; Pattanashetti ve ark., 2016; Nayak ve ark., 2020), Pakistan koşullarında 67-77 gün arasında (Shah ve ark., 2012), Çad ülke koşullarında 62.0-78.67 gün arasında değiştiğini bildirmişlerdir (Naoura ve ark., 2020). . Bulgularımızın önceki çalışmalarda elde edilen çiçeklenme gün sayısı değerleri arasında yer aldığı, önceki çalışmalarda yer alan materyal sayısının fazla olması nedeniyle çiçeklenme gün sayısı değerleri bakımından da önemli varyasyonların olduğu görülmektedir.

Bitki Boyu (cm): Yapılan varyans analiz sonuçlarına göre bitki boyu bakımından popülasyonlar, %1 göre istatistiki olarak önemli bulunmuştur (Çizelge 1). Bitki boyuna ilişkin en düşük, en yüksek, ortalama ve F değeri, Çizelge 2’de verilmiştir, söz konusu tabloda görüleceği üzere popülasyonlar bitki boyu ortalamaları 146.5- 344.0 cm arasında değiştiği ve ortalamasının ise 268.1 cm olduğu saptanmıştır. Farklı ekolojilerde ve genotiplerle yapılan çalışmalarda genotiplere, yıllara ve uygulamalara göre değişmekle birlikte bitki boyu değerleri; Nijerya’da 137-377 cm (Izge ve ark., 2007; Angarawai ve ark., 2016), Hindistan ekolojik koşullarında 30-490 cm arasında (Upadhyaya ve ark., 2007; Govindaraj ve ark., 2011; Upadhyaya ve ark., 2013; Athoni ve ark., 2016; Pattanashetti ve ark., 2016), Pakistan koşullarında 143-262.4 cm arasında (Shah ve ark., 2012; Hassan ve ark., 2014) değiştiği bildirilmektedir. Khairwal ve ark. (2007) Hindistan’da 90-358 cm arasında, Naoura ve ark. (2020) Çad koşullarında 169.7-253.3 cm arasında, Nayak ve ark. (2020) Hindistan’da 129-182 cm arasında değiştiğini bildirmişlerdir. Ülkemizde yapılan çalışmalarda, Dağtekin (2019) Çukurova koşullarında popülasyonların bitki boyunun 174-449 cm arasında, Saygıdar (2021) GAP koşullarında 198.0-341.0 cm arasında değiştiğini bildirmişlerdir.

Salkım Uzunluğu (cm): Yapılan varyans analiz sonuçlarına göre salkım uzunluğu bakımından popülasyonlar, %1 göre istatistiki olarak önemli bulunmuştur (Çizelge 1). Salkım uzunluğuna ilişkin en düşük, en yüksek, ortalama ve F değeri, Çizelge 2’de verilmiştir, popülasyonların salkım uzunluğu ortalamalarının 15.34-40.34 cm arasında değiştiği ve popülasyonların ortalamasının ise 23.70 cm olduğu saptanmıştır. İnci darısı ile farklı genotip ve farklı ekolojilerde yapılan önceki çalışmalarda; popülasyonların başak uzunluğunun 22.67-66.25 cm arasında (Abdulhakeem ve ark., 2019), 5.00-135.00 cm arasında (Upadhyaya ve ark., 2007), 8.3-48.6 cm arasında (Khairwal ve ark., 2007) ve 15.00-31.00 cm arasında (Shah ve ark., 2012) değiştiği bildirilirken, Rao ve ark. (1985) Gana’da 227 inci darısı genotiplerinin salkım uzunluğunun 6-53 cm arasında değiştiğini bildirmişlerdir. Izge ve ark. (2007) Nijerya’nın kuzeydoğusu bölgesinde yürüttükleri araştırmada, salkım uzunluğunun 11.8-37.5 cm arasında

değiştirdiğini saptamışlardır. Govindaraj ve ark. (2011) Hindistan'da 61 inci darısı popülasyonu ile yürüttükleri araştırmada, popülasyonlara göre değişmekle birlikte salkım uzunluğunun 19.5-28.2 cm arasında değiştiğini saptamışlardır. Pucher ve ark. (2015) Batı ve Orta Afrika orijinli 347 yerel inci darısı hattı ve 13 ıslah edilmiş çeşit ile yürüttükleri araştırmada, genotiplere bağlı olarak salkım uzunluğunun 17-89 cm arasında değiştiğini saptamışlardır. Athoni ve ark. (2016) Hindistan'da 243 inci darısı popülasyonlar ile yürüttükleri araştırmada, popülasyonların salkım uzunluğunun 22-43.75 cm arasında değiştiğini saptamışlardır. Pattanashetti ve ark. (2016) ICRISAT'ta yaptıkları araştırmada inci darısında fertil kardeş sayısının 1-19 adet, salkım uzunluğunun 5-135 cm arasında değiştiğini saptamışlardır. Anuradha ve ark. (2018) Hindistan'da başak uzunluğunun 12.91-31.13 cm arasında değiştiğini bildirmektedirler. Abdulhakeem ve ark. (2019) Nijerya'da başak uzunluğunun 22.67-66.25 cm arasında değiştiğini bildirmişlerdir. Nayak ve ark. (2020) Hindistan'da salkım uzunluğunun 14.8-245 cm arasında değiştiğini bildirmişlerdir. Önceki çalışmalarda görüldüğü gibi bazı çalışmalarda popülasyon sayısının fazla olması nedeniyle başak uzunluğu bakımından popülasyonlar arasında büyük bir varyasyonun olduğu görülmektedir.

Ana Saptaki Yaprak Sayısı (adet): Yapılan varyans analiz sonuçlarına göre ana saptaki yaprak sayısı bakımından popülasyonlar arasındaki farkın istatistiksel olarak önemli olmadığı görülmektedir. Ana saptaki yaprak sayısına ilişkin en düşük, en yüksek, ortalama ve F değeri, Çizelge 2'de verilmiştir. Popülasyonların ana saptaki yaprak sayısı ortalamaları 7.67-17.00 adet arasında değiştiği ve ortalamasının ise 12.40 adet olduğu saptanmıştır. Önceki çalışmalarda yaprak sayısının; Nijerya'da 8.0-19.0 adet arasında (Izge ve ark., 2007; Abdulhakeem ve ark., 2019), Benin'de 6.9-9.7 adet (Abd-El-Lattief, 2011), Pakistan koşullarında 11-15 adet arasında (Shah ve ark., 2012) değiştiği bildirilmektedir. Ülkemiz GAP koşullarında yapılan çalışmalarda ana saptaki yaprak sayısının 11.13-15.66 adet arasında değiştiği bildirilmektedir (Saygıdar, 2021). Bulgularımız, çalışmamızın da yer aldığı aynı ekolojik koşullarda ve diğer koşullarda yürütülen çalışmalarla benzerlik gösterdiği görülmektedir.

Fertil Sap Sayısı (adet/bitki): Yapılan varyans analiz sonuçlarına göre fertil sap sayısı bakımından popülasyonlar, %1 göre istatistiksel olarak önemli bulunmuştur (Çizelge 1). Fertil sap sayısına ilişkin en düşük, en yüksek, ortalama ve F değeri, Çizelge 2'de verilmiştir. Söz konusu çizelgede görüleceği üzere popülasyonların, fertil sap sayısı ortalamaları 1.50-6.33 adet arasında değişmiş ve genotiplerin ortalamasının ise 3.75 adet olduğu saptanmıştır. Yapılan çalışmalarda fertil sap sayısının; Hindistan'da 1.0-17 adet/bitki arasında (Khairwal ve ark., 2007), Batı ve Orta Afrika orijinli popülasyonların fertil kardeş sayısının 2.0-6.5 adet arasında (Pucher ve ark., 2015), ICRISAT'ta fertil kardeş sayısının 1-19 adet arasında (Pattanashetti ve

ark., 2016), Hindistan'da 0.99-3.55 adet arasında (Anuradha ve ark., 2018), Gana koşullarında fertil kardeş sayısının 3-5 adet arasında (Asungre, 2014) değiştiği bildirilmektedir.

Steril (Vejetatif) Sap Sayısı (adet/bitki): Genotiplerin bazılarında bitki başına vejetatif (salkım oluşmayan sap) sap sayısı değerlerinin olmaması (0.00) nedeniyle varyans analizleri yapılamadığı için, varyans analiz tablosu oluşturulamamıştır. Ancak söz konusu özellik bakımından sadece en düşük, en yüksek, ortalama ve F değeri, Çizelge 2'de verilmiştir. Çizelge 2'de görüleceği üzere popülasyonların vejetatif sap sayısı ortalamalarının 0.00-2.33 adet arasında değiştiği ve popülasyonların ortalamasının ise 1.05 adet/bitki olduğu saptanmıştır. Yapılan önceki çalışmalarda vejetatif kardeş sayısının; Gana koşullarında 1-3 adet/bitki arasında (Rao ve ark., 1985), Nijerya'nın kuzeydoğu bölgesinde 1.7-2.3 adet arasında (Izge ve ark., 2007) değiştiği bildirilmiştir.

Toplam Sap Sayısı (adet/bitki): Yapılan varyans analiz sonuçlarına göre toplam sap sayısı bakımından popülasyonlar, %1 göre istatistiki olarak önemli bulunmuştur (Çizelge 1). Toplam sap sayısına ilişkin en düşük, en yüksek, ortalama ve F değeri, Çizelge 2'de verilmiştir. Söz konusu tablolarda görüleceği üzere popülasyonların toplam sap sayısı ortalamaları 2.33-7.50 adet arasında değişmiş ve popülasyonların ortalamasının ise 4.80 adet/bitki olduğu saptanmıştır. Sap sayısı birim alan verimini etkileyen önemli bitkisel özelliklerdendir. Toplam sap sayısı ile yaş ve kuru ot verimi arasında olumlu ve önemli ilişkiler saptanmıştır (Çizelge 3). Sap sayısı ile verim arasında önemli ve olumlu ilişkilerin olduğu bir çok çalışmada da bildirilmektedir (Kumari ve Nagaajan, 2008; Dağtekin, 2019; Saygıdar, 2021; Aswini ve ark., 2022). Farklı ekolojilerde ve popülasyonlarla yapılan çalışmalarda inci darısında sap sayısının; tek biçimlerde bitki başına 1.3 sap olduğu bildirilirken (Marshall ve Willey, 1983), Pakistan'da sap (kardeş) sayısının 0-3 adet/bitki arasında (Shah ve ark., 2012), Gana koşullarında 6-8 adet arasında (Asungre, 2014), Hindistan şartlarında 0.55-6.4 adet aralığında (Athoni ve ark., 2016), Cezayir şartlarında 5.3-12.5 adet arasında olduğu bildirilmektedir (Rahal-Bouziane ve Semiani, 2016). Abd El-Lattief (2011) Mısır ülkesinde çok biçimli inci darısı çeşitlerinde ilk hasat öncesinde bitki başına 10.3 adet sap olduğunu, ikinci ve üçüncü hasatlarda sırasıyla 13.9 ve 17.5 adet sap elde edildiğini bildirmişlerdir. Dağtekin (2019) Çukurova koşullarında bitki başına sap sayısının 5.4-15.2 adet arasında değiştiğini bildirmiştir. Saygıdar (2021) GAP koşullarında sap sayısının 9.94-13.29 adet/bitki arasında saptandığını bildirmiştir.

Yaş Ot Verimi (g/bitki): Yapılan varyans analiz sonuçlarına göre yaş ot verimi bakımından genotipler arasında istatistiki olarak önemli derecede farklılık olduğu bulunmuştur. Bitki başına yaş ot verimine ilişkin en düşük, en yüksek, ortalama ve F değeri (genotip), Çizelge 2'de

verilmiştir. Söz konusu tabloda görüleceği üzere popülasyonların bitki başına yaş ot ağırlık ortalamaları 438.0 ile 2803.3 g/bitki arasında değişmiş ve genotiplerin ortalamasının ise 1460.3 g/bitki olduğu saptanmıştır. Farklı ekoloji, uygulamalar ve popülasyonlarla yapılan çalışmalarda; Khairwal ve ark. (2007) Hindistan’da yaş ot veriminin 3.5-666.6 g/bitki arasında değiştiği bildirilmiştir. Dağtekin (2019) Çukurova koşullarında yaş ot veriminin 562-7808 g/bitki arasında değiştiğini bildirmektedir. Benin’de yürütülen çalışmada inci darısı yaş ot verimi 1689-2094 kg/da arasında (Abd El-Lattief, 2011), Suudi Arabistan koşullarında 7744-8615 kg/da arasında değiştiği bildirilmektedir (Al-Suhaibani, 2011). Shah ve ark. (2012) Pakistan koşullarında genotiplere göre değişmekle birlikte %50 olgunlukta biçilen inci darısı yeşil ot veriminin 3500-13000 kg/da ve tam olgunlaşmada yapılan biçimde ise yeşil ot veriminin 3300-10000 kg/da arasında değiştiğini bildirmişlerdir. Bunun yanı sıra Hassan ve ark. (2014) Pakistan şartlarında 870-440 kg/da arasında, Sheahan (2014) 750-1250 kg/da arasında, Medici ve ark. (2018) Brezilya koşullarında 1750-2270 kg/da aralığında yaş ot verimi aldıklarını belirtmişlerdir. Salama ve ark. (2020), Mısır’ın Alexandria koşullarında inci darısı popülasyonunun, yaş ot veriminin 18.1-24.3 t/ha arasında değiştiğini bildirmişlerdir. Ülkemizin GAP bölgesinde yürütülen çalışmada 5937.5-12571.4 kg/da arasında yeşil ot verimi alındığı bildirilmektedir (Saygıdar, 2021).

Kuru Ot verimi (g/bitki): Yapılan varyans analiz sonuçlarına göre bitki başına kuru ot verimi bakımından genotiplerin %1 göre istatistiki olarak önemli derece farklı olduğu bulunmuştur (Çizelge 1). Bitki başına kuru ot verimi ile ilgili en düşük, en yüksek, ortalama ve F değerleri ise Çizelge 2’de verilmiştir. Söz konusu Çizelgede görüleceği üzere popülasyonların bitki başına kuru ot veriminin ortalamaları 146.4 ilen 1054.0 g/bitki arasında değiştiği ve ortalamasının ise 528.1 g/bitki olduğu saptanmıştır. Farklı ekolojilerde, uygulamalarda ve genotiplerle yapılan çalışmalarda; Winkel ve ark. (1997) Nijer’de yerel bir inci darısı çeşidi ile farklı sulama uygulamaları ile yürütmüş oldukları çalışmada, bitki başına kuru ot veriminin 144 g olduğunu saptamışlardır. Abd El-Lattief (2011) Benin’de kuru ot veriminin birinci biçimde 284.9-400 kg/da, ikinci biçimde ise 340-448 kg/da arasında değiştiğini saptamıştır. Al-Suhaibani (2011) Suudi Arabistan koşullarında kuru ot veriminin 5715-6301 kg/da arasında değiştiğini saptamıştır. Pasternak ve ark. (2012) Nijer koşullarında yumuşak hamur olum dönemindeki hasatların kuru madde verimlerinin yüksek olduğunu ve Malgorou çeşidinde en yüksek kuru madde verimin (857 kg/da) hamur olum döneminde ve yüksek bitki sıklığında elde edildiğini saptamışlardır. Hassan ve ark. (2014) Pakistan şartlarında KM veriminin 169-347 kg/da arasında değiştiğini, Machicek (2018) Texas/ABD eyaletinde KM veriminin 396 ila 987 kg/da aralığında değiştiğini tespit etmiştir. Medici ve ark. (2018) Brezilya şartlarında kuru

madde veriminin 390-520 kg/da aralığında değiştiğini, Salama ve ark. (2020), Mısır'ın Alexandria koşullarında KM veriminin 2.74-3.82 t/ha arasında değiştiğini bildirmişlerdir.

Kuru Ot Oranı (%): Yapılan varyans analiz sonuçlarına göre kuru ot oranı bakımından genotipler arasında istatistiki olarak önemli farklar bulunmamıştır. Kuru ot oranına ilişkin en düşük, en yüksek, ortalama ve F değeri ise Çizelge 2'de verilmiştir. Söz konusu Çizelgede görüleceği üzere popülasyonların kuru ot oranı ortalamaları %26.48-45.24 arasında değişmiş ve popülasyonların ortalamasının ise %36.20 olduğu saptanmıştır. Buso ve ark. (2014) Brezilya şartlarında inci darısı bitkilerinin %50'sinin 70 cm'ye ulaştığında yapılan biçimden elde edilen otun kuru ot oranının %8.9-11.14 aralığında değiştiğini, Saygıdar (2021) GAP koşullarında yürütmüş olduğu araştırmada kuru ot oranının %26.47-33.35 arasında değiştiğini saptamışlardır. Buso ve ark. (2014) çalışmasında biçimlerin bitki gelişiminin çok erken döneminde hasat yapıldığı için, bitkinin olgunlaşmadığı ve hala taze döneminde olduğundan dolayı kuru ot oranının düşük çıkmasının normal karşılanması gerektiği savunmuşlardır.

Çizelge 2. GAP lokasyonunda inci darı popülasyonlarının ot verimi ve verimle ilişkili incelenen özelliklerin en düşük, en yüksek, ortalama ve F değerleri (n:1350)

İncelenen Özellikler	Birim	En Düşük	En Yüksek	Ortalama	F
Çiçeklenme Gün Sayısı	gün	67.5	88.0	75.5	
	3.6476**				
Bitki Boyu	cm	146.5	344.0	268.1	3.0521**
Salkım Uzunluğu	cm	15.34	40.34	23.70	2.2476**
Ana Saptaki Yaprak Sayısı	adet	7.67	17.00	12.40	1.1956
Fertil Sap Sayısı	adet	1.50	6.33	3.75	2.2085**
Steril Sap Sayısı	adet	0.00	2.33	1.05	-----
Toplam Sap Sayısı	adet	2.33	7.50	4.80	1.7125**
Yaş Ot Verimi	g/bitki	438.0	2803.3	1460.3	1.9582**
Kuru Ot Verimi	g/bitki	146.4	1054.2	528.1	1.8299**
Kuru Ot Oranı	%	26.48	45.24	36.20	0.9593

*) $P \leq 0.01$ hata sınırları içinde önemli ; *) $P \leq 0.05$ hata sınırları içinde önemli

Steril Sap Sayısı: Varyans analizleri yapılamadığı için, sadece en düşük, en yüksek ve ortalamaları verilmiştir.

İncelenen özellikler Arasındaki İlişkiler

İnci darısı popülasyonlarında incelenen özellikler arasındaki ikili ilişkiler için saptanan korelasyon katsayıları, Çizelge 3'de verilmiştir. Çiçeklenme gün sayısı ile yaş ot verimi, kuru ot verimi, ana sapta yaprak sayısı ve steril sap sayısı arasında önemli ve olumlu ilişkiler

saptanırken, diğer özellikler arasında ise önemsiz ilişkiler saptanmıştır. Yaş ot verimi ile kuru ot verimi, bitki boyu, ana sapta yaprak sayısı, fertil ve steril sap sayısı ve toplam sap sayısı arasında önemli ve olumlu ilişkiler saptanırken, diğer özellikler arasında ise önemsiz ilişkiler saptanmıştır. Kuru ot verimi ile kuru ot oranı, bitki boyu, ana sapta yaprak sayısı, fertil ve steril sap sayısı ve toplam sap sayısı arasında önemli ve olumlu ilişkiler saptanırken, diğer özellikler arasında ise önemsiz ilişkiler saptanmıştır. Kuru ot oranı ile salkım uzunluğu, bitki boyu, ana sapta yaprak sayısı, fertil ve steril sap sayısı ve toplam sap sayısı arasında önemsiz ve olumsuz ilişkiler saptanmıştır. Bitki boyu, ana sapta yaprak sayısı, steril sap sayısı ve toplam sap sayısı arasında önemli ve olumlu ilişkiler saptanırken, salkım uzunluğu ve fertil sap sayısı arasında ise önemsiz ilişkiler saptanmıştır. Salkım uzunluğu ile toplam sap sayısı arasında önemli ve olumsuz ilişkiler saptanırken, ana saptaki yaprak sayısı ve fertil sap sayısı arasında ise olumsuz ve önemsiz, toplam sap sayısı arasında ise önemli ve olumsuz ilişkiler saptanmıştır. Ana saptaki yaprak sayısı ile steril sap sayısı ve toplam sap sayısı arasında önemli ve olumlu ilişkiler saptanırken, fertil sap sayısı arasında ise olumsuz ve önemsiz ilişkiler saptanmıştır. Fertil sap sayısı ile toplam sap sayısı arasında önemli ve olumlu ilişkiler saptanırken, steril sap sayısı arasında ise olumsuz ve önemli ilişkiler saptanmıştır. Steril sap sayısı ile toplam sap sayısı arasında önemli ve olumlu ilişkiler saptanmıştır.

Çizelge 3. İnci Darısı Bitkisinde İncelenen Özellikler Arasındaki Korelasyon Katsayılar

Özellikler	YOV	KOV	KOO	BB	SU	AYS	FSS	SSS	TSS
ÇGS	0.2410**	0.2434**	0.0426	0.0403	-0.1339	0.2069**	-0.0147	0.1542**	0.0740
YOV		0.9244**	-0.0497	0.4084**	-0.0505	0.4117**	0.5222**	0.2045**	0.5950**
KOV			0.3197**	0.3412**	-0.0745	0.3520**	0.4838**	0.1733**	0.5430**
KOO				-0.1061	-0.0787	-0.0873	-0.0215	-0.0428	-0.0424
BB					0.0980	0.3706**	0.0194	0.1478**	0.0996*
SU						-0.0133	-0.1270	0.0100	-0.1106*
AYS							-0.0170	0.2283**	0.1140*
FSS								-0.1526**	0.8371**
SSS									0.4110**

*) $P \leq 0.01$ hata sınırları içinde önemli ; *) $P \leq 0.05$ hata sınırları içinde önemli

ÇGS: Çiçeklenme Gün Sayısı; YOV: Yaş Ot Verimi; KOV: Kuru Ot Verimi; KOO: Kuru Ot Oranı; BB: Bitki Boyu; SU: Salkım Uzunluğu; AYS: Ana Saptaki Yaprak Sayısı; FSS: Fertil Sap Sayısı; SSS: Steril Sap Sayısı; TSS: Toplam Sap Sayısı

SONUÇ

GAP koşullarında inci darısı popülasyonları ile yürütülen bu çalışmanın sonuçlarına dayanılarak, inci darısının ülkemizde kaba yem açığının kapatılması için üretimi yapılabilecek potansiyel yem bitkisi olabileceği sonucuna varılmıştır

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KAYNAKÇA

- Abd El-Lattief, E.A. 2011. Growth and fodder yield of forage pearl millet in newly cultivated land as affected by date of planting and integrated use of mineral and organic fertilizers. *Asian Journal of Crop Science*, 3(1):35-42.
- Abdulhakeem, A., Ahmed, F.O., Omoniyi, A.M., Kayode, O.I., Yusuf, D.O.A. 2019. Genetic diversity studies for morphological traits in pearl millet (*Pennisetum glaucum* L.) landraces of Northern Nigeria. *GSC Biological and Pharmaceutical Sciences*, 07 (02):060-070.
- Al-Suhaibani, N.A. 2011. Better forage and grain yield quality of pearl millet (*Pennisetum glaucum* L.) under different irrigation water supplies and plant densities. *World Applied Sciences Journal*, 15 (8):1136-1143.
- Andrews, D.J., Kumar, K.A. 1992. Pearl millet for food, feed, and forage. *Advances in Agronomy*, 48:89-139.
- Angarawai, I.I., Aladele, S., Dawud, M.A., Turaki, Z.G.S., Yakub, Y. 2016. Genetic diversity among Nigeria maiwa type of pearl millet germplasm. *The Global Journal of Science Frontier Research*, 16 (3):1-6.
- Anonim, (2021a). GAP Tarımsal Araştırma Enstitüsü Laboratuvarı, Toprak Analiz Sonuçları, Haziran-2022, Şanlıurfa.
- Anonim, (2021b). T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı, Meteoroloji Genel Müdürlüğü, Şanlıurfa İli İklim Parametreleri. <https://mgm.gov.tr/?il=C5%9Ean%C4%B1urfa>.
- Anuradha, N., Satyavathi, C.T., Bharadwaj, C., Sankar, M., Singh, S.P., Pathy, T.L. 2018. Pearl millet genetic variability for grain yield and micronutrients in the arid zone of India. *Journal of Pharmacognosy and Phytochemistry*, 7 (1):875-878.
- Asungre, P.A. 2014. Characterisation of pearl millet [*Pennisetum glaucum*, (L), R.Br.] germplasm in Ghana. Msc Thesis, Kwame Nkrumah University of Science and Technology, Kumasi School of Graduate Studies Department of Crop and Soil Sciences, 131 p.
- Aswini, M.S., Ganesan, K.N., Ezhilarasi, T., Sivakumar, S.D. 2022. Genetic studies on association and inter-relationship of green fodder yield and fodder quality traits in hybrids of fodder pearl millet [*Pennisetum glaucum* (L.) R.Br.]. *International Journal of Multidisciplinary Research and Growth Evaluation*, www.allmultidisciplinaryjournal.com.
- Athoni, B.K., Ishwar, B., Pattanashetty, S.K. & Guggari, A.K. (2016). Genetic diversity for yield and its component traits in Pearl millet [*Pennisetum glaucum* (L.) R.Br.]. *International Journal of Science and Nature*, 7 (4):795-798.
- Bidinger, F.R., Rai, K.N. 1989. Photoperiodic response of paternal lines and F1 hybrids in pearl millet. *Indian Journal of Genetics and Plant Breeding*, 49:257-264.
- Burton, G.W. 1983. Breeding pearl millet. *Plant Breed. Reviews*, 1:162-182.
- Buso, W.H.D., França, A.F.S., Miyagi, E.S. 2014. Bromatological composition and dry matter digestibility of millet cultivars subjected to nitrogen doses. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*, 66 (3):887-893.
- Dağtekin, Z. 2019. Çukurova koşullarında bazı bir yıllık sıcak mevsim buğdaygil yem bitkilerinin adaptasyonu üzerine bir araştırma. Çukurova Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri ABD, Yüksek Lisans Tezi, 141 s.
- Fribourg, H.A. 1995. Summer annual grasses. pp 463-472 in R. Barnes, C. J. Nelson, M. Collins, and K. Moore, eds. *Forages an introduction to grassland agriculture*. Vol.1. 5th ed. Iowa State Press:Ames, Iowa.
- Gill, K.S. 1991. Pearl millet and improvement. *Indian Council of Agricultural Research*, New Delhi.

- Govindaraj, M., Selvi, B., Rajarathinam, S., Sumathi, P. 2011. Genetic variability and heritability of grain yield components and grain mineral concentration in India's pearl millet (*Pennisetum glaucum* (L) R. Br.) accessions. African Journal of Food, Agriculture, Nutrition and Development, 11 (3):4758-4771.
- Hassan, M.U.I., Ahmad, A.U.H., Zamir, S.I., Haq, I., Khalid, F., Rasool, T., Hussain, A. 2014. Growth, yield quality performance of pearl millet (*Pennisetum glaucum* L.) varieties under Faisalabad conditions, Pakistan. American Journal of Plant Sciences, 5:2215-2223.
- Heuzé, V., Tran, G., Hassoun, P., Sauvant, D. 2015. Pearl millet (*Pennisetum glaucum*), forage Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. <https://www.feedipedia.org/node/399>. Last updated on September 30, 2015, 14:02
- Izge, A.U., Kadams, A.M., Sajo, A.A. 2007. Agronomic performance of selected cultivars of pearl millet (*Pennisetum glaucum* (L.) R.Br.) and their hybrids in North-Eastern Nigeria. Journal of Agronomy, 6(2):344-349.
- Kameswara, R.N., Bramel, J.P. 2000. Manual of Genebank Operations and Procedures. Technical Manual no. 6. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.
- Khairwal, I.S., Yadav, S.K., Rai, K.N., Upadhyaya, H.D., Kachhawa, D., Nirwan, B., Bhattacharjee, R., Rajpurohit, B.S., Dangaria, C.J., Srikant. 2007. Evaluation and identification of promising pearl millet germplasm for grain and fodder traits. Journal of SAT Agricultural Research, 5(1):1-6.
- Kumar, K.A. 1989. Pearl millet: Current status and future potential. Outlook on Agriculture 18:46-53.
- Kumari, M., Nagarajan, P. 2008. Character association and path analysis of yield components in pearl millet (*Pennisetum glaucum* L. R.Br.). Madras Agricultural Journal, 95 (1-6):192-195.
- Machicek, J. 2018. Evaluating forage sorghum and pearl millet for forage production and quality in the Texas high plains. Masters of Science, Plant, Soil, and Environmental Science, West Texas, A&M University Canyon, Texas, 65 p.
- Marshall, B., Willey, R.W. 1983. Radiation interception and growth in an intercrop of pearl millet/groundnut. Field Crops Research, 7:141-160.
- Medici, L.O., Gonçalves, F.V., Da Fonseca, M.P.S., Gaziola, S.A., Schmidt, D., Azevedo, R.A., Pimentel, C. 2018. Growth, yield and grain nutritional quality in three Brazilian pearl millets (*Pennisetum americanum* L.) with African or Indian origins. Anais da Academia Brasileira de Ciências, 90(2):1749-1758.
- Naoura, G., Sawadogo, N., Djirabayé, N., Hassane, M.A. 2020. Agronomic performance of improved pearl millet cultivars in southern Chad. International Journal of Biological and Chemical Sciences, 14(9):2980-2991. <https://www.ajol.info/index.php/ijbcs>
- Nayak, L., B. B. Dalei, S. K. Biswasi, K. Pradhan and Acharya, P. 2020. Performance of Released Hybrid Varieties of Pearl Millet (*Pennisetum glaucum* L.) under Rainfed Condition of Odisha. Int.J.Curr.Microbiol.App.Sci. 9(09): 1799-1804. doi: <https://doi.org/10.20546/ijcmas.2020.909.225>.
- Panaud, O. 2006. Foxtail millet. In K. Chittaranjan (Ed.), Cereals and millet (pp. 325-332). Berlin/Heidelberg: Springer
- Pasternak, D., Ibrahim, A., Augustine, A. 2012. Evaluation of five pearl millet varieties for yield and forage quality under two planting densities in the Sahe. African Journal of Agricultural Research, 7(32):4526-4535, 21 August, 2012 Available online at <http://www.academicjournals.org/AJAR> DOI: 10.5897/AJAR11.1569,

- Pattanashetti, S.K., Upadhyaya, H.D., Dwivedi, S.L., Vetriventhan, M., Reddy, K.N. 2016. Pearl millet (M.Singh and D. Upadhyaya, Editors). Genetic and Genomic Resources for Grain Cereals Improvement, Elsevier Inc., Amsterdam, pp: 253-288.
- Pucher, A., Sy, O., Angarawai, I.I., Gondah, J., Zangre, R., Ouedraogo, M., Sanogo, M.D., Boureima, S., Hash, C.T., Haussmann, B.I.G. 2015. Agro-morphological characterization of West and Central African pearl millet accessions. *Crop Science*, 55:737-748.
- Rahal-Bouziane, H., Semiani, Y. 2016. Pearl millet [*Pennisetum glaucum* (L.) R.Br] landraces from south Algeria: variability, yield components, grain and panicle quality. *American Journal of Agricultural Research*, 1(1):38-46.
- Rao, S.A., Mengesha, M.H., Sharma, D. 1985. Collection and evaluation of pearl millet (*Pennisetum americanum*) germplasm from Ghana. *Economic Botany*, 39(1):25-38.
- Salama, H.S.A, Shaalan, A.M., Nasser. M.E.A. 2020. Forage performance of pearl millet (*Pennisetum glaucum* [L.] R.Br.) in arid regions: Yield and quality assessment of new genotypes on different sowing dates. *Chilean Journal of Agricultural Research*, 80(4) October-December, 572-584.
- Saygıdar, M.N. 2021. GAP koşullarında inci darısının ot verimi ve yem kalitesinin belirlenmesi üzerine bir araştırma. Şırnak Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri ABD, Yüksek Lisans Tezi, 49 s.
- Shah, I.A., Rahman, H.U., Shah, S.M.A., Shah, Z., Rahman, S., Ullah, I., Noor, M. 2012. Characterization of pearl millet germplasm for various morphological and fodder yield parameters. *Pakistan Journal of Botany*, 44 (1):273-279.
- Sheahan, C.M., 2014. Plant guide for pearl millet (*Pennisetum glaucum*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center, Cape May, NJ. Published 08/2014.
- Upadhyaya, H.D., Reddy, K.N., Gowda, C.L.L. 2007. Pearl millet germplasm at ICRISAT genebank-status and impact. *Journal of SAT Agricultural Research*, 3 (1):1-5.
- Upadhyaya, H.D., Reddy, K.N., Sastry, D.V.S.S.R. 2008. Regeneration guidelines: pearl millet. In: Dulloo ME, Thormann I, Jorge MA and Hanson J, editors. Crop specific regeneration guidelines [CD-ROM]. CGIAR System-wide Genetic Resource Programme, Rome, Italy. 9 pp.
- Upadhyaya, H.D., Gowda, C.L.L. 2009. Managing and enhancing the use of germplasm-strategies and methodologies. Technical Manual no.10. ICRISAT, Patancheru, Andhra Pradesh, India. 236 p.
- Upadhyaya, H.D., Reddy, K.N., Singh, S., Gowda, C.L.L., Ahmed, M.I., Kumar, V. 2013. Diversity and gaps in *Pennisetum glaucum* subsp. *monodii* (Maire) Br. germplasm conserved at the ICRISAT genebank. *Plant Genetic Resources: Characterization and Utilization*, 12(2):226-235.
- Winkel, T., Renno, J.F., Payne, W.A. 1997. Effect of the timing of water deficit on growth, phenology and yield of pearl millet (*Pennisetum glaucum* (L.) R.Br.) grown in Sahelian conditions. *Journal of Experimental Botany*, 48 (5):1001-1009.
- Yücel, C., Yücel, D. 2022. Tarımda değişen yapılar ve beklentiler. İnci darı (*Pennisetum glaucum* (L.) R.Br.). Ed. Serap Doğan ve Nazlı Kalender. İksad publishing house, ISBN: 978-625-8323-16- 0, S: 3-46.

II. ÜRÜN MISIR HASADI SONRASI BUĞDAY BİTKİSİNDE DOĞRUDAN EKİM

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ÖZET

II. Ürün mısır-buğday üretim sisteminde, mısır bitkisinin hasadı sonrası anız yakılmadan buğday bitkisinin ekilmesi toprağın ve çevrenin korunması açısından oldukça önemlidir. Türkiye'nin Güneydoğu Anadolu Bölgesi'nin güney kısmında yaygın şekilde uygulanan II. ürün mısır-buğday ürün rotasyonunda mısır hasadından sonra tarlada kalan mısır anızları toprak işlemenin ve ekimin kolay bir şekilde yapılması amacıyla üreticiler tarafından yakılmaktadır. Çevresel sorunlara neden olan anız yakmanın önlenmesi amacıyla bu çalışma planlanmış ve 2021-2022 buğday üretim sezonunda yürütülmüştür. Mardin ili Kızıltepe ilçesi Çağıl köyünde üretici şartlarında yürütülmüş olan bu çalışmada II. ürün mısır bitkisinin hasadından sonra tarlada kalan saplar parçalanarak doğrudan ekim mibzeri ile buğdayın ekimi yapılmıştır. Doğrudan ekim, üreticiler tarafından uygulanan II. ürün mısır saplarının yakılması sonrası toprağın diskaro ile işlenmesiyle karşılaştırılmıştır. Bu iki uygulamanın karşılaştırılmasında t testi kullanılmıştır. Yapılan istatistiksel değerlendirme sonucunda bitki boyu, başakta tane sayısı, başakta tane ağırlığı, metrekarede başak sayısı, biyolojik verim ve birim alan tane verimi açısından iki uygulama arasında istatistiksel olarak farklılık bulunmamıştır. Hasat indeksi, anız yakma sonrası toprağın diskaro ile sürülmesi uygulamasında daha yüksek bulunmuştur. Çiftçi şartlarında yürütülen bu çalışma sonucunda, II. ürün mısır hasadının ardından anız parçalandıktan sonra doğrudan ekim mibzeri kullanılarak buğdayın yetiştirilebileceği sonucuna varılmıştır.

Anahtar Kelimeler: Anız yakma, II. ürün mısır-buğday üretim sistemi, doğrudan ekim

DIRECT SOWING IN WHEAT AFTER SECOND CROP MAIZE HARVESTING

ABSTRACT

Sowing a wheat without burning the stubble after harvesting second crop maize plant is very important for the protection of the soil and the environment in second crop maize-wheat crop rotation system. The maize stubble remaining in the field after the maize harvest is burned by the farmers for easy tillage and sowing in the second crop maize-wheat crop rotation which is widely applied in the southern part of the Türkiye's Southeastern Anatolia Region. This study was planned and carried out in the 2021-2022 wheat production season in order to prevent stubble burning, which causes environmental problems. In this study, which was carried out under farmer conditions in Çağıl village of Kızıltepe district of Mardin province, the stalks remaining in the field were shredded after the harvest of the second crop maize, and the wheat was sown with a direct sowing machine. Direct sowing was compared with the soil tillage with a disc harrow after burning the second crop maize stalks applied by the producers. The t test was used to compare these two applications. As a result of the statistical evaluation, there was no statistical difference between the two applications in terms of plant height, the number of grains per spike, grain weight per spike, the number of spikes per m², biological yield and grain yield per unit area. The harvest index was found to be higher in the application soil tillage with a disc harrow after stubble burning. As a result of this study carried out under farmer conditions, it was concluded that wheat can be grow by using direct sowing machine after the stubble is shredded after the second crop maize harvest.

Keywords: Stubble burning, second crop maize-wheat crop rotation, direct sowing

Giriş

GAP Projesi ile birlikte Türkiye'nin Güneydoğu Anadolu Bölgesi'nde sulanabilir alanlarda oldukça önemli artış olmuştur. Bu bölgede tarım alanlarının sulamaya açılması devam etmektedir. Sulu tarıma geçiş ile birlikte kuru tarımda yaygın olarak uygulanan bir yılda bir ürün uygulaması da azalmış ve bir yılda birden fazla ürün elde etme olanağı doğmuştur. Bölgenin daha sıcak olan ve ana ürün hasadının daha erken yapıldığı güney kesimlerinde üreticiler tarafından ana ürün buğday hasadından sonra yaygın olarak ikinci ürün mısır yetiştiriciliği yapılmaktadır. Haziran veya Temmuz aylarında ekilen mısırın hasadı Kasım-Aralık bazen de Ocak ayında olmaktadır. Mısır bitkisinin hasadından sonra üreticilerin zaman kaybetmeden hızlı bir şekilde buğday bitkisini ekmeleri gerekmektedir. Söz konusu zamanda üreticiler yaygın şekilde mısır anızını yakmaktadırlar. Mısır anızının fazla olması ve kök sisteminin çok güçlü olması nedeniyle toprak işleme zorluğu üreticiler tarafından anız yakmaya gerekçe olarak gösterilmektedir. Anız yakıldıktan sonra toprakta bulunan nem miktarı dikkate alınarak farklı sürüm teknikleri üreticiler tarafından kullanılmaktadır. Bazı yıllarda pulluk veya çizel kullanılarak toprak derin işlendikten sonra ikincil bir toprak işleme aleti (kültüvator, diskaro vb.) ile işlenmektedir. Bazı yıllarda ise anız yakıldıktan sonra sadece ikincil bir toprak işleme aleti ile tarla sürülerek ekime hazırlanmaktadır.

Üreticiler tarafından anızın yakılması birçok olumsuz durumu meydana getirmektedir. Bunların başında çevresel felaketler gelmektedir. Anız yakılarak atmosfere CO₂ ve CH₄ gibi zararlı gazların salınımına neden olunmaktadır (Şahin ve Avcıoğlu, 2016; Büyükşahin, 2018). Anız yakılan dönemlerde hava kirliliği meydana gelmekte ve bu durum insan ve hayvan sağlığına zarar vermektedir. Anız yangınları bazen yerleşim yerlerine sıçramakta, evlerin yanmasına ve insanların hayatlarını kaybetmeleri ile sonuçlanabilmektedir. Ayrıca anız yangınları tarlalarda yaşayan birçok canlının hayatını kaybetmesine neden olarak ekolojik dengeyi bozmaktadır.

Anız yakmanın neden olduğu çevresel felaketler kadar önemli olan bir diğer husus da toprak üzerine olan olumsuz etkileridir. Anız yakılması sonucunda toprağın birçok özelliği oldukça olumsuz etkilenmektedir. Toprağın özellikle üstte bulunan 1 cm'lik kısmında yaşayan canlılar anız yakılarak yok edilmektedir. Toprak canlılarının yok edilmesi toprağın verimsizleşmesine ve topraktaki dengenin bozulmasına neden olmaktadır. Anız yakma ile toprak nemi de büyük oranda kaybedilmekte ve bitkiler tarafından kullanılacak faydalı su yok edilmektedir. Gözübüyük ve ark. (2012) tarafından Erzurum kuru tarım koşullarında fiğ-buğday-nadas münavebe sisteminde farklı toprak işleme sistemlerinin toprakta nem muhafazasına etkisini inceledikleri çalışma sonucunda geleneksel ekim yönteminin bünyesinde en az nem biriktiren yöntem olduğu belirlenmiştir. Anız yangınları nedeniyle anızın yapısında yer alan fosfor,

potasyum, magnezyum, kalsiyum, mangan, çinko, demir, bakır gibi mikro elementler de bitkilerin yararlanamayacağı formlar olan oksitlere dönüşmektedir (Savcı ve Bağdatlı, 2016). Anız yakma sonucunda toprağın birçok fiziksel özelliği olumsuz yönde etkilenmektedir.

Anız yakma sonucunda meydana gelen en önemli hususlardan biri de toprak için oldukça faydalı olabilecek ve toprağın organik madde miktarının yükselmesini sağlayacak olan anızın yok edilmesidir. Tarlada bulunan anızın toprağa kazandırılması toprak organik maddesinin ve dolayısıyla toprak özelliklerinin iyileşmesini sağlar. Yapılmış araştırmalarda, genel olarak bitkisel artıkların toprağın fiziksel özelliklerine olumlu etkide bulunduğu, agregat stabilitesini artırdığı, erozyon kontrolü ile toprak havalanmasını düzelttiği görülmüştür (Gürsoy, 2012). Ancak anız yakma ile bu faydalı materyal yok edilmektedir.

Anız yakmadan yapılacak olan azaltılmış toprak işleme ve doğrudan ekim uygulamaları ile anızın toprağa kazandırılması sağlanabilir. Sessiz ve ark. (2010), azaltılmış toprak işleme ve doğrudan ekim yöntemlerinin ekonomik faktörlerin yanında tarlada bırakılan atıklardan dolayı aynı zamanda çevre dostu olduğunu bildirmiştir. Doğrudan ekim yönteminde tarlanın ekime hazır hale getirilmesi için uygulanan birincil ve ikincil toprak işleme aletleri kullanılmadığı için sürüm masrafı olmamaktadır. Bu nedenle yakıt, işgücü ve zamandan tasarruf sağlamaktadır. Toprak işleme yapılmaması bu avantajlarının yanı sıra toprakta nemin korunmasını da sağlamaktadır. Govaerts ve ark. (2007) 12 yıl boyunca yürüttükleri çalışmalarında, mısır ve buğdayı monokültür ve rotasyon uygulaması şeklinde, geleneksel ve sıfır toprak işleme uygulamaları altında, iki farklı anız yönetimi (anız muhafaza edilmiş ve anız uzaklaştırılmış) uygulaması altında inceledikleri çalışmalarında infiltrasyon ve toprak nem seviyesinin sıfır toprak işlemede daha yüksek bulunduğunu bildirmişlerdir.

Bu çalışma, Türkiye'nin Güneydoğu Anadolu Bölgesi'nin güneyinde uygulanan II. Ürün mısır-buğday münavebe sisteminde, II. Ürün mısırın hasadı sonrası anız yakılmasının önlenmesi amacıyla, mısır saplarının parçalanması sonrası doğrudan buğday ekiminin yapılarak sonuçlarının anız yakma uygulaması ile karşılaştırılması ve üreticilerin çalışma sonuçları hakkında bilgilendirilmesi amacıyla yapılmıştır.

Materyal ve Yöntem

Bu çalışma 2021-2022 buğday üretim sezonunda yürütülmüştür. Çalışma alanı Türkiye'nin Güneydoğu Anadolu Bölgesi'nin güney kesimlerinde bulunan Mardin ili, Kızıltepe ilçesi, Çağıl Köyü'dür. Mardin ili Kızıltepe ilçesinde yaygın olarak II. ürün mısır-buğday münavebe sistemi uygulanması nedeniyle, çalışma bu alanda yürütülmüştür.

Güneydoğu Anadolu Bölgesi ülkemizin en kaliteli makarnalık buğdaylarının yetiştiği bölgemizdir. Bu nedenle, bu çalışmada, makarnalık bir buğday çeşidi olan Ganem

kullanılmıştır. Bu çeşit, 2019 yılında Diyarbakır'da GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi Müdürlüğü tarafından ıslah ettirilmiştir. Hem sulanan hem de yağışa dayalı koşullar için tavsiye edilen bu çeşidin sulu koşullardaki verimi 700-1050 arasındadır. Hektolitreye ağırlığı 80,2 – 84,4, bin dane ağırlığı 29,2 – 39,6 ve protein oranı 12,9 – 15,3 arasında değişmektedir (Anonim, 2023).

Çalışma, geleneksel ve anıza doğrudan ekim olmak üzere 2 farklı uygulama olarak 3 tekerrürlü yürütülmüştür. Geleneksel ekim uygulamasında, 11. ürün mısır hasadından sonra tarlada kalan anız yakılmıştır. Anız yakıldıktan sonra tarla diskaro ile sürülmüş ve ekime hazırlanmıştır. Denemenin yürütüldüğü alanda, üreticiler tarafından, geleneksel uygulamada anız yakma sonrası kullandıkları tarım aletlerinin yıllara göre değiştiği, toprak nem durumu dikkate alınarak farklı aletlerle toprak işleme yaptıkları bildirilmiştir. Bazı yıllarda pulluk veya çizel kullanılarak toprak derin işlendikten sonra ikincil bir toprak işleme aleti (kültivatör, diskaro vb.) ile işlenmektedir. Bazı yıllarda ise anız yakıldıktan sonra sadece ikincil bir toprak işleme aleti ile tarla sürülerek ekime hazırlanmaktadır. Çalışmanın yürütüldüğü yılda, anız yakma sonrası tarla diskaro ile sürüm yapılarak ekime hazır hale getirilmiştir. Doğrudan ekimin yapılacağı parsellerde ise hasat sonrası öncelikle sap parçalayıcı kullanılarak tarlada bulunan anız parçalanmıştır. Anız parçalama sonrası doğrudan ekim mibzeri kullanılarak buğday bitkisinin ekimi gerçekleştirilmiştir. Ekim, 15 Aralık 2021 tarihinde yapılmıştır. Ekimle birlikte 8 kg N ve 8 kg P₂O₅ 20.20.0 kompoze gübresi kullanılarak mibzerle uygulanmıştır. Ayrıca 12 kg saf N üst gübre olarak üre formunda uygulanmıştır. Çalışma sulu koşullarda yürütülmüştür. Damla sulama yöntemi ile sulanan parsellere eşit oranda su uygulanmıştır. Hasat olgunluğuna gelen bitkiler Haziran ayının sonunda hasat edilmiştir.

Her parselden rastgele seçilen 10 adet başaktaki taneler sayılarak ve ortalaması alınarak başakta tane sayısı, ağırlık ortalamaları alınarak ise başakta tane ağırlıkları belirlenmiştir. Her parselden rastgele seçilen 10 bitkinin toprak yüzeyinden en üst noktasına kadar olan mesafe ölçülerek ve ortalaması alınarak bitki boyu tespit edilmiştir. Biyolojik verim hasat dönemindeki bitkilerde belirlenmiştir. 0,25 metre karelik çerçeve içerisinde kalan bitki aksamı toprak yüzeyinden kesilerek ağırlığı belirlenmiş ve metre kareye çevrilmiştir. Her parselde 4 adet çerçeve atılarak ortalaması belirlenmiştir. Ayrıca atılan çerçeveler içerisindeki başaklar sayılarak ve ortalaması alınarak m²'de başak sayısı belirlenmiştir. Tane verimi her parselden elde edilen tane ağırlığının dekara çevrilmesiyle elde edilen değerdir. Hasat indeksi ise birim alandan elde edilen tane ağırlığının, sap + tane ağırlığına % olarak oranlanması ile bulunmuştur.

Çizelge 1: Çalışmada kullanılan doğrudan ekim mibzerinin bazı özelliklerine ait değerler

Özellikler	Doğrudan Ekim Mibzerine Ait Değerler
Toplam Uzunluk (a) m	3
Toplam Genişlik © m	3,42
Toplam Yükseklik (b) m	1,65
İş Genişliği (b) m	2,10
Tekerlek Ölçüleri	10.0/75-15.3
Gerekli Güç (Kw)	44-52
Ekici Ayak Sayısı (adet)	15
Ekici Ayak Ara Mesafe (cm)	14
Tohum Sandığı Kapasitesi (kg)	235
Gübre Sandığı Kapasitesi (kg)	235
Ağırlık (ton)	2,050
Ayak Tipi	Diskli

Çalışma sonucunda bitki boyu, başakta tane sayısı, başakta tane ağırlığı, metrekarede başak sayısı, biyolojik verim, hasat indeksi ve birim alan tane verimi parametreleri belirlenmiştir. Elde edilen veriler SPSS programında t testi uygulanarak değerlendirilmiştir.

ARAŞTIRMA ve BULGULAR

Çalışma sonucunda incelenen parametrelerin istatistiksel değerlendirmesi sonucunda elde edilen veriler şu şekildedir;

Çizelge 2: İncelenen parametrelere ait ortalamalar ve t testi karşılaştırma sonuçları

Uygulamalar	İncelenen Parametreler							
	Başakta tane ağırlığı (g)	Başakta tane sayısı (adet)	Bitki boyu (cm)	Biyolojik verim (g m ⁻²)	Hasat indeksi (%)	m ² 'de başak sayısı (adet)	Tane verimi (kg da ⁻¹)	
Anız parçalama sonrası doğrudan ekim	2,51	74,40	81,00	2051,40	40,04 b	506,67	806,67	
Anız yakma sonrası geleneksel üretici uygulaması	2,27	66,30	83,30	1455,73	53,05 a	534,67	774,00	
F	3,867	1,600	0,022	1,730	8,051	0,196	0,887	
t	-3,464	-44,36	1,481	-2,794	2,991	0,678	-0,429	
Sigma (P)	0,121	0,275	0,889	0,259	0,047*	0,681	0,400	
D.K.	6,4	6,3	2,6	22,9	18,4	9,2	10,8	

*: %5 seviyesinde önemli

** : %1 seviyesinde önemli

Çizelge 2 incelendiğinde başakta tane ağırlığı, başakta tane sayısı, bitki boyu, biyolojik verim, m²'de başak sayısı ve tane verimi parametreleri açısından uygulamalar arasında istatistiksel

olarak farklılık olmadığı, hasat indeksi yönünden farklılık olduğu görülmektedir. Anızın yakıldığı ve toprağın diskaro ile işlendiği uygulamada hasat indeksi değeri daha yüksek bulunmuştur.

Yalçın ve ark. (2010) tarafından mısır sonrası buğday ve arpada farklı toprak işleme sistemlerinin (azaltılmış toprak işleme, doğrudan ekim teknikleri ve geleneksel toprak işleme) incelendiği çalışmada, buğday bitkisinde toprak işleme sistemleri arasındaki farklılık, istatistiksel olarak belirgin bulunmamıştır. Çıkman ve ark. (2017), buğday-mısır münavebesinde farklı toprak işleme sistemleri ile yürüttükleri 5 yıllık çalışma sonucunda en yüksek buğday verimini “ana ürün toprak işlemeli ikinci ürün toprak işlemesiz anıza direkt ekim” uygulamasından elde etmişlerdir. Aynı çalışmanın ekonomik analiz sonuçlarında ise en karlı yöntem “ana ürün ve ikinci ürün toprak işlemesiz” olarak belirlenmiştir (Çıkman ve ark., 2019). Kara ve Arslan (2021) soya hasadı sonrası buğdayda farklı toprak işleme yöntemlerini inceledikleri çalışmalarında, sırta ekim uygulamasında en düşük verim değerini elde etmişlerdir ancak geleneksel, azaltılmış ve doğrudan ekim istatistiksel olarak aynı grupta yer almıştır. Yapmış olduğumuz bu çalışmada, geleneksel çiftçi uygulaması ile anıza doğrudan ekim arasında istatistiksel olarak farklılık bulunmaması açısından Yalçın ve ark. (2010) ayrıca Kara ve Arslan (2021) ile benzer sonuçlar bulunmuştur.

Türkiye'nin Güneydoğu Anadolu Bölgesi'nin güney kesimlerinde bulunan Ceylanpınar TİGEM' de yapılmış olan bazı çalışmalar incelendiğinde ikinci ürün mısır tarımında doğrudan ekimin uygulanabileceği görülmektedir. Çalışkan (2015) tarafından yürütülmüş olan “Ceylanpınar Tarım İşletmesi'nde ikinci ürün mısır tarımında koruyucu toprak işleme uygulamaları” adlı yüksek lisans çalışmasında, tane verimi değerleri üzerine yapılan varyans analizi sonuçlarına göre, uygulamaların tane verimi üzerindeki etkisi istatistikî olarak önemli bulunmuş ve en iyi sonuç doğrudan ekim uygulamasından elde edilmiştir. Farklı uygulamalara ait verim değerleri dikkate alındığında ikinci ürün mısır üretiminde en yüksek verim değerine sahip olan doğrudan ekim uygulamasının daha karlı bir üretim tekniği olduğu bildirilmiştir. Gürsoy ve ark. (2015), TİGEM işletmelerindeki üretim alanlarındaki çalışmaların birçoğunda sulu koşullarda tarla tarımının yapıldığı bölgelerde II. Ürün tarımında doğrudan ekim yönteminin uygulanabileceğinin görüldüğünü belirtmişlerdir. Her ne kadar bu çalışmalar mısır bitkisinde yapılmış olsa da, aynı bölgede ve aynı ürün rotasyonunda yapılması sebebiyle önem arz ettiği düşünülmektedir.

Sonuç

Türkiye'nin Güneydoğu Anadolu Bölgesi'nin güney kesimlerinde uygulanan II. ürün mısır-buğday ekim nöbeti sisteminde buğday ekimi öncesi tarlada kalan mısır anızı üreticiler

tarafından yakılmakta, daha sonra yıllara göre deęişen şekilde farklı toprak işleme aletleri ile toprak işlenerek tarla buęday ekimine hazır hale getirilmektedir. Mısır anızının yakılması büyük sorun arz etmektedir. Hem çevresel sorunlara hem de topraęın verimsizleşmesine neden olan bu yöntemin yerine çevre dostu tarım tekniklerinin uygulanması gerekir. Anız parçalama sonrası doğrudan ekim bu yöntemlerden biridir. Bu çalışmada anız yakmaya alternatif olarak II. ürün mısırın hasadından sonra tarlada kalan saplar parçalanmış ve doğrudan ekim mibzeri ile buęday bitkisinin ekimi yapılmıştır. Bu iki uygulamanın karşılaştırılması sonucunda hasat indeksi deęeri dışında, dięer tüm parametreler yönünden uygulamalar arasında farklılık olmadığı görülmüştür.

Bu çalışma sonucunda, Güneydoęu Anadolu Bölgesi'nin güney kısmında, II. ürün mısır-buęday ekim nöbeti sisteminde buęday bitkisinin yetiştiricilięinde mısır saplarının sap parçalayıcı ile parçalanması sonucu doğrudan ekimin herhangi bir sorun yaşanmadan ve verim kayıpları olmadan uygulanabileceęi gözlenmiştir. Ancak daha uzun süreli ve toprak özelliklerinin detaylı şekilde incelendięi bilimsel çalışmaların yapılmasının faydalı olacağı düşünülmektedir.

Kaynakça

- Anonim, 2023. GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi Müdürlüğü Resmi İnternet Adresi. , Erişim Adresi: <https://arastirma.tarimorman.gov.tr/gaputaem/Belgeler/%C3%A7e%C5%9Fit%20belgeleri/t%C3%BCrk%C3%A7e/makarnal%C4%B1k%20bu%C4%9Fday/GANEM%20.pdf> (Erişim Tarihi:24.02.2023)
- Büyükşahin, F. 2018. Antropojenik etkiler ile havanın kirletilmesi ve iklim değişikliği. Uluslararası İnsan Çalışmaları Dergisi, 1(1): 14-26.
- Çalışkan, M. 2015. Ceylanpınar Tarım İşletmesinde ikinci ürün mısır tarımında koruyucu toprak işleme uygulamaları, Selçuk Ün., Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi
- Çıkman, A., Monis, T., Nacar, A. S., Vurarak, Y. 2017. Şanlıurfa koşullarında buğday ve mısır münavebesinde geleneksel toprak işleme ile anıza doğrudan ekim yöntemlerinin verime olan etkileri. Tarım Makinaları Bilimi Dergisi, 13(2): 113-119.
- Çıkman, A., Monis, T., Nacar, A. S., Vurarak, Y. 2019. Şanlıurfa koşullarında buğday ve mısır münavebesi için geleneksel toprak işleme ve anıza doğrudan ekim yöntemlerinin ekonomik yönden incelenmesi. Tarım Makinaları Bilimi Dergisi, 15(3): 91-96.
- Govaerts, B., Fuentes, M., Mezzalama, M., Nicol, J. M., Deckers, J., Etchevers, J. D., Sandoval B.F., Sayre, K. D. 2007. Infiltration, soil moisture, root rot and nematode populations after 12 years of different tillage, residue and crop rotation managements. Soil and Tillage Research, 94(1): 209-219.
- Gözübüyük, Z., Öztürk, İ., Demir, O., Çelik, A. 2012. Erzurum kuru tarım koşullarında farklı toprak işleme-ekim sistemlerinin toprak nem değişimine etkisi. Tarım Makinaları Bilimi Dergisi, 8(4): 365-374.
- Gürsoy, S. 2012. Diyarbakır ilinde uygulanan buğday anızı ve sapı yönetim sistemlerinin değerlendirilmesi. Yuzuncu Yıl University Journal of Agricultural Sciences, 22(3): 173-179.
- Gürsoy S., Turgut M. M., Sessiz A. 2015. Türkiye’de doğrudan ekim uygulamaları ve karşılaşılan sorunlar, 29. Ulusal Tarımsal Mekanizasyon ve Enerji Kongresi, 2-5 Eylül 2015, Diyarbakır
- Kara O., Arslan, E. 2021. Buğday üretiminde farklı toprak işleme ve ekim yöntemlerinin verim, maliyet ve net kar yönünden karşılaştırılması. Toprak Bilimi ve Bitki Besleme Dergisi, 9(2): 12-21.
- Savcı, S., Bağdatlı, M. C. 2016. Anız yakmanın çevre üzerine olan etkileri ve çözüm önerileri. I. Uluslararası Şehir Çevre ve Sağlık Kongresi, Kongre Kitabı, 11-15 Mayıs 2016, Kuzey Kıbrıs Türk Cumhuriyeti
- Sessiz, A., Akıncı, C., Turgut, M. M. 2010. GAP Bölgesinde ikinci ürün mısır tarımında azaltılmış ve doğrudan ekim uygulamalarının verime etkileri. Tarım Makinaları Bilimi Dergisi, 6(3): 203-208.
- Şahin, G., Onurbaş Avcıoğlu, A. 2016. Tarımsal üretimde sera gazları ve karbon ayak izi. Tarım Makinaları Bilimi Dergisi, 12(3): 157-162.
- Yalçın, H., Çakır, E., Aykas, E., Önal, İ., Gülsoylu E., Okur, B., Nemli Y., Delibacak, S., Ongun A. R., Türkseven S. 2010. Ege bölgesinde buğday ve arpa üretiminde koruyucu toprak işleme ve doğrudan ekim sistemleri. Bitkisel Araştırma Dergisi, (2010)2: 8-16

**KURU GIDA OLARAK DEĞERLENDİRİLEN BEZELYE (*Pisum sativum* L.)
TANELERİNİN BAZI FİZİKSEL ÖZELLİKLERİNİN BELİRLENMESİ**

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Özet

Dünyada nüfus artışına bağlı olarak ulaşılabilir gıda miktarı değişim göstermektedir. Küresel ısınma ve çevresel faktörler sebebiyle yaşanan olumsuz durumlar tarımsal üretimi doğrudan etkilemektedir. Bu nedenle, alternatif üretim yöntemlerinin uygulanması ya da üretilen ürünlerin farklı şekillerde depolanması yönünde çalışmalar yapılmaktadır. Gıdaların depolama şartlarına bağlı olarak daha uzun süre muhafaza edilmesi, farklı şekillerde değerlendirilmesi ile tüketicilerin beslenme ihtiyacı karşılanmaktadır. Bu çalışma, 2022 yılında Bingöl Üniversitesi Ziraat Fakültesi Biyosistem Mühendisliği ve Tarla Bitkileri Bölümlerine ait laboratuvarlarda gerçekleştirilmiştir. Kuru gıda olarak değerlendirilen iki farklı bezelye çeşidine ait tanelerin bazı fiziksel özellikleri incelenmiştir. Elde edilen verilerin, üretim ve ürün işleme aşamasında uygun alet, makine ve sistemlerinin seçiminin yapılmasında faydalı olacağı ön görülmektedir.

Anahtar Kelimeler: Bezelye, *Pisum sativum* L., Tohum özellikleri, Ürün işleme

**DETERMINATION OF SOME PHYSICAL PROPERTIES OF PEAS (*Pisum sativum*
L.) EVALUATED AS DRY FOOD**

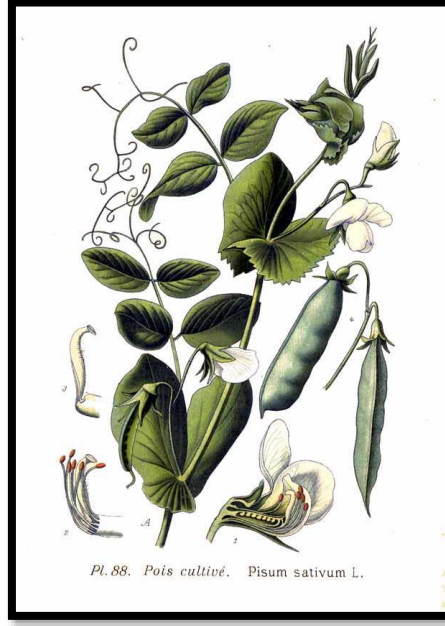
Abstract

The amount of accessible food varies depending on the population increase in the world. Negative conditions due to global warming and environmental factors affect agricultural production directly. For this reason, studies are carried out to apply alternative production methods or to store the products produced in different ways. The nutritional needs of the consumers are met by keeping the foods for a longer period of time depending on the storage conditions and evaluating them in different ways. This study was carried out in the laboratories of Bingol University Faculty of Agriculture, Biosystem Engineering and Field Crops Departments in 2022. Some physical properties of the grains of two different pea varieties, which are considered as dry food, were investigated. It is foreseen that the obtained data will be useful in the selection of suitable tools, machines and systems in the production and product processing stages.

Keywords: Pea, *Pisum sativum* L., Seed characteristics, Product processing

Giriş

Bezelye, *Leguminosae* familyasında, *Faboideae* alt familyasında, *Fabeae* takımında, *Pisum* genusuna bağlı baklagiller içerisinde yer alan bir türdür. Baklagiller, bitkiler aleminde 650'den fazla cins ve 18.000 kadar tür ile üçüncü en büyük familyayı oluşturmaktadırlar (Lewis ve ark., 2005). Bezelyenin kökeninin Doğu Akdeniz'in dağlık bölgeleri, Türkiye, Suriye Irak ve Lübnan'ın içerisinde yer aldığı verimli hilal olarak adlandırılan bölge ile İran, Kafkasya, Afganistan ve Tibet'e dayandığı belirtilmektedir (Adak, 2021) (Şekil 1).



Şekil 1. Bezelye (*Pisum sativum* L.,)

(https://commons.wikimedia.org/wiki/File:88_Pisum_sativum_L.jpg)

Baklagil türündeki bitkilerin büyük bir çoğunluğu insan beslenmesinde protein ve karbonhidrat kaynakları olarak kullanılmakta ve yüksek oranda protein (%18-31) ve önemli bazı amino asitleri içermeleri nedeniyle, özellikle gelir seviyesi düşük ülkelerin en önemli protein kaynaklarını oluşturduğu gibi (Özdemir, 2002), hayvan beslenmesinde ihtiyaç duyulan kaba ve kesif yem amacıyla da kullanılmaktadır (Karaköy ve ark., 2016). Son yıllarda tarla tarımı içerisinde yetiştiriciliği yapılan bezelyelerin toplandığı *Pisum sativum* L. türü, iki alt türü içermektedir. Bunlardan beyaz çiçekli olanı (ssp. *sativum*) yeşil veya kuru taneleri için yetiştirilen yemeklik bezelye veya diğer ismi ile bahçe bezelyesi, mor çiçekli olanı (ssp. *arvense*) ise ot veya tane yem olarak değerlendirilmek amacıyla yetiştirilen yem bezelyesidir (Açıkgöz, 2001).



Şekil 2. Bezelye taneleri

(<https://www.gardenia.net/plant/pisum-sativum>)

Kendine döllen bezelye, diploid kromozom sayısı $2n=2x=14$ olan önemli bir baklagil bitkisidir (Dolezel ve Greilhuber, 2010). Doğu Akdeniz, Kafkasya, Afganistan, İran ve Tibet'e kadar uzanan bölgeler bezelyenin birinci derecedeki, Güney Batı Arabistan'dan Etiyopya ve Kuzey Afrika'ya kadar uzanan bölgeler ise ikinci derecedeki orijin merkezini oluşturmaktadır (Govorov, 1937; Davies, 1976; Hagedorn, 1984) (Şekil 2).

Çizelge 1. Bezelye tanesinin kimyasal bileşimi (Leterne, 1990; Dahl ve ark., 2012, Adak, 2021)

KURU MADDE	%	AMİNOASİT	G/100 PROTEİN
YAĞ	1.2-2.4	İsoleucin	3.33
NİŞASTA	36.9-49.0	Leucin	6.58
PROTEİN	21.2-32.9	Lysin	6.84
LİF	14-24	Methionin	1.03
ŞEKER	5.3-8.7	Phenylalanin	4.19
KÜL	2.4-3.4	Threonin	3.59
NEM	13.04	Valin	3.89
KALORİ: KCAL/100 G	303	Tryptophan	0.94

Dünyada kuru bezelye üretim bakımından baklagiller içerisinde fasulyeden sonra ikinci sırada bulunurken (Skyrpetz, 2004), ülkemizde nohut, mercimek, fasulye ve bakladan sonra beşinci sırada bulunmaktadır. Ülkemizin değişik ekolojik bölgelerine adapte olabilen bezelye çeşitlerinin geliştirilememiş olması nedeniyle ülkemizdeki kuru bezelye üretimi istenilen seviyede değildir. Oysaki yapılan araştırmalara göre, bezelye tanesinin kimyasal bileşeninde %1.2-2.4 yağ, %36.9-49.0 nişasta, %21.2-32.9 oranında protein ve %14-24

oranında lif içerdiği belirlenmiştir. Protein bakımından bezelye tanesini incelendiğinde ise pek çok farklı aminoasit çeşidini içerdiği saptanmıştır (Çizelge 1).

Bezelye tanelerinin morfolojik olarak yapılarında farklılıklar gözlenebilmektedir. Tek yıllık serin iklim bitkisi olan bezelyenin tanesi, tohum kabuğu, kotiledonlar ve embriyodan meydana gelmektedir. Testa olarak da bilinen tohum kabuğu sert ve kalın bir yapıya sahiptir. Tanenin yaklaşık %6-10'unu meydana getirmektedir. Bezelye tane çapı 6-9 mm arasında değişiklik göstermektedir (Adak, 2021).

Genellikle 3-5 cm derinlikte ekilen bezelye tohumları, sonbahar aylarında 7-8 cm, erken ilkbaharda 5-6 cm, ilkbahar aylarında ise 4-5 cm civarında ekilmelidir. Bodur bezelyelerde ekim sıklığı sıra arası 30-40 cm ve sıra üzeri 5-10 cm, yatık ve sarılcı tip bezelyelerde ise ekim sıklığı sıra arası ve sıra üzeri mesafeler daha geniş olacak şekilde yapılmalıdır. Dekara atılacak tohumluk miktarı, ekim sıklığı ve çeşidin dane iriliğine bağlı olarak 6-18 kg arasında değişmektedir (Anonim, 2022).

Son yıllarda iş yükünün yoğunluğuna bağlı olarak hızlı, pratik ve lezzetli olan hazır gıdaların kullanımı artmıştır. Bu tarz beslenme ürünlerinin mümkün olduğunca içeriğinin (vitamin, protein, mineral vb.) zengin olması, uygun maliyetli ve ulaşılabilir olması tüketici alışkanlıklarında gün geçtikçe daha fazla kendisine yer edinmesine sebep olmuştur. Bezelye, kuru bakliyatlar içerisinde tanesi değerlendirilen önemli bitkisel ürünler içerisinde yer almaktadır. Hazır çorbalardan, bebek mamalarına kadar pek çok hazır gıda içerisinde farklı formlarda değerlendirilen bezelye ürün işleme pazarında önemli bir yer sahiptir (Göçmen ve Şahin, 2000). Çölyak hastalarının beslenmesinde gluten içermeyen gıdaların tüketilmesi gerekmektedir (Dumanoğlu ve Geren, 2020). Bu nedenle, gluten içermeyen gıdaların yer aldığı beslenme ürünlerinde yine bezelye değerlendirilen ürünler içerisinde yer almaktadır (İşleroğlu ve ark., 2009). Bunların yanında bezelye, vegan beslenen kişiler için hayvansal proteinlerine yerine kullanılacak protein içeriği yüksek bitkisel ürünler içerisinde yer almaktadır.

Bu araştırmanın amacı, özellikle kuru gıda olarak değerlendirilen bezelye bitkisine ait tanelerin bazı fiziksel özelliklerinin belirlenerek ürün işleme basamağında burada elde edilen verilerden faydalanılarak işlem basamaklarında kullanılması yönündedir. Ayrıca bu konuda yapılan ıslah çalışmalarına ve mekanizasyon aralığı ile yapılacak olan üretime de katkı sağlayacağı ön görülmektedir.

Materyal ve Metod

Bu çalışma, 2022 yılında Bingöl Üniversitesi Ziraat Fakültesine ait laboratuvarlarda yürütülmüştür. Çalışmada incelenen iki farklı kuru bezelye çeşidi (Deren ve Irmak) 2022 yılında Doğu Akdeniz Tarımsal Araştırma Enstitüsü Müdürlüğü'nden temin edilmiştir. Çimlenme kapasitelerinin yaklaşık olarak %98-99 oranlarında olduğu belirlenmiştir. Bezelye tanelerinin, uzunluk (mm), genişlik (mm), yüzey alan (mm²), ortalama aritmetik çap (mm), küresellik ve bin tane ağırlığı (g) gibi bazı fiziksel özellikleri incelenmiştir. Rastgele olacak şekilde 100'er adet seçilen taneler, kendine ait yazılımı olan Nikon SMZ 745T marka stereo mikroskop altında incelenmiştir (Dumanoğlu & Geren, 2020; Dumanoğlu ve ark., 2021). Buradan elde edilen değerlerden faydalanılarak tanelere ait ortalama aritmetik çap (mm) ((D:L+W)/2), küresellik (Φ : D_0/L) değerler belirlenmiştir (Alayunt, 2000; Kara, 2012; Kara, 2017; Mohsenin, 1970) (L: Tohum uzunluk, W: Tohum genişlik, D:Ortalama aritmetik çap, Φ : Küresellik). Bunların yanında yine rastgele olacak şekilde alınan örnekler içerisinde her bir çeşidin bin tane ağırlığı hassas terazi (0.001 g) aracılı ile saptanmıştır (Dumanoğlu ve ark, 2022). Elde edilen veriler Yağcıoğlu (2015) belirtmiş olduğu tohum tane özelliklerine göre sınıflandırılmıştır (Çizelge 2).

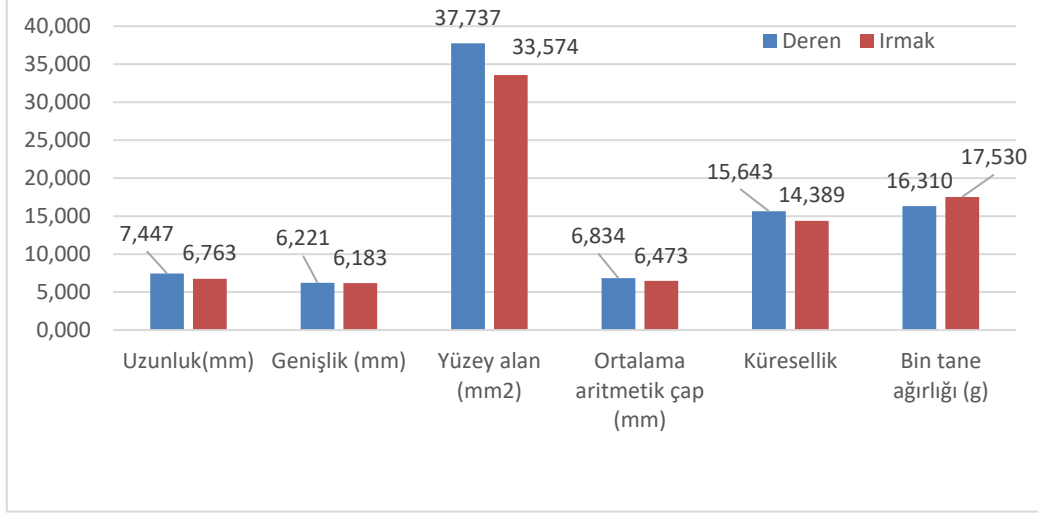
Çizelge 2. Tohumların geometrik ve şekil özelliklerine göre sınıflandırılması (Yağcıoğlu, 2015)

Geometrik özelliklerine göre tohumlar	Tane genişliği/Tane uzunluğu (b/a) (mm)
Uzun	< 0.6
Orta	0.6 – 0.7
Kısa	> 0.7
Şekil özelliklerine göre tohumlar	Uzunluk (a), Genişlik (b), Kalınlık (c) (mm)
Yuvarlak	$a \approx b \approx c$
Oval	$a/3 < b \approx c$
Uzun	$c < b < a/3$

Bulgular

Bu çalışmada incelenen iki farklı bezelye çeşitlerine ait tanelerin bazı fiziksel özellikleri; ortalama 7.105 mm uzunluk, 6.202 mm genişlik, 35.656 mm² yüzey alan, 6.654 mm aritmetik çap, 15.016 küresellik ve 16.920 g bin tane ağırlığı şeklinde belirlenmiştir. Deren çeşidinin, 7.447 mm uzunluk, 6.221 mm genişlik, 37.737 mm² yüzey alan, 6.834 mm ortalama aritmetik çap, 15.643 küresellik ve 16.310 g bin tane ağırlığına sahip olduğu belirlenmiştir. Irmak çeşidinin, 6.763 mm uzunluk, 6.183 mm genişlik, 33.574 mm² yüzey alan, 6.834 mm ortalama

aritmetik çap, 14.389 küresellik ve 17.530 g bin tane ağırlığına sahip olduğu saptanmıştır (Şekil 3). Yağcıoğlu (2015)' te yapmış olduğu sınıflandırmaya göre; her iki çeşide ait tanelerin kısa ve oval tohum özelliklerine sahip olduğu belirlenmiştir. Çalışmada elde edilen değerlerin Adak (2021) yapmış olduğu araştırmalar ile uyumlu olduğu belirlenmiştir.



Şekil 3. Kuru gıda olarak değerlendirilen bezelye çeşitlerinin tanelerine ait bazı fiziksel özellikler

Sonuç

Gün geçtikçe artan nüfusun bezlenmesine yönelik yapılan çalışmalar artmaktadır. Farklı yöntemler kullanılarak üretin tarımsal ürünlerin depolanması için bir yandan yeni yöntemler aranırken diğer yandan mevcut değerlendirme şekilleri kullanılmaktadır. Ürünlerin mümkün olduğunca tazeliğini kaybetmeden lezzetli ve standart bir kalitede tüketiciye ulaşması ana hedefler içerisinde yer almaktadır. Bu çalışma kapsamında kuru gıda olarak değerlendirilen bezelye bitkisine ait iki farklı çeşidin tanelerine ait bazı fiziksel özellikler belirlenmiştir. Elde edilen değerlerin, hem üretim aşamasında mekanizasyon olanaklarının değerlendirilmesinde, hem de ürün işleme aşamasında farklı basamaklarda alet, makine ve sistemlerin seçilerek kayıplar olmaksızın kullanılmasına olanak sağlayacağı ön görülmektedir. Ayrıca, bu çeşitlere ilişkin ileride yapılacak olan ıslah çalışmalarında fayda sağlayacağı düşünülmektedir.

Teşekkür

Bu çalışma kapsamında incelenen, iki farklı kuru bezelye çeşidine ait tanelerin (Deren ve Irmak) temini sağlayan, Doğu Akdeniz Tarımsal Araştırma Enstitüsü Müdürlüğü'ne ve Sayın Dr. Meltem TÜRKERİ'ye teşekkür ederiz.

Kaynaklar

- Açıkgöz, E. (2001). Yem Bitkileri. Uludağ Üniversitesi Güçlendirme Vakfı Yayın No: 182, Bursa.
- Adak, S. (2021). Yemeklik baklagiller. Ankara Üniversitesi Ziraat Fakültesi Yayınları. Yayın no:1652, Ankara.
- Anonim. (2022). Dane Baklagiller Yetiştiriciliği (Bakla ve Bezelye).pdf. http://www.megep.meb.gov.tr/mte_program_modul/moduller_pdf/Yemeklik
- Alayunt, F.N. (2000). Biyolojik Malzeme Bilgisi, Ege Üniversitesi Ziraat Fakültesi Tarım Makineleri Bölümü Ders Kitabı, Ege Üniv. Ziraat Fak. Yayınları No: 541.
- Dahl, W. (2012). Review of the health benefits of peas (*Pisum sativum* L.) The British Journal of Nutrition. 230731678.
- Davies, D.R. (1976). Peas (Ed: N.W. Simmonds), Volution of Crop Plants. Longman, London, pp. 172-174.
- Dumanoğlu, Z., Çağan, E. & Kökten, K. (2021). Korunga (*Onobrychis viciifolia* Scop.) genotiplerine ait tohumların fiziksel özelliklerinin belirlenmesi. Journal of Anatolian Environmental and Animal Sciences. 6(1):18-24.
- Dumanoğlu, Z., Çağan, E. & Kökten, K. (2022). A Study on determination of some morphological and physiological characteristics of broadcast vetch (*Vicia sativa* L.) seeds. MAS Journal. 7(1):41-47.
- Dumanoğlu, Z., Geren, H. (2020). An Investigation on Determination of Seed Characteristics of Some Gluten-Free Crops (*Amarantus mantegazzianus*, *Chenopodium quinoa* Willd., *Eragrostis tef* [Zucc] Trotter, *Salvia hispanica* L.). Turkish Journal of Agriculture-Food Science and Technology. 8(8), 1650-1655.
- Dolezel, J., Greilhuber, J. (2010). Nuclear genome size. Are we getting closer? Cytometry, 77, 635-642.
- Govorov, L.I. (1937). *Pisum* (N.I. Vavilov, E.V. Wulff), Flora of Cultivated Plants. IV. Grain Leguminosae. State Agricultural Publishing Company, Moscow, Leningrad, pp. 231-336.
- Göçmen, D. & Şahin, İ. (2000). Hazır çorba üretiminde kuru bezelye kullanım olanağının araştırılması, GIDA 25(2):87-91.
- Hagedorn, D.J. (1984). Compendium of Pea Disases. University of Wisconsin-Madison.
- İşleroğlu, H., Dirim, S. N., Kaymak Ertekin, F. (2009). Gluten İçermeyen, Hububat Esaslı Alternatif Ürün Formülasyonları Ve Üretim Teknolojileri. GIDA 34(1):29-36.
- Kara, M. (2012). Biyolojik Ürünlerin Fiziksel Özellikleri, Atatürk Üniv. Ziraat Fakültesi Yayınları No: 242.
- Kara, M. (2017). Physical Properties of Biological Products. Güven Bilimsel. ISBN: 978-975-6240-56-4, İstanbul.
- Karaköy, T., Demirbaş, A., Yörük, V., Toklu, F., Baloch, F.S., Ton, A., Anlarsal, A.E., Özkan, H. (2016). Sivas Ekolojik Koşullarında Soğuga Dayanıklı Bezelye (*Pisum sativum* ssp. *sativum* L. ve ssp. *arvense* L.) Genotiplerinin Belirlenmesi. Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi, 25 (Özel sayı-1), 171-176.
- Leterne, P. (1990). Amino acid composition of pea (*Pisum sativum*) proteins and protein of pea flour. Journal of the Science Food and Agriculture. 230106119.
- Lewis, G., Schrirer, B., Mackinder, B., Lock, M. (2005). Legumes of the World; Royal Botanical Gardens: Kew, UK.
- Özdemir, S. (2002). Yemeklik Baklagiller. Hasad Yayıncılık, İstanbul.

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- Mohsenin, N.N. (1970). Physical Properties of Plant and Animal Materials. Gordon and Breach Science Publishers.
- Skrypetz, S. (2004). Dry Peas: Situation and outlook. Agriculture and Agri-Food Canada, Market Analysis Division. Bi-weekly Bulletin, 17, 1-10.
- Yağcıođlu, A. (2015). Ürün İşleme, Ege Üniversitesi Yayınları Ziraat Fakültesi Yayın No: 517, Genişletilmiş 2. Baskı.

**DİYARBAKIR EKOLOJİK KOŞULLARINDA NOHUT GENOTİPLERİNİN
BAZI TEKNOLOJİK ÖZELLİKLERİNİN BELİRLENMESİ**

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ÖZET

Dünya nüfusunun 2050 yılında yaklaşık 9.5 milyar olacağı tahmin edilmekte olup üretim kaynaklarının azalması, gıda üretiminin dünya üzerinde dengesiz dağılımı ve ekolojik şartlar, dengesiz beslenmenin en önemli sebepleri arasında yer almaktadır. İklim değişikliklerinin ve yetiştirme koşullarının verimi direkt etkilemesinin yanı sıra, tane kalitesini de önemli düzeyde etkilemektedir. Nohutta verimi artırmak önemli amaçlar arasında yer alsa da tane kalitesi de insan beslenmesi ve sağlığı açısından önemli olduğu bilinmektedir. Bu çalışma, Diyarbakır'da yetiştirilen bazı nohut hat ve çeşitlerinin kalite özelliklerini belirlemek amacıyla yürütülmüştür. Çalışmada, 2021-2022 yazlık yetiştirme sezonunda Diyarbakır ekolojik koşullarında 25 nohut genotipinin, tesadüf blokları deneme desenine göre 4 tekrarlamalı yürütülen tarla çalışmasından elde edilen tanelerde teknolojik özellikler incelenmiştir. Araştırma sonucunda incelenen teknolojik özellikler bakımından nohut genotipleri arasında istatistiki olarak önemli fark bulunmuştur. Nohut genotiplerine göre değişimle birlikte kuru ağırlık 22.91-35.35 g; yaş ağırlık 49.75-79.55 g; kuru hacim 60.0-100.0 ml; yaş hacim 126.67-162.5 ml; su alma kapasitesi 0.267-0.443 g/tane; su alma indeksi % 0.150-0.667; şişme kapasitesi 0.05-0.167 ml/tane ve şişme indeksi %1.100-3.333 arasında değişmiştir. Sonuç olarak, Azkan, Botan, Hasanbey, FLIP 07-34C, FLIP 09-183 C ve FLIP 09-184 C genotipleri sahip olduğu teknolojik özellikleri ile daha erken pişebilecek genotipler olabileceği belirlenmiştir.

Anahtar Kelimeler: Nohut, genotip, tane, kalite, teknolojik özellik

**DETERMINATION OF SOME TECHNOLOGICAL CHARACTERISTICS OF
CHICKPEA GENOTYPES UNDER ECOLOGICAL CONDITIONS OF
DIYARBAKIR**

ABSTRACT

The world population is estimated to be around 9.5 billion in 2050, and the decrease in production resources, the unstable distribution of food production and ecological conditions are among the most important reasons for malnutrition. Climatic changes and growing conditions not only directly affect yield, but also significantly affect grain quality. Although increasing the yield of chickpea is among the important goals, it is known that grain quality is also important for human nutrition and health. This study was carried out to determine the quality characteristics of some chickpea genotypes and varieties grown in Diyarbakır. In the study, the technological properties of chickpea seeds obtained from the field experiment carried out in 4 replications according to the randomized blocks trial design of 25 chickpea genotypes in Diyarbakır ecological conditions in the 2021-2022 growing season were investigated. As a result of the research, a statistically significant difference was found between chickpea genotypes in terms of technological properties. According to chickpea genotypes, the dry weight; wet weight, dry volume, wet volume, water absorption capacity, water uptake index, swelling capacity varied between 22.91 and 35.35 g, between 49.75 and 79.55 g, between 60.0 and 100.0 ml, between 126.67 and 162.5 ml, between 0.267-0.443 g/seed, between 0.150 and 0.667%, between 0.05 and 0.167 ml/seed and between 1.100 and 3.333%, respectively. As a result, it has been determined that Azkan, Botan, Hasanbey, FLIP 07-34C, FLIP 09-183 C and FLIP 09-184 C genotypes can be cooked earlier with their technological features.

Keywords: Chickpea, genotype, seed, quality, technological properties

GİRİŞ

Nohut (*Cicer arietinum* L.), fasulyeden sonra Dünya’da en fazla üretimi yapılan yemeklik tane baklagil bitkisidir. Nohut, tane büyüklüğü, renk ve şekillerine göre Desi ve Kabuli tip olarak iki gruba ayrılır. Desi tipi nohut; küçük, düzensiz şekilli, renkli (sarı, yeşilimsi, kahverengi, siyah) tane yapısına sahiptir. Kabuli tipi nohut; iri, genellikle düzgün, koç başı şeklinde olup, beyaz veya açık-krem rengindedir.

İnsan yaşamının daha sağlıklı, kaliteli ve sürdürülebilir olması için tüm besin kaynaklarından yeteri kadar alması gerekmektedir. Et ve et ürünleri, süt ve süt ürünleri, meyve ve sebzeler ile beraber bakliyat ürünleri de dengeli beslenme açısından oldukça gereklidir. Baklagiller; ekonomik ve yüksek besin değerine sahip olması sebebiyle eski çağlardan beri yaygın olarak yetiştirilmekte ve tüketilmektedir.

Nohut, %20-40 protein içeriğinden dolayı insan ve hayvan beslenmesinde önemli bir yere sahiptir. Yüksek düzeyde karbonhidrat, vitamin ve mineraller (kalsiyum, potasyum, fosfor, magnezyum, demir ve çinko), lif, doymamış yağ asitleri ve β -karoten bakımından da zengindir (Jukanti ve ark., 2012). Nohut bitkisel kaynaklı, zengin bir beslenme programının bir parçası olarak tüketildiğinde çeşitli kronik hastalıkların gelişimini önlemeye yardımcı olabilecek bileşenlerde içermektedir. İçeriğindeki protein, kas kütlesi oluşturmaya yardımcı olur ve hücrelerin sağlığını iyileştirirken, magnezyum, manganez ve kalsiyum kemikleri güçlendirir. Nohudun yüksek lif ve protein içeriği obezitenin önlenmesinde ve obezite tedavisinde kullanılabilir. Lif ve doymamış yağlar da kan lipit seviyelerini olumlu yönde etkileyebilir ve düşük glisemik indekse sahip olması nedeniyle kan şekeri ve insülin seviyelerinde ani dalgalanmaları önlediği için diyabet hastalarını diyet programında önemli bir yere sahiptir. Nohut, bağırsaklarda fermente edilen bir oligosakkarit olan çözünebilir lif (rafinoz) içeri ile bağırsak çalışmasını düzenlemeyi teşvik ederek kolorektal kanseri önlemede rol almaktadır (Muzquiz ve Wood, 2007; Wood ve Grusak, 2007, Wang ve ark., 2010).

Dünya’da nohudun tüketim biçimleri etnik ve kültürlere göre değişebilmektedir. Hindistan’da, dhal olarak (kotiledonlar ayrılır) ve un (besan) yapmak için öğütülür. Dünyanın diğer bölgelerinde, özellikle Asya ve Afrika’da nohut, yemeklerde, çorbalarda/salatalarda haşlanmış, tuzlanmış ve fermente edilmiş formlarda tüketilmektedir. Ülkemizde nohut yemeklik olarak tüketiminin yanında leblebi ve firik olarak tüketimi de çok yaygındır. Son yıllarda, içeriğindeki yüksek protein oranı nedeni ile nohut unu çeşitli gıdaların içeriğini zenginleştirebilmek için kullanılmaktadır.

Dünya’da nohut tüketimi yıllık kişi başı 7 kg iken, Türkiye’de ise 5.4 kg’dır (TUİK, 2020). Nohut tanelerinin kalitesi sadece içerdiği besin değerleri ile değil pişme özellikleri ile de değerlendirilmelidir. Tanenin pişme kalitesi tanenin içeriği, tarımsal uygulamalar, iklim, toprak gibi birçok faktörden etkilenebilmektedir. Ülkemizde nohut alanında yapılan çalışmalarda yüksek verimli, iri taneli, hastalık ve zararlılara toleransı çeşitlerin geliştirilmesine odaklanılmaktadır. Ancak, geliştirilen çeşitlerin teknolojik özellikleri yeterince araştırılmamış ve bu konu ile ilgili az sayıda çalışma bulunmaktadır.

Bu çalışma ile, Diyarbakır ekolojik koşullarında yetiştirilen 25 nohut genotipinin teknolojik özellikleri ve bu özellikler arası ilişkiler incelenmiştir.

MATERYAL ve YÖNTEM

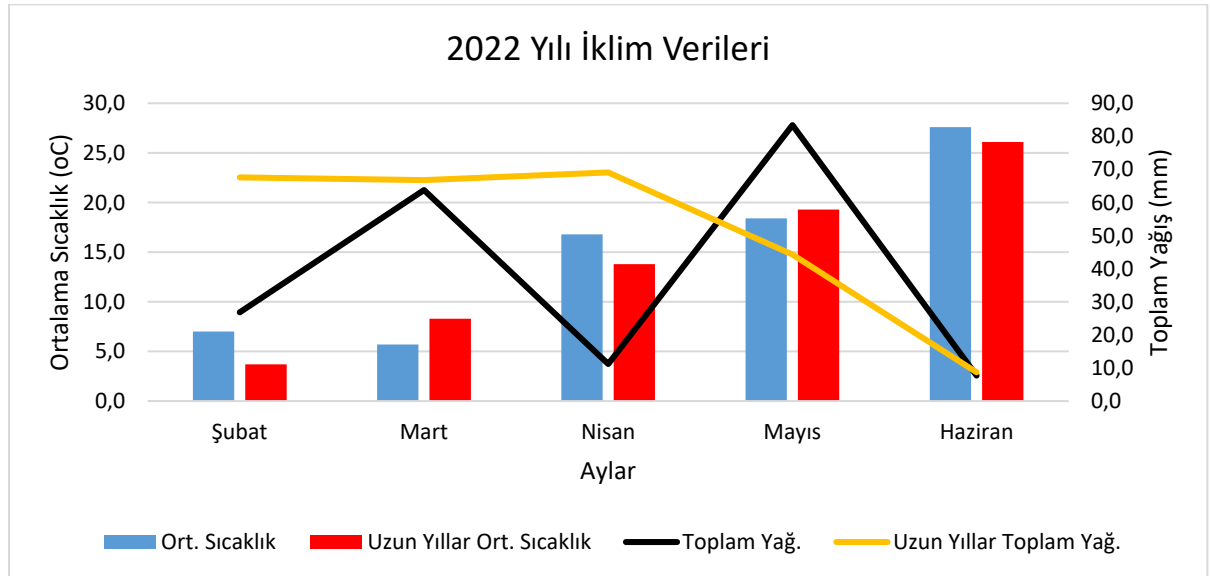
Araştırmada, ICARDA'dan temin edilen ve önceki çalışmalarda öne çıkmış 17 nohut genotipi ile 8 adet tescilli çeşit (Arda, Azkan, Botan, Hasanbey, Seçkin, Aksu, Diyar 95, Arslanbey) olmak üzere toplam 25 adet nohut genotipi materyal olarak kullanılmıştır.

Denemeler, Diyarbakır/Sur ilçesi GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi Müdürlüğü deneme alanında (37° 30 ve 38° 43 Kuzey enlemleri ile 40° 37 ve 41° 20 Doğu boylamları, 570 m yükseklik) yürütülmüştür.

Araştırmanın yürütüldüğü Diyarbakır ili karasal iklimi yansıtmaktadır. Yazları çok sıcak ve kurak, kışları ise daha az yağışlı ve soğuktur. Araştırmanın yürütüldüğü Diyarbakır ili 2022 yılı vejetasyon dönemi ve uzun yıllar iklim verileri, Grafik 1'de verilmiştir. Grafik 1'den görüleceği gibi, vejetasyon süresince en düşük sıcaklık ortalaması Mart (0.3 °C) ayında görülürken, en yüksek sıcaklık ortalaması Haziran (31.7 °C) ayında görülmüştür. Vejetasyon süresi boyunca toplam 192.6 mm yağış düşmüştür.

Araştırmanın yürütüldüğü Diyarbakır ili Şubat-Haziran dönemine ait uzun yıllar iklim verilerine bakıldığında ise en sıcak ay ortalaması 33.6°C (Haziran) ve en soğuk ay ortalaması ise -1.0 °C' (Şubat) olarak kaydedilmiştir. Uzun yıllar yıllık toplam yağış ortalaması 256.5 mm olup bunun büyük bir kısmı bahar aylarında düşmektedir (Anonim, 2022).

Deneme alanı toprakları (0-30 cm) killi-tınlı, toplam tuz değerine göre orta tuzlu (% 0.400), organik madde açısından düşük (% 1.66), toprak pH bakımında alkali (pH: 8.07) ve CaCO₃ içeriği (%7.93) ile orta seviyedir.



Grafik 1. Araştırmanın Yürütüldüğü Diyarbakır İli 2022 Yetiştirme Sezonunu ile Uzun Yıllara İlişkin Önemli Meteorolojik Parametreler (Uzun Yıllar: 1929 – 2021 yılları arası veri grubu)

YÖNTEM

Denemeler tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak 2021-2022 yetiştirme döneminde yürütülmüştür. Ekimler, sıra uzunluğu 6 m, sıra arası 0.30 m ve her parsel 4 sıradan oluşacak şekilde, 4 tekrarlamalı olarak kurulmuştur. Her parsel, $0.30 \times 6 \text{ m} \times 4 = 7.2 \text{ m}^2$ ve her sıraya 81 adet tohum gelecek şekilde (45 tohum/m^2 , $45 \times 7.2 \text{ m}^2 = 324 \text{ adet /parsel}$) 21 Şubat 2022 tarihinde yapılmıştır. Deneme hasatları, 08 Temmuz 2022'de yapılmıştır.

Teknolojik Özellikler

Hasat edilen tanelerde Tohumluk Tescil ve Sertifikasyon Merkezi (TTSM)'nin tarımsal değerleri ölçme denemeleri teknik talimatına göre Laboratuvar şartlarında kuru ağırlık (g), yaş ağırlık (g), su alma kapasitesi (g/tane), su alma indeksi (%), kuru hacim (ml), ıslak hacim (ml), şişme kapasitesi (ml/tane) ve şişme indeksi (%) ölçümleri yapılmıştır (Anonim, 2021).

Kuru Ağırlık(g): Yüz adet nohut tohumu sayılır, tartılır ve kuru ağırlık olarak kaydedilir.

Yaş Ağırlık (g): Yüz adet nohut tohumu 150 ml saf su içinde 16 saat bekletildikten sonra kurutma kâğıdı ile kurulanıp tartılır. Sonuç yaş ağırlık olarak kaydedilir.

Kuru Hacim (ml): Yüz adet nohut tohumu 100 ml'lik silindire alınır, 50 ml saf su ilave edilir ve sonuç kuru hacim olarak kaydedilir.

Yaş Hacim (ml): Yüz adet nohut tohumu 100 ml'lik silindire alınır 50 ml su ilave edilip 16 saat bekletildikten sonra kâğıt havlu ile kurutulur. Kurutulan tohumlara 100 ml saf su ilave edilir ve sonuç yaş hacim olarak kaydedilir.

Su Alma Kapasitesi (gr/tane) = Yaş ağırlık – Kuru ağırlık / 100

Su Alma İndeksi (%) = Şişme kapasitesi(g/tane) / (Kuru ağırlık / 100)

Şişme Kapasitesi (ml/tane)=[(Islak hac.-100)-(Kuru hac.-50)]-[Kuru hacim-50/100]xŞişmeyen tane sayısı] 100 – Şişmeyen tane sayısı

Şişme İndeksi (%) = (Yaş hacim – 100) / (Kuru hacim – 50)

Verilerin Değerlendirilmesi

Elde edilen veriler, tesadüf blokları deneme deseninde analiz edilmiştir. İstatistikî analizler, JMP ve GenStatRelease14.1 (Copyright 2011, VSN International Ltd.) versiyonu kullanılarak yapılmış, önemli çıkan ortalamalar, TUKEY testine göre gruplandırılmıştır (Gauch, 1988).

BULGULAR ve TARTIŞMA

Diyarbakır ekolojik koşullarında 2022 yetiştirme döneminde 25 nohut genotipinde incelenen özelliklerden; kuru ağırlık (g), yaş ağırlık (g), kuru hacim (ml) ve yaş hacim (ml) bakımından genotipler arasında istatistiki olarak önemli farklılıklar bulunmuştur. İncelenen özelliklere ait ortalama değerler ve oluşan gruplar, Çizelge 1'de verilmiştir.

Çizelge 1'den görüldüğü gibi kuru ağırlık değeri genotiplere göre değişmekle birlikte 22.91-35.35 g arasında değişmiş, Arslanbey çeşidinde en yüksek değer saptanırken Aksu ve EN 934 genotipleride istatistiki olarak aynı grubu paylaşmışlardır. Araştırmada incelenen genotiplerin ortalama kuru ağırlık değeri ise 28.40 g'dır. Bulgularımıza benzer şekilde kuru ağırlık değerinin

genotiplere göre deđiřtiđi deđiřik arařtırmacılar tarafından da belirtilmiřtir. Williams ve ark. (1983), 9.2 - 54.1 g, Kaya ve ark. (2016), 32.27-60.49 g; Mart ve Akın (2022), 29.70-53.74 g; Özaktan (2021), 37.17-49.35 g arasında deđiřtiđini belirtmiřlerdir. Tane iriliđi tüketiciler için ve pazar deđeri aısından önemli bir özelliktir. Tane iriliđinde tercih ülkelerin kullanım alışkanlıđına göre deđiřse de yaygın olarak iri taneli nohut eřitleri tercih edilmektedir.

Nohut genotiplerinin yař ađırlık deđerleri genotiplere göre deđiřmekle birlikte 49.75-79.55 g arasında deđiřmiř, Arslanbey nohut eřidi en yüksek ve FLIP06-138C genotipi ise en düşük yař ađırlık deđerine sahip oldukları saptanmıřtır (izelge 1). Nohutta yař ađırlık deđerinin genotiplere göre deđiřebileceđi deđiřik arařtırmalarda da belirtilmiřtir Kaya ve ark. (2016), yař ađırlık deđerinin genotiplere göre 72.06-132.82 g; Özaktan (2021), 78.41-103.85 g; Mart ve Akın (2022), 59.08-112.27 g arasında deđiřtiđini belirtmiřlerdir.

Nohut genotiplerinin kuru hacim deđerleri genotiplere göre deđiřmekle birlikte 60.0-100.0 ml arasında deđiřmiř, Botan, FLIP03-112C, FLIP06-133C, FLIP07-34C, FLIP09-183C, FLIP97-503C ve Hasanbey genotipleri en yüksek deđerde ve istatistiki olarak aynı grupta yer almıřlardır. Bulgularımıza benzer şekilde kuru hacim deđerinin genotiplere göre 27.0-91.0 ml arasında deđiřebileceđi belirtilmiřtir (Kaya ve ark., 2017; Bier ve ark., 2017). Nohutta kuru hacim deđerinin genotiplere ve evre kořullarına göre Sfayhi ve Kharrat (2011), 11.16-26.5; Özaktan (2021), 25.67-41.67 ml; Mart ve Akın (2022), 71.5-91.0 ml arasında deđiřtiđini belirtmiřlerdir.

Yař hacim deđerleri nohut genotiplerine göre deđiřmekle birlikte 126.67-162.50 ml arasında deđiřmiř olup tüm genotiplerin ortalama deđerleri 148.67 ml'dir. En yüksek yař hacim deđerleri FLIP07-34C genotipinde saptanmıřtır. Bulgularımıza benzer şekilde yař hacim deđerinin genotiplere göre deđiřebileceđi belirtilmiřtir (Bier ve ark., 2017; Kaya ve ark., 2017; Özaktan, 2021; Mart ve Akıncı, 2022). Arařtırmada kuru hacim deđerleri yüksek olan genotiplerin yař hacim deđerleri de yüksek bulunmuřtur.

Çizelge 1. Diyarbakır ekolojik koşullarında, nohut genotiplerinde kuru ağırlık, yaş ağırlık, kuru hacim ve yaş hacim değerlerine ilişkin ortalamalar ve oluşan gruplar

Genotip	Kuru Ağırlık (g)*	Yaş Ağırlık (g)*	Kuru Hacim (ml)*	Yaş Hacim (ml)*
17.POP/3	28.86 efg	61.65 f-j	92.50 abc	150.00 a-d
Aksu	34.21 ab	73.84 b	60.00 f	126.67 f
Arda	27.15 f-1	57.41 ı-m	85.00 bcd	150.00 a-d
Aslanbey	35.35 a	79.55 a	60.00 f	126.67 f
Azkan	30.35 de	66.85 def	87.50 a-d	155.00 ab
Botan	32.95 bc	73.40 bc	100.00 a	160.00 ab
Diyar-95	25.77 h-k	54.19 k-n	82.50 cde	145.00 a-e
EN 934	33.63 abc	71.81 bcd	83.33 b-e	143.33 b-f
FLIP03-112C	27.22 f-1	64.42 e-h	100.00 a	157.50 ab
FLIP06-133C	28.48 efg	62.37 f-1	100.00 a	157.50 ab
FLIP06-138C	22.91 l	49.75 n	73.33 def	136.67 c-f
FLIP06-39C	24.45 jkl	54.23 k-n	87.50 a-d	145.00 a-e
FLIP06-97C	27.28 fgh	59.65 h-k	85.00 bcd	150.00 a-d
FLIP07-34C	31.53 cd	68.13 cde	100.00 a	162.50 a
FLIP07-57C	26.63 g-j	59.68 h-k	97.50 ab	155.00 ab
FLIP09-183C	30.61 de	63.74 e-h	100.00 a	155.00 ab
FLIP09-184C	29.40 def	63.13 e-h	94.17 abc	152.50 abc
FLIP09-259C	25.00 ı-l	56.74 j-m	95.00 abc	150.00 a-d
FLIP09-278C	28.90 ef	64.06 e-h	90.00 abc	155.00 ab
FLIP10-125C	24.86 jkl	55.34 klm	70.00 ef	133.33 def
FLIP10-227C	24.51 jkl	53.94 lmn	88.33 abc	155.00 ab
FLIP10-279C	24.20 kl	53.08 mn	94.17 abc	150.00 a-d
FLIP97-503C	27.38 fgh	59.41 h-l	100.00 a	155.00 ab
Hasanbey	30.37 de	65.91 efg	100.00 a	160.00 ab
Seçkin	28.08 fg	60.96 g-j	66.67 f	130.00 ef
Ortalama	28.40	62.13	87.70	148.67
DK (%)	2.54	2.80	5.31	3.83
F	**	**	**	**

*) Farklı harf ile gösterilen ortalamalar, Tukey testine göre ≤ 0.05 hata sınırları içinde birbirinden istatistiksel olarak farklı değildir.

Diyarbakır ekolojik koşullarında 2021-2022 yetiştirme döneminde 25 nohut genotipinde incelenen özelliklerden; su alma kapasitesi (g/tane), su alma indeksi (%), şişme kapasitesi ve şişme indeksi (%) bakımından genotipler arasında istatistiki olarak önemli fark bulunmuştur. İncelenen özelliklere ait ortalama değerler ve oluşan gruplar, Çizelge 2’de verilmiştir.

Nohut genotiplerinin su alma kapasitesi değerleri bakımından genotipler arasında istatistiki olarak önemli fark bulunmuş olup 0.267-0.443 g/tane arasında değişmiş, Arslanbey çeşidi en yüksek değere sahip olurken, FLIP06-138C genotipinin ise en düşük su alma kapasitesi değerine sahip olduğu saptanmıştır. Su alma kapasitesini Özer ve ark. (2010), 0.2585- 0.6169 g/tane; Mart ve Akıncı (2022), 0.24-0.60 g/tane; Özaktan (2021) 0.412-0.451 g/tane arasında değiştiğini belirtmişlerdir. Sefa-Dedeh ve Stanley (1979), baklagil tohumlarının su alma kapasitesinde tane büyüklüğü, tane kabuk kalınlığının önemli rol oynadığını belirtmişlerdir.

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Çizelge 2. Diyarbakır Ekolojik Koşullarında, 2022 yetiştirme döneminde, Nohut genotiplerinde Su Alma Kapasitesi (g/tane), Su Alma İndeksi (%), Şişme Kapasitesi (ml/tane), ve Şişme İndeksi (%) değerlerine ilişkin ortalamalar ve oluşan gruplar

Genotip	Su Alma Kapasitesi (g/tane)	Su Alma İndeksi (%)	Şişme Kapasitesi (ml/tane)	Şişme İndeksi (%)
17.POP/3	0.327 f-j*	0.247 bc*	0.073 ab*	1.180 c*
Aksu	0.397 bc	0.480 abc	0.167 a	3.333 a
Arda	0.300 h-l	0.540 abc	0.150 ab	1.450 c
Aslanbey	0.443 a	0.473 abc	0.167 a	2.667 ab
Azkan	0.367 b-f	0.567 ab	0.173 a	1.473 c
Botan	0.403 ab	0.287 abc	0.100 ab	1.200 c
Diyar-95	0.280 kl	0.473 abc	0.123 ab	1.390 c
EN 934	0.383 bcd	0.287 abc	0.100 ab	1.303 c
FLIP03-112C	0.373 b-e	0.257 bc	0.073 ab	1.150 c
FLIP06-133C	0.340 e-h	0.243 bc	0.073 ab	1.150 c
FLIP06-138C	0.267 l	0.570 ab	0.133 ab	1.677 bc
FLIP06-39C	0.300 h-l	0.290 abc	0.073 ab	1.207 c
FLIP06-97C	0.323 g-j	0.537 abc	0.150 ab	1.450 c
FLIP07-34C	0.367 b-f	0.383 abc	0.123 ab	1.250 c
FLIP07-57C	0.333 e-l	0.267 bc	0.073 ab	1.160 c
FLIP09-183C	0.330 f-j	0.150 c	0.050 b	1.100 c
FLIP09-184C	0.337 e-h	0.267 bc	0.083 ab	1.193 c
FLIP09-259C	0.317 g-k	0.180 bc	0.050 b	1.110 c
FLIP09-278C	0.353 d-g	0.507 abc	0.150 ab	1.380 c
FLIP10-125C	0.303 h-l	0.533 abc	0.133 ab	1.723 bc
FLIP10-227C	0.293 i-l	0.667 a	0.167 a	1.433 c
FLIP10-279C	0.290 jkl	0.220 bc	0.057 b	1.137 c
FLIP97-503C	0.320 g-k	0.163 c	0.050 b	1.100 c
Hasanbey	0.357 c-g	0.310 abc	0.100 ab	1.200 c
Seçkin	0.330 f-j	0.470 abc	0.133 ab	2.000 bc
Ortalama	0.337	0.375	0.109	1.457
DK (%)	3.86	33.33	2.71	22.99
F	**	**	**	*

*) Farklı harf ile gösterilen ortalamalar, Tukey testine göre ≤ 0.05 hata sınırları içinde birbirinden istatistiksel

Su alma kapasitesi, tane büyüklüğü, tane kabuğunun kalınlığı, tane kabuğunun geçirgenliği, tane dokusu ve doku oluşturan hücrelerin yapısına göre değişebilmektedir. İri taneli, geçirgenliği yüksek tane kabuğuna ve yumuşak bir kotiledon yapısına sahip genotiplerin su alma kapasiteleri de daha fazla olmaktadır. Ayrıca, su alma kapasitesi çeşit, yetiştirilen yerin toprak ve iklim özellikleri, olgunluk durumu, saklama koşulları, gibi birçok faktörden etkilenmektedir.

Su alma indeksi değeri, genotiplere göre % 0.150-0.667 arasında değişmiş olup, tüm çeşitlerin ortalaması % 0.375 olarak belirlenmiştir. En yüksek değer FLIP10-227C genotipinde saptanırken, FLIP97-503C ve FLIP09-183C genotipleri istatistiki olarak aynı grupta yer almış ve en düşük değere sahiplerdir. Su alma indeksinin genotiplere göre; Kaya ve ark. (2016) % 0.7-3.46, Cin ve Topal (2021) % 0.95-1.23, Özaktan (2021), %1.05-1.17; Mart ve Akın (2022) %0.91-1.12 arasında değiştiğini belirtmişlerdir.

Nohut genotiplerinin şişme kapasitesi değerleri genotiplere göre değişmekle birlikte 0.050-0.173 ml/tane arasında değişmiş, Azkan, Aksu, Arslanbey ve FLIP10-227C genotipleri istatistiki olarak ilk sırada yer almışlardır. En düşük şişme kapasitesi değeri FLIP97-503C genotipide saptanırken FLIP 10-279C, FLIP 09-183C ve FLIP 09-259C genotipleri istatistiki olarak son sırada yer almışlardır. Bu çalışmada belirlenen şişme kapasitesi değeri Özer ve ark. (2010), Mart ve Akıncı (2022) nın belirledikleri değerlerde daha yüksek iken Kaya ve ark. (2016) ve Shayfi ve Kharrat (2011)'ın bulduğu değerlerden daha düşük bulunmuştur. Şişme kapasitesi genotip ve çevre koşullarına göre değişebilmektedir.

Araştırmada incelen nohut genotiplerinin şişme indeksi değerleri % 1.100-3.333 arasında değişmiş, Aksu çeşidi en yüksek değere sahip olurken, FLIP 09-183C ve FLIP 95-503C genotipleri ise en düşük şişme indeksi değerine sahip olduğu saptanmıştır. Şişme indeksinin genotip ve genotipin yetiştirildiği çevre koşullarına göre Özer ve ark. (2010) %0.721-1.186; Özaktan (2021) % 2.183- 2.867; Mart ve Akın (2022) % 2.11-2.97 arasında değiştiğini belirtmişlerdir.

Çizelge 3. Diyarbakır koşullarında, 2022 yetiştirme döneminde Nohut Genotiplerinde İncelenen Teknolojik Özellikler Arası İlişkiler Ve Korelasyon Katsayıları (n=75)

	St. Sp	Kuru Ağırlık	Yaş Ağırlık	Kuru Hacim	Yaş Hacim	Su Alma Kapasitesi	Su Alma İndeksi	Şişme Kapasitesi
Kuru Ağırlık	3.37	1						
Yaş Ağırlık	7.39	0.967**	1					
Kuru Hacim	13.12	-0.131	-0.124	1				
Yaş Hacim	11.29	-0.076	-0.068	0.930**	1			
Su Alma Kap.	0.04	0.888**	0.975**	-0.106	-0.055	1		
Su Alma İndeksi	0.18	-0.097	-0.096	-0.498**	-0.162	-0.101	1	
Şişme Kapasitesi	0.05	0.179	0.178	-0.535**	-0.186	0.157	0.956**	1
Şişme İndeksi	0.58	0.324	0.331	-0.826**	-0.717**	0.312	0.457**	0.557**

Diyarbakır koşullarında, 2022 yetiştirme döneminde nohut genotiplerinde incelenen teknolojik özellikler arası ilişkiler Çizelge 3'de verilmiştir. Yaş ağırlık kuru ağırlık ($r=0.967$) ile yaş hacim kuru hacim ile ($r=0.930$) önemli ve pozitif bir ilişkiye sahiptir. Su alma kapasitesi Kuru ağırlık ($r=0.888$), yaş ağırlık ($r=0.975$) ile önemli ve pozitif bir ilişkiye sahiptir. Daha önce yapılan çalışmalarda da nohutta tane ağırlığı ile su alma kapasitesi arasında önemli ve olumlu bir ilişki olduğu belirtilmiştir (Williams ve ark., 1983; Singh ve ark., 1992; Gil ve ark., 1996; Özer ve ark., 2010; Özaktan, 2021). Su alma indeksi kuru hacim ($r=-0.498$) ile önemli ve negatif bir ilişkiye sahiptir. Şişme kapasitesi kuru hacim ($r=-0.535$) ile önemli ve negatif, su alma indeksi ($r=0.956$) ile pozitif bir ilişkiye sahiptir. Benzer bulgular Özer ve ark. (2010) ve Özaktan (2021) tarafından da belirtilmiştir. Şişme indeksi kuru hacim ($r=-0.826$), yaş hacim ($r=-0.717$) ile önemli ve negatif, su alma indeksi ($r=0.457$) ve şişme kapasitesi ile ($r=0.559$) önemli ve pozitif bir ilişkiye sahiptir. Sonuç olarak, tane büyüklüğü su alma kapasitesi ve şişme indeksini etkileyebilen bir özellik olduğu belirlenmiştir.

SONUÇ

Diyarbakır ekolojik koşullarında yetiştirilen nohut genotiplerinin teknolojik özelliklerini ve bu özellikler bakımından genetik varyasyonun değerlendirildiği araştırma sonucunda, Azkan, Botan, Hasanbey ve FLIP 07-34C nohut genotiplerinin kuru ağırlık, yaş ağırlık, kuru hacim, yaş hacim, su alma kapasitesi ve su alma indeksi bakımından öne çıktıkları belirlenmiştir. Ayrıca, FLIP 09-183 C ve FLIP 09-184 C genotipleri kuru ağırlık, yaş ağırlık, kuru hacim, yaş hacim değerleri bakımından diğer genotiplerden daha yüksek değere sahip olmuşlardır. Belirtilen genotiplerin sahip oldukları bu teknolojik özellikleri ile araştırmada incelenen genotiplerden daha erken pişebilecek genotipler olabileceği söylenebilir.

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KAYNAKLAR

- Anonim, 2001. Tohumluk Tescil Ve Sertifikasyon Merkezi Müdürlüğü. Tarımsal Değerleri Ölçme Denemeleri Teknik Talimatı. <https://www.tarimorman.gov.tr/BUGEM/TTSM>
- Anonim, 2022. Meteoroloji Genel Müdürlüğü, Diyarbakır İli İklim Parametreleri. <https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=DIYARBAKIR>
- Biçer, B.T., Albayrak, Ö., Akıncı, C. 2017. Farklı Ekim Zamanlarının Nohutta Verim ve Verim Unsurlarına Etkisi. ADÜ Ziraat Derg, 2017;14(1):51-57
- Cin, S.T., Topal, N. 2021. Determination of some Quality Characteristics in Chickpea (*Cicer arietinum* L.) Genotypes and Relationships between Characteristics. Turkish Journal of Agriculture-Food Science and Technology, 9(1):130-136, DOI: <https://doi.org/10.24925/turjaf.v9i1.130-136.3761>
- Gauch, H. G. 1988. Model selection and validation for yield trials with interaction. Biometrics 44: 705-715
- Gil, J., Nadal, S., Luna, D., Moreno, M.T., Haro, A.D. 1996. Variability of some physico-chemical characters in desi and kabuli chickpea types. J Sci Food Agric 71:179–184
- Jukanti A.K. Gaur, P.M., Gowda C.L.L., Chibbar, R.N. 2012. Nutritional quality of chickpea (*Cicer arietinum* L.): A review, breeding journal of nutrition, 108 (suppl.1), s11-26
- Kaya, M., R. Karaman, M. Capar. 2016. Evaluation for Some Quality and Technological Properties of Grown Chickpea Cultivars in The Lake District Provincials. Journal of Field Crops Central Research Institute 25 (Special issue-1): 184-190. <https://doi.org/10.21566/tarbitderg.280377>
- Mart, D., Akın, R. 2022. Investigation of Quality Traits of Some Chickpea (*Cicer arietinum* L.) Varieties Winter Grown in Different Locations. ISPEC Journal of Agr. Sciences 6(3): 520-529
- Muzquiz, M., Wood, J.A. 2007. Anti-nutritional factors. In: Yadav SS, Redden B, Chen W, Sharma B (Ed) Chickpea Breeding and Management, CAB International, Wallingford, UK, 143-166
- Özer S, T. Karakoy, F. Toklu, F.S. Baloch, B. Kilian, H. Ozkan. 2010. Nutritional and physicochemical variation in Turkish kabuli chickpea (*Cicer arietinum* L.) landraces. Euphytica 175: 237–249. <https://doi.org/10.1007/s10681-010-0174-3>
- Özaktan, H. 2021. Technological Characteristics of Chickpea (*Cicer arietinum* L.) Cultivars Grown under Natural Conditions. Turk J Field Crops, 26(2), 235-243. DOI: 10.17557/tjfc.1018627
- Sefa-Dedeh S, Stanley DW (1979) Textural implications of the microstructure of legumes. Food Technol 33:77–83
- Sfayhi, D., Kharrat, M. 2011. Physicochemical and Cooking Characteristics of Tunisian Chickpea Varieties. Global Science Book. Food, Special Issue-1: 68-72
- Singh, N., Sekhon, K.S., Bajwa, U., Goyal, S. 1992. Cooking and parching characteristics of chickpea (*Cicer arietinum* L.). J Food Sci Technol 29:347–350
- TÜİK, 2020. Türkiye İstatistik Kurumu. <https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Uretim-Istatistikleri-2021-37249>
- Wang, N., Hatcher, D.W., Tyler, R.T., Toews, R., Gawalko, E.J. 2010. Effect of cooking on the composition of beans (*Phaseolus vulgaris* L.) and chickpeas (*Cicer arietinum* L.). Food Research International 43: 589-594
- Williams, P.C., Singh, K.B., Nakkoul, H. 1983. Relation of some physical aspects of kabuli type chickpeas to cooking time. J Sci Food Agric 34:492–496
- Wood, J.A., Grusak, M.A. 2007. Nutritional value of chickpea. In: Yadav SS, Redden B, Chen W, Sharma B (Eds) Chickpea Breeding and Management, CAB International, Wallingford, UK, 101-142

**DİYARBAKIR EKOLOJİK KOŞULLARINDA NOHUT GENOTİPLERİNİN
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ÖZET

Son yıllarda etkisi daha belirgin hale gelen iklim değişiklikleri nedeniyle, yüksek sıcaklığa ve kuraklığa toleranslı tür ve çeşitler, önemli konuma gelmiş bulunmaktadır. Bu çalışma, bazı nohut genotiplerinin tarımsal özelliklerinin belirlenmesi amacıyla, 2021-2022 yılı yazlık yetiştirme sezonunda Diyarbakır koşullarında yürütülmüştür. Çalışma, 25 nohut genotipi ile tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak kurulmuştur. Varyans analizi sonucuna göre, incelenen özelliklerden olgunlaşma gün sayısı ve dal sayısı dışında tüm özelliklerde genotipler arasında istatistiki olarak önemli farklılıklar belirlenmiştir. Araştırma sonucunda; çiçeklenme gün sayısı 81.3-91.0 gün ve fizyolojik olgunlaşma gün sayısı 121.8-143.8 gün arasında; bitki boyu 44.0-56 cm, ilk bakla yüksekliği 19.8-27.5 cm, bitkide dal sayısı 2.23-2.83 adet, bitkide toplam bakla sayısı 8.0-22.3 adet, bitkide tane sayısı 6.2-18.8 adet, bitkide tane ağırlığı 1.50-5.19 g, yüz tane ağırlığı 23.88-32.83 g arasında değiştiği belirlenmiştir. Tane verimi bakımından Botan çeşidi 112.75 kg/da ile en yüksek değere sahip olmuştur. Sonuç olarak, FLIP 06-39 C, FLIP 09-183 C, FLIP 09-259 C, FLIP 09-278 C ve FLIP 10-227 C genotipleri, erken çiçeklenen, bakla sayısı, tane sayısı, tane ağırlığı, yüz tane ağırlığı ve verim yönünden ümitvar hatlar olarak belirlenmiş olup ıslah çalışmalarında değerlendirilebilir.

Anahtar Kelimeler: Nohut, verim, genotip, parametre

**DETERMINATION OF AGRICULTURAL CHARACTERISTICS OF CHICKPEA
GENOTYPES IN DİYARBAKIR ECOLOGICAL CONDITIONS**

ABSTRACT

Due to the climatic changes, the effect of which has become more evident in recent years, species and varieties that are tolerant to high temperature and drought have become important. In order to determine the agricultural characteristics of some chickpea genotypes, this study was carried out in Diyarbakır conditions in the summer growing season of 2021-2022. The study was established with 25 chickpea genotypes in a randomized block design with 4 replications. According to the results of the analysis of variance, statistically significant differences were determined between the genotypes in all traits except the number of maturation days and the number of branches. As a result of the research; flowering days, physiological maturation day, plant height, first pod height, number of branches per plant, total number of pods per plant, number of seeds per plant, seed weight per plant, hundred seed weight was determined to vary between 81.3 and 91.0 days, between 121.8 and 143.8 days; between 44.0 and 56 cm, between 19.8 and 27.5 cm, between 2.23 and 2.83 unit, between 8.0 and 22.3 unit, between 6.2 and 18.8, between 1.50 and 5.19 g, between 23.88 and 32.83 g, respectively. In terms of seed yield, Botan variety had the highest value with 112.75 kg/da. In terms of flowering time, pod number, seed number, seed weight, hundred seed weight and seed yield FLIP 06-39 C, FLIP 09-183 C, FLIP 09-259 C, FLIP 09-278 C and FLIP 10-227 C genotypes have been determined as promising genotypes and can be evaluated in future breeding studies.

Keywords: Chickpea, yield, genotype, parameter

GİRİŞ

Nohut (*Cicer arietinum* L.), baklagil familyasından, diploid ($2n=16$), kendine döllen, tek yıllık bir bitki olup, iri tanelilerinin gen merkezinin Güneybatı Asya ile Akdeniz, küçük tanelilerin gen merkezinin Güney Asya ve Habeşistan olduğu belirtilmektedir (Auckland ve Maesen, 1980). Dünya’da yaklaşık 15 milyon ha ekim alanı ve 16 milyon ton üretimi ile Fasulyeden sonra en fazla tarımı yapılan yemeklik tane baklagil türüdür. Dünya’da nohut üretiminin en fazla yapıldığı ülkeler Hindistan (11.910.000 ton), Avustralya (876.468 ton), Etiyopya (478.211 ton), Türkiye (475.000 ton) ve Myanmar (467.340 ton) olarak göze çarpmaktadır (FAO 2021).

Ülkemizde 487.886 ha ekim alanı ve 475.000 ton üretimi ile mercimek ve kuru fasulyenin önünde ilk sırada bulunmaktadır. Nohut yetiştiren dünya ülkelerinde verim ortalaması dekara 103 kg iken, ülkemizde bu değer 121 kg civarındadır (TUİK, 2021).

Bir baklagil olarak nohut, tahıl-tahıl veya tahıl-nadas rotasyonu sistemlerine iyi uyum sağladığından, tarımsal üretimin sürdürülebilirliğini sağlar ve azotlu gübreleme ihtiyacını azaltır. Nohut tanelerinin % 18-36 gibi oldukça yüksek düzeyde protein içermesi, özellikle az gelişmiş veya gelişmekte olan ülkelerde, gelir düzeyinin düşüklüğü nedeni ile yeterince hayvansal ürün tüketemeyen insanlar için önemli bir gıda maddesidir. Ayrıca nohut taneleri mineraller (kalsiyum, potasyum, fosfor, magnezyum, demir ve çinko), lif, doymamış yağ asitleri ve β -karoten bakımından da zengindir (Jukanti ve ark., 2012).

Ancak nohut üretimini arttırarak, artan dünya nüfusunun protein ihtiyacını karşılamak mümkün değildir. Çünkü nohut, Ekvator kuşağından kuzeyde 50° - $52'$ paralel (Rusya) ve güneyde 35° - $36'$ paralele (Avustralya) kadar uzanan çok geniş bir bölgede yetişebilse de üretimde, kuraklık, düşük ve yüksek sıcaklıklar gibi çeşitli abiyotik stresler nedeniyle birçok zorlukla karşı karşıyadır. Kuraklık stresi, iklim değişikliği ve sürekli artan dünya nüfusu için ciddi bir sorun olup bitki büyümesi, fizyolojisi ve üremesini etkiler ve verimi azaltır. Serin mevsim baklagil bitkisi olan nohut, sıcak bölgelerde ve geç ekimlerde yüksek sıcaklık stresiyle karşı karşıyadır. Yüksek sıcaklık, çiçek tomurcuklarını, çiçekleri ve baklaları dökerek, tane iriliğini ve verimi azaltmaktadır.

Bu senaryoya göre, ıslah çalışmalarına yeni yaklaşımlar ile yüksek verimli nohut genotiplerinin geliştirilmesi gerekmektedir. Yakın ve orta vadeli gelecekte, gıda güvenliğini sağlayabilmek için iklim değişikliğine dayanıklı, farklı genetik özellikleri olan, erkenci, geniş adaptasyon yeteneğine sahip, yüksek verimli yeni çeşitlerin geliştirilmesi gerekmektedir. Bu anlamda, bu çalışmanın temel amacı, farklı nohut genotiplerinin verim ve verim komponentleri incelenerek, bölge tarımına uygun, abiyotik faktörlere toleranslı, nohut genotiplerinin belirlenmesidir.

MATERYAL ve YÖNTEM

Araştırmada, ICARDA’dan temin edilen ve önceki çalışmalarda öne çıkmış 17 nohut genotipi ile 8 adet tescilli çeşit (Arda, Azkan, Botan, Hasanbey, Seçkin, Aksu, Diyar 95, Arslanbey) olmak üzere toplam 25 adet nohut genotipi materyal olarak kullanılmıştır.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Denemeler, Diyarbakır/Sur ilçesi GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi Müdürlüğü deneme alanında (37° 30 ve 38° 43 Kuzey enlemleri ile 40° 37 ve 41° 20 Doğu boylamları, yükselti 570 m) yürütülmüştür.

Araştırmanın yürütüldüğü Diyarbakır ili karasal iklimi yansıtmaktadır. Yazları çok sıcak ve kurak, kışları ise daha az yağışlı ve soğuktur. Araştırmanın yürütüldüğü Diyarbakır ili 2022 yılı vejetasyon dönemi ve uzun yıllar iklim verileri, Çizelge 1’de verilmiştir. Çizelge 1’den görüleceği gibi, vejetasyon süresince en düşük sıcaklık ortalaması Mart (0.3 °C) ayında görülürken, en yüksek sıcaklık ortalaması Haziran (31.7 °C) ayında görülmüştür. Vejetasyon süresi boyunca toplam 192.6 mm yağış düşmüştür.

Çizelge 1. Araştırmanın Yürütüldüğü Diyarbakır İli 2022 Yetiştirme Sezonunu ile Uzun Yıllara İlişkin Önemli Meteorolojik Parametreler*

Aylar	Sıcaklık (°C)			Toplam Yağış (mm)
	Min.	Max.	Ort.	
Şubat-2022	2.6	11.8	7.0	26.8
Uzun Yıllar	-1.0	9.2	3.7	67.6
Mart-2022	0.3	13.2	5.7	63.8
Uzun Yıllar	2.5	14.5	8.3	66.8
Nisan-2022	8.1	21.3	16.8	11.2
Uzun Yıllar	7.0	20.4	13.8	69.1
Mayıs-2022	11.4	28.3	18.4	83.4
Uzun Yıllar	11.3	26.7	19.3	44.3
Haziran-2022	20.4	31.7	27.6	7.4
Uzun Yıllar	16.6	33.6	26.1	8.7

* Uzun Yıllar: 1929 – 2021 yılları arası veri grubu değerlendirilmiştir.

Araştırmanın yürütüldüğü Diyarbakır ili Şubat-Haziran dönemine ait uzun yıllar iklim verilerine bakıldığında ise en sıcak ay ortalaması 33.6°C (Haziran) ve en soğuk ay ortalaması ise -1.0 °C’ (Şubat) olarak kaydedilmiştir. Uzun yıllar yıllık toplam yağış ortalaması 256.5 mm olup bunun büyük bir kısmı bahar aylarında düşmektedir (Anonim, 2022).

Deneme alanı toprakları (0-30 cm) killi-tınlı, toplam tuz değerine göre orta tuzlu (% 0.400), organik madde açısından düşük (% 1.66), toprak pH bakımında alkali (pH: 8.07) ve CaCO₃ içeriği (%7.93) ile orta seviyededir.

Yöntem

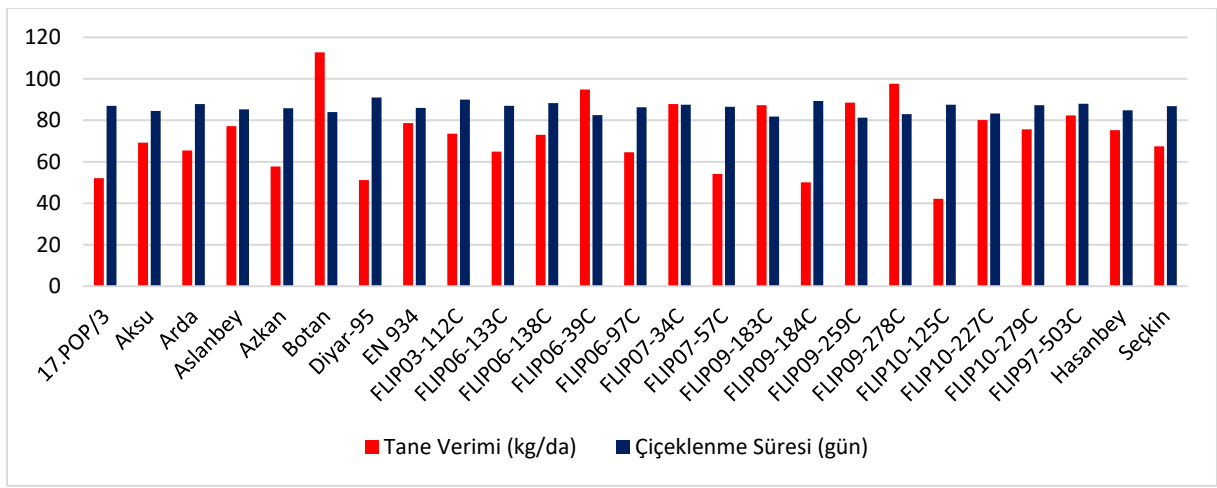
Denemeler tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak 2021-2022 yetiştirme döneminde yürütülmüştür. Ekimler, sıra uzunluğu 6 m, sıra arası 0.30 m ve her parsel 4 sıradan oluşacak şekilde, 4 tekrarlamalı olarak kurulmuştur. Her parsel, 0.30 x 6 m x 4 = 7.2 m² ve her sıraya 81 adet tohum gelecek şekilde (45 tohum/m², 45 x 7.2 m² = 324 adet /parsel) 21 Şubat 2022’de, hasatlar ise 08 Temmuz 2022’de yapılmıştır. Hasat edilen parseller kurutulmaya bırakıldıktan sonra harman işlemi elle yapılmıştır. Araştırmamızda, çiçeklenme ve olgunlaşma gün sayısı, bitki boyu, ilk bakla yüksekliği, bitkide dal, bitkide toplam bakla ve tane sayısı, bitki tane ağırlığı, 100 tane ağırlığı ve tane verimi karakterine ait gözlem ve ölçümleri yapılmıştır (Anonim, 2021).

Elde edilen veriler, tesadüf blokları deneme deseninde analiz edilmiştir. İstatistikî analizler, JMP ve GenStatRelease14.1 (Copyright 2011, VSN International Ltd.) versiyonu kullanılarak yapılmış, önemli çıkar ortalamalar, Tukey testine göre gruplandırılmıştır (Gauch, 1988).

BULGULAR ve TARTIŞMA

Diyarbakır ekolojik koşullarında nohut genotipinde incelenen özelliklerden; çiçeklenmeye kadar geçen gün sayısı (gün), bitki boyu (cm), ilk bakla yüksekliği (cm), bitkide toplam bakla sayısı (adet), bitkide tane sayısı (adet), bitkide tane ağırlığı (g), 100 tane ağırlığı (g) ve tane verimi (kg/da) bakımından genotipler arasında istatistiki olarak önemli farklılıklar bulunmuştur. Kültüre alınan nohut genotiplerinde istenilen tarımsal özellikler yönünden yapılan seleksiyonlar nedeniyle nohudun genetik çeşitliliği dardır. Araştırmada incelenen özelliklerin çoğunda genotipler arasında önemli farklılıkların olması, istenilen özelliklere sahip yeni bir çeşit geliştirebilmek için bu genotipler arasından seleksiyon yapılabileceğini göstermektedir. Benzer bulgular Yücel, 2020; Matur ve Yücel, 2022 tarafından da belirtilmiştir.

Çiçeklenmeye kadar geçen gün sayısı değerleri 81.3- 91.0 gün arasında değişmiş olup ortalama 86.08 gün 'dür. Araştırmada incelenen genotiplerden FLIP 06-39C, FLIP 09-183C, FLIP 09-259C, FLIP 09-278C, FLIP 10-227C ve Hasanbey nohut genotipleri ortalama çiçeklenme süresinden daha erken çiçeklenebildikleri için vejetatif dönemden generatif döneme daha kısa zamanda geçmişlerdir (Grafik 1). Nohutta generatif dönem, çiçeklenme ile başlar ve çiçeklenme dönemindeki abiyotik stres faktörleri nedeni ile tane veriminde azalmalar olabilmektedir. Generatif dönemde kuraklık ve terminal sıcaklık stresi özellikle yağışa bağlı tarımsal üretimin yapıldığı yerlerde tane verimini azaltmaktadır. Bu durum dikkate alındığında erkencilik, verimi etkileyen önemli bir faktör olarak değerlendirilebilir. Erken çiçeklenme, nohudun yetiştirme sezonu sonlarında oluşabilecek abiyotik stres koşullarından (kuraklık, yüksek sıcaklık) kaçmasına yardımcı olduğu için, generatif döneminin uzamasına ve oluşacak mevsimsel yağışlardan daha fazla faydalanarak verim artmasını sağlamaktadır. Çiçeklenmeye kadar geçen gün sayısı değeri genotipik bir özellik olmakla birlikte çevre koşullarından da etkilenmektedir. Farklı ekolojilerde ve farklı genotiplerle çiçeklenmeye kadar geçen gün sayısı 97.7-161.7 gün arasında değiştiği belirtilmiştir (Anlarsal ve ark., 1999; Demirci ve Bildirici, 2020; Nalbant, 2021; Yücedağ, 2021; Özcan ve Yücel, 2022,; Matur ve Yücel, 2022).



Grafik 1. Nohut Genotiplerinin Çiçeklenme Süresi (gün) ve Tane verimi (kg/da) Ortalamaları

Nohut genotiplerinin olgunlaşmaya kadar geçen gün sayısı değerleri genotiplere göre değişmekle birlikte 121.8-147.8 gün arasında değişmiştir (Çizelge 1). Erken genotipler terminal kuraklık stresinden etkilenmedikleri için strese bağlı verim kayıplarından daha az etkilenmektedirler. Bu nedenle yüksek verimli ve erkenci çeşit geliştirebilmek bitki ıslah programlarının önemli hedeflerden biridir (Kumar ve ark., 2015).

Bitki boyu değeri genotiplere göre değişmekle birlikte 44.0-56.0 cm arasında değişmiş olup tüm genotiplerin ortalama değeri 50.41 cm'dir. En yüksek değer FLIP 06-133C genotipinde ölçülürken, 17.POP/3, Arda, Azkan, Diyar, EN 934, FLIP 06-138C, FLIP 07-34C, FLIP 09-183C, FLIP 09-184C, FLIP 10-125C, FLIP 10-227C, FLIP 97-503C, Hasanbey ve Seçkin genotipleride istatistiki olarak aynı grubu paylaşmışlardır. Bulgularımıza benzer şekilde, bitki boyu değerinin genotiplere göre 27.5-54.7 cm arasında değişebileceği belirtilmiştir (Ağsakallı ve ark., 2001; Demirci ve Bildirici, 2020 Matur ve Yücel, 2022; Özcan ve Yücel, 2022). Nohut yetiştiriciliğinde makinalı hasat için uzun boylu bitkiler tercih edilmesine karşın, olgunlaşma döneminde önemli verim kayıplarına neden olabilmektedir (İsmail ve ark., 2017). Vejetatif dönemde yapraklarda fotosentezle üretilen şeker, olgunlaşma döneminde floemlerle taneye taşınır. Ancak, bitki boyunun uzunluğu nedeni ile yapraklardaki şekerin tamamı taneye taşınmadan bitkiler olgunlaşabilirler ve tane verimi düşer. Bu nedenle, yüksek tane verim için nohutta orta uzunlukta bitkiler tercih edilmelidir.

Denemeye alınan nohut genotiplerinin ilk bakla yüksekliğinin 19.8-27.5 cm arasında değişmiştir. En yüksek ilk bakla yüksekliği Arslanbey çeşidinde ölçülürken araştırmada incelenen çeşitlerin önemli bir kısmı da istatistiki olarak aynı grubu paylaşmışlardır. İlk bakla yüksekliği değeri çeşitlere, ekolojik koşullara, ekim zamanı gibi bir çok faktöre göre değişebilmektedir. Bulgularımıza benzer olarak, farklı çeşitlerle ve farklı çevrelerde yürütülen çalışmalarda ilk bakla yüksekliğinin 10.7-44.3 cm arasında değişebileceğini belirtmişlerdir (Demirci ve Bildirici, 2020; Karadavut ve Sözen, 2020; Yücedağ, 2021; Şakar ve Yücel, 2022). Daha önce yürütülen araştırmalarda bitki boyu ve ilk bakla yüksekliği değerlerinde geniş bir varyasyonun olduğu görülürken çalışmamızdaki bitki boyu ve ilk bakla yüksekliği değerlerine ait varyasyon ise daha dardır. Bunun sebebinin çalışmamızda yer alan çeşit sayısının az olması,

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

seçilen genotipler ile çalışmanın yürütülmesi ve bu nedenle çevreden daha az etkilenmelerinden kaynaklanabileceği düşünülmektedir.

Nohut genotiplerinin dal sayısı değerleri genotiplere göre 2.23-2.83 adet arasında değişmiştir (Çizelge 1). Mardin koşullarında yürütülen çalışmalarda dal sayısının 2.5-5.2 adet/bitki (Doğan ve Doğan, 2023; Kurtarıcı ve Yücel, 2023), olduğunu bildirmişlerdir. Bitkide dal sayısı genotip, çevre, toprak yapısı, kültürel uygulamalar ve yetiştirme tekniklerinden etkilenebilmektedir.

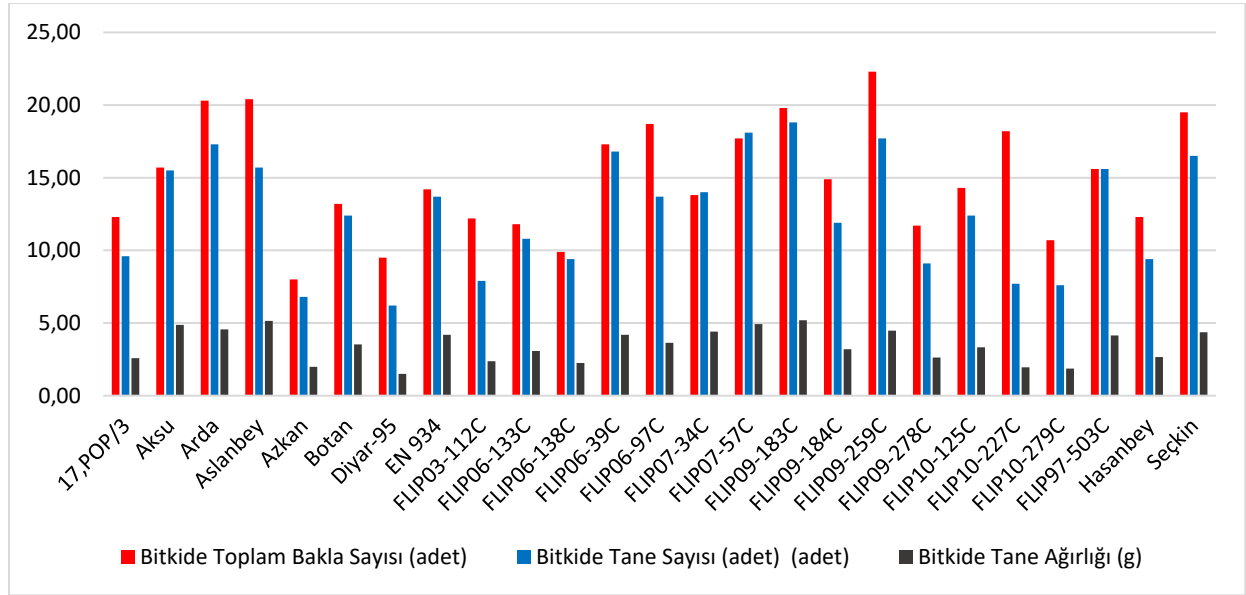
Çizelge 1. Diyarbakır ekolojik koşullarında, nohut genotiplerinde saptanan olgunlaşmaya kadar geçen gün sayısı, bitki boyu, ilk bakla yüksekliği, bitkide dal sayısı ve 100 tane ağırlığı değerlerine ilişkin ortalamalar ve oluşan gruplar

Genotip	Olgunlaşmaya Kadar Geçen Gün Sayısı (gün)	Bitki Boyu (cm)	İlk Bakla Yüksekliği (cm)	Bitkide Dal Sayısı (adet)	100 Tane Ağırlığı (g)	Tane
17.POP/3	124.8	49.5 a-e	22.3 abc	2.33	27.03 b-e	
Aksu	123.0	48.0 b-e	25.5 abc	2.73	31.58 ab	
Arda	125.0	52.8 a-d	21.8 abc	2.58	26.33 b-e	
Aslanbey	122.5	46.5 cde	27.5 a	2.33	32.83 a	
Azkan	123.5	50.5 a-e	24.5 abc	2.48	28.95 a-e	
Botan	147.8	44.5 e	21.5 abc	2.40	28.15 a-e	
Diyar-95	126.0	53.8 abc	25.8 abc	2.40	23.88 e	
EN 934	123.3	52.8 a-d	23.8 abc	2.50	30.55 abc	
FLIP03-112C	123.5	47.0 cde	20.8 bc	2.55	29.85 a-d	
FLIP06-133C	123.5	56.0 a	25.5 abc	2.50	28.80 a-e	
FLIP06-138C	123.8	51.3 a-e	24.8 abc	2.75	23.88 e	
FLIP06-39C	122.0	50.8 a-e	23.0 abc	2.33	24.93 de	
FLIP06-97C	124.0	54.3 abc	25.8 abc	2.48	26.55 b-e	
FLIP07-34C	122.5	52.8 a-d	26.8 ab	2.40	31.50 ab	
FLIP07-57C	122.3	48.0 b-e	22.3 abc	2.70	27.35 a-e	
FLIP09-183C	122.5	49.5 a-e	22.8 abc	2.53	27.73 a-e	
FLIP09-184C	124.0	55.5 ab	24.8 abc	2.58	26.78 b-e	
FLIP09-259C	122.0	48.0 b-e	22.5 abc	2.33	24.98 de	
FLIP09-278C	122.3	44.0 e	19.8 c	2.33	28.85 a-e	
FLIP10-125C	124.0	51.0 a-e	25.3 abc	2.83	26.48 b-e	
FLIP10-227C	121.8	51.0 a-e	22.0 abc	2.40	25.38 cde	
FLIP10-279C	123.0	45.5 de	20.0 c	2.23	24.48 de	
FLIP97-503C	124.3	53.3 a-d	24.8 abc	2.43	26.20 b-e	
Hasanbey	122.8	50.3 a-e	24.8 abc	2.43	28.05 a-e	
Seçkin	123.8	54.0 abc	24.0 abc	2.33	26.63 b-e	
Ortalama	124.30	50.41	23.67	2.47	27.51	
DK (%)	7.98	5.81	9.63	2.5	7.52	
F	ÖD	**	**	ÖD	**	

*) Farklı harf ile gösterilen ortalamalar, Tukey testine göre ≤ 0.05 hata sınırları içinde birbirinden istatistiksel olarak farklıdır.

Bitkide toplam bakla sayısı, değeri genotiplere göre 8.0-22.3 adet arasında değişmiştir. Araştırmada incelenen genotiplerden FLIP 09-259C genotipi en yüksek değere sahip olurken Arda, Arslanbey, FLIP 06-39C, FLIP 06-97C, FLIP 07-57C ve FLIP 09-183 C, FLIP 09-278C ve Seçkin genotipleri istatistiki olarak aynı grupta yer almaktadırlar. Farklı ekolojilerde ve farklı genotiplerle yapılan çalışmalarda nohutta bitki başına toplam bakla sayısının Adana'da 15.8-27.3 adet (Anlarsal ve ark., 1999); Diyarbakır koşullarında 15.3-34.7 adet (Biçer ve Anlarsal, 2004; Biçer ve ark., 2017), Şanlıurfa ekolojik şartlarında 6.9-13 adet (Demirci ve Bildirici, 2020); Şırnak'da 15.0-44.2 adet (Özcan ve Yücel, 2022) arasında değiştiğini bildirmişlerdir. Çalışmada elde edilen bitkide bakla sayısı değerleri, önceki çalışmalar ile

farklılıkların kaynağı, çeşitlerin genetik özellikleri, ekolojik, yağış rejimi veya toprak özellikleri olabilir.



Grafik 3. Nohut Genotiplerinin Bitkide Toplam Bakla Sayısı (adet), Bitkide Tane Sayısı (adet) ve Bitkide Tane Ağırlığı (g) Ortalamaları

Bitkide tane sayısı değeri genotiplere göre 6.2-18.8 adet arasında değişmiş olup, en fazla tane sayısı FLIP 09-183C genotipinde saptanırken FLIP 07-57C genotipi ile istatistiki olarak bir fark bulunmamaktadır. Aksu, Arda, Arslanbey, Botan, EN934, FLIP 06-39C, FLIP 06-97C, FLIP 07-34C ve FLIP 09-184 C, FLIP 09-259C, FLIP 10-125C ve FLIP 97-503C ve Seçkin genotipleride istatistiki olarak yüksek değere sahip olmuşlardır. Bitkide tane sayısı bakımından daha önce yapılan çalışmalarda; Yücedağ (2021), Şanlıurfa'da 22.0-46.2 adet; Kırşehir'de 11.3-30.2 adet arasında değiştiğini bildirmişlerdir (Karadavut ve Sözen 2020; Nalbant, 2021). Bitkide tane ağırlığı değeri genotiplere göre 1.50-5.19 g arasında değişmiş olup, en yüksek tane ağırlığı değeri FLIP 09-183 genotipinde saptanırken Aksu, Arda, Arslanbey, Botan, EN934, FLIP 06-39C, FLIP 06-97C, FLIP 07-34C, FLIP 07-57C, FLIP 09-184 C, FLIP 09-259C, FLIP 10-125C ve FLIP 97-503C genotipleride istatistiki olarak yüksek değere sahip olmuşlardır. Çalışmada, elde edilen bitkide tane ağırlığı değerleri diğer çalışmalar ile kıyaslandığında; Adana'da 5.3-8.6 g (Anlarsal ve ark., 1999; Biçer ve Anlarsal 2004), Diyarbakır koşullarında 4.2-7.2 g; (Biçer ve ark. 2004), Şırnak'da 8.7-15.7 g (Şakar ve Yücel, 2022) arasında değiştiğini belirtmişlerdir.

Bitkide bakla sayısı, tane sayısı ve tane ağırlığının verim için önemli bir parametre olduğu bilinmekle birlikte çevresel faktörlerden etkilense de asıl etkili faktör çeşidin genetik potansiyelidir. Bitki başına daha fazla bakla bağlamasına paralel olarak da bitkideki toplam tane sayısı da yüksek olmuştur. Toplam bakla sayısı ile tane sayısı arasında önemli ve olumlu ilişkilerin olduğu bir çok araştırmacı tarafından da bildirilmektedir (Yücel ve ark., 2006).

Yüz tane ağırlığı değeri genotiplere göre 23.88-32.83 g arasında değişmiş olup, en yüksek yüz tane ağırlığı değeri Arslanbey genotipinde saptanırken Aksu, Azkan, Botan, EN934, FLIP 03-

112C, FLIP 06-133C, FLIP 07-34C, FLIP 09-184 C, FLIP 09-278C, Hasanbey genotipleride istatistiki olarak yüksek değere sahip olmuşlardır. Araştırmada yüz tane ağırlığı yüksek olan genotiplerin seçilmesi, iri taneli yeni çeşitlerin geliştirilebilmesi için önemli olacaktır. Böylece, ileride yapılacak ıslah çalışmalarında bu nohut hatlarının kullanılması ticari bakımdan önemli bir kriter olan tane iriliğini arttırarak yeni geliştirilecek çeşitlerin iç ve dış pazardaki talebini de arttıracaktır.

Tane verimi değeri genotiplere göre 42.10-112.75 kg/da arasında değişmiş olup, en yüksek değer Botan çeşidinden saptanırken EN934, FLIP 06-39C, FLIP 07-34C, FLIP 09-183 C, FLIP 09-259C, FLIP 09-278C, FLIP 10-227C ve FLIP 97-503C genotipleride istatistiki olarak yüksek değere sahip olmuşlardır. Tane verimi bakımından elde edilen ortalama değerler daha önce yapılan çalışmalarda elde edilen veriler ile karşılaştırıldığında, farklılıkların çalışmaların yapıldığı çevre, kullanılan genotip ve iklim koşullarının farklılığından kaynaklanabilir. Ayrıca, yetiştirme döneminde özellikle bakla doldurma dönemi olan Nisan-Mayıs aylarında yağış değerlerinin çok düşük olması düşük tane veriminin nedeni olabilir (Çizelge 1). Tane verimi, bitkinin hem genetik yapısı hem de çevre faktörlerinden etkilenebilen nicel bir özelliktir. Farklı nohut genotipleri ile yapılan bir çok çalışmada tane veriminin genotiplere göre değiştiği bir çok çalışmada bildirilmiştir (Anlarsal ve ark., 1999; Toker ve Çancı, 2003; Yücel, 2004, Doğan, 2014). Ayrıca, ekim zamanı, ekim sıklığı ve farklı kültürel uygulamalar (sulama, yabancı ot kontrolü, gübreleme, farklı toprak işleme yöntemleri gibi) da tane verimini etkileyebilmektedir.

SONUÇ

Araştırma sonucunda, incelenen genotipler arasında verim ve verimle ilgili özellikler bakımından önemli varyasyon saptanmıştır. Bu durum, incelenen genotipler ile yapılacak melezleme ve seleksiyon çalışmaları ile istenilen özelliklere sahip yeni çeşit geliştirilebileceğini göstermektedir. Ülkemizde nohut tarımının yapıldığı Güneydoğu Anadolu bölgesinde, üreticiler, kış mevsimine uyum sağlayabilen ve aynı zamanda bakla doldurma aşamasında kuraklık ve terminal sıcaklığından kaçabilen, erken olgunlaşan ve yüksek verimli çeşitleri tercih ediyor. Araştırma sonucunda, FLIP 06-39 C, FLIP 09-183 C, FLIP 09-259 C, FLIP 09-278 C ve FLIP 10-227 C genotipleri, erken çiçeklenen, bakla sayısı, tane sayısı, tane ağırlığı, yüz tane ağırlığı ve verim yönünden ümitvar hatlar olarak belirlenmiş olup ve ıslah çalışmalarında değerlendirilebilir.

Teşekkür

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KAYNAKLAR

- Ağsakallı A., S. Yıldız, S., Kılıç, E. & Babagil, G.E. 2001. Nohut Islah Çalışmalarında Çeşit Adayı Hatların Verim Ve Verim Unsurlarının Belirlenmesi. IV. Tarla Bitkileri Kongresi, Tekirdağ.
- Anlarsal, A.E., Yücel, C. & Özveren, D. 1999. Çukurova Koşullarında Bazı Nohut (*Cicer arietinum* L.) Hatlarının Verim Ve Verimle İlgili Özelliklerinin Saptanması Üzerine Bir Araştırma. Türkiye 3. Tarla Bitkileri Kongresi, Çayır-Mer'a Yem bitkileri ve Yemeklik Tane Baklagiller, III: 342-347, 15-20, Kasım, Adana.
- Anonim, 2001. Tohumluk Tescil ve Sertifikasyon Merkezi Müdürlüğü. Tarımsal Değerleri Ölçme Denemeleri Teknik Talimatı. Ankara
- Anonim, 2022. Meteoroloji Genel Müdürlüğü, Diyarbakır İli İklim Parametreleri. <https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=DIYARBAKIR>
- Auckland, A.K., & Maesen, L.J.G. Van Der. 1980. Chickpea. W.R. Fehr, H.H. Hadley (Eds.), Hybridization of Crop Plants, American Society of Agronomy and Crop Science Society of America, Madison, WI, USA (1980), pp. 249-259
- Biçer, B.T. & Anlarsal, A.E., 2004. Bazı Nohut (*Cicer arietinum* L.) Köy Çeşitlerinde Bitkisel ve Tarımsal Özelliklerin Belirlenmesi. Ankara Üniversitesi Ziraat Fakültesi Tarım Bilimleri Dergisi 10(4):289-396.
- Biçer, B.T., Albayrak, Ö. & Akıncı, C. 2017. Farklı Ekim Zamanlarının Nohutta Verim ve Verim Unsurlarına Etkisi. ADÜ Ziraat Der. ;14(1):51-57
- Demirci, Ö. & Bildirici, N. 2020. Şanlıurfa Ekolojik Koşullarında Yetiştirilen Bazı Nohut Çeşitlerinin Verim ve Verim Unsurlarının Belirlenmesi. Avrupa Bilim ve Teknoloji Dergisi, 20:656-662.
- Doğan, Y. 2014. Mardin Kızıltepe Ekolojik Koşullarında Kışlık Olarak Yetiştirilebilecek Nohut Çeşitlerinin Belirlenmesi. Gaziosmanpaşa Üni. Ziraat Fakültesi Der.3 (1): 37-46.
- Doğan, S. & Doğan, Y. (2023). Yarı Kurak İklim Koşullarında Bazı Nohut (*Cicer arietinum* L.) Hat Ve Çeşitlerinin Verim Ve Verim Unsurlarının Belirlenmesi. Harran Tarım ve Gıda Bilimleri Dergisi, 27(1):73- 82. DOI:10.29050/harranziraat.1226284
- FAO 2021. <http://faostat3.fao.org/home/index.htm>
- Gauch, H. G. 1988. Model Selection And Validation For Yield Trials With Interaction. Biometrics 44: 705-715
- Jukanti, A.K., Gaur, P.M., Gowda, C.L.L. & Chibbar, R.N., 2012. Nutritional Quality And Health Benefits Of Chickpea (*Cicer arietinum* L.): A Review. British Journal of Nutrition, 108(S1):S11-S26
- Ismail, M.M., Moursy, A.A. & Mousa, A.E., 2017. Effect of Organic And İnorganic Fertilizer On Growth and Yield Of Chickpea (*Cicer arietinum* L.) Grown on Sandy Soil Using 15N tracer. Bangladesh J. Bot. 46, 155–161.
- Matur, İ. & Yücel, D. 2022. Şırnak-İdil Ekolojik Koşullarında Bazı Nohut Genotiplerinin Verim ve Verim Unsurlarının Değerlendirilmesi. MAS Journal of Applied Sciences 7(1): 187–198. DOI: <https://doi.org/10.52520/masjaps.219>
- Nalbant, M. 2021. Kırşehir Ekolojik Koşullarında Bazı Nohut Çeşitlerinin Tane Verimi Ve Verim Ögelerinin Belirlenmesi Üzerine Bir Çalışma. Kırşehir Ahi Evran Üniversitesi Fen Bilimleri Enstitüsü Tarla Bitkileri Anabilim Dalı, Yüksek Lisans Tezi, 126 S.
- Karadavut U. & Sözen, Ö, 2020, Multivariable Analysis of Characters Affecting Yield In Chickpea Plants, J. Glob. Innov. Agric. Soc. Sci., 8(3): 155-160
- Kumar T., Bharadwaj C., Rizvi A. H., Sarker A., Tripathi S., Alam, A. & Chauhan S. K. 2015 Chickpea Landraces: A Valuable And Divergent Source For Drought Tolerance. Int. J. Trop. Agric. 33, 633–638.

- Kurtarıcı, H. & Yücel, D., 2023. Mardin İlinde Toplanan Yerel Nohut Genotiplerinin Karakterizasyonu. ISPEC Tarım Bilimleri Dergisi, 7(1): 60-71. DOI:<https://doi.org/10.5281/zenodo.7718399>
- Özcan, M.A. & Yücel, D. 2022. Şırnak-İdil Koşullarında Yetiştirilebilecek Kışlık Nohut Genotiplerinin Saptanması. ISPEC Tarım Bilimleri Dergisi 6(1):99-109. DOI:<https://doi.org/10.46291/ISPECJASvol6iss1pp99-109>
- Şakar, S. & Yücel, D., 2022. Şırnak-İdil Koşullarında Kışlık Ve Erken İlkbaharda Yetiştirilen Nohut Çeşitlerinin Verim ve Verimle İlgili Özelliklerinin Belirlenmesi. MAS Journal of Applied Sciences, 7(1): 249–261
- TÜİK, 2021. Türkiye İstatistik Kurumu. <https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Uretim-Istatistikleri-2021-37249>
- Toker, C. & Çancı, H., 2003. Selection of Chickpea (*Cicer arietinum* L.) Genotypes for Resistance to Ascochyta Blight [*Ascochyta rabiei* (Pass.) Labr.], Yield and Yield Criteria. Turkish Journal of Agricultural Forestry 27:277-283.
- Yücedağ, M., 2021. Bazı Nohut (*Cicer arietinum* L.) Çeşitlerinin Şanlıurfa-Bozova Koşullarında Verim ve Bazı Verim Öğelerinin Belirlenmesi. Mardin Artuklu Üniversitesi Lisansüstü Eğitim Enstitüsü Tarla Bitkileri Anabilim Dalı, 70 Sayfa
- Yücel, Ö.D. 2004. Çukurova Koşullarında Farklı Ekim Zamanları ve Sıklıklarının Bazı Nohut Çeşitlerinde Verim ve Verimle İlgili Özelliklere Etkisi Üzerine Araştırma. Yayınlanmamış Doktora Tezi, Çukurova Üniversitesi, Fen Bilimleri Enstitüsü, Adana.
- Yücel, D., Anlarsal, A.E. & Yücel, C. 2006. Genetic Variability, Correlation and Path Analysis of Yield, and Yield Components in Chickpea (*Cicer arietinum* L.). Turk J Agric For 30: 183-188
- Yücel, D. 2020. Genotypic And Phenotypic Variability For Yield And Its Components İn Normal And Late Sown Chickpea (*Cicer arietinum* L.). Legume Research-An International Journal 43 (1), 18-24

**BAZI YAYGIN FİĞ GENOTİPLERİNİN SİVAS EKOLOJİK ŞARTLARINDA
PERFORMANSLARININ DEĞERLENDİRİLMESİ**

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ÖZET

Yaygın fiğ (*Vicia sativa* L), tek yıllık bir baklagil yem bitkisi olup, dünyanın birçok bölgesinde yaş ve kuru ot, yeşil gübreleme ve tane amaçlı olarak, bitkisel ve hayvansal üretim sistemlerinde yetiştirilmekte ve ruminantların beslenmesinde yaygın olarak kullanılmaktadır. Yurdumuzda en fazla yetiştirilen fiğ türü yaygın fiğdir. Yaygın fiğ yem bitkisinin gen merkezi Akdeniz havzası olarak bilinmektedir. Günümüzde ise besin değerinin yüksek olması, ekonomik ve ekolojik avantajlara sahip olması nedeniyle tüm dünyada yetiştirilmektedir. Bu çalışma, beş farklı yaygın fiğ genotipinin Sivas ekolojik koşullarında agronomik ve ot verimi özellikleri bakımından performanslarının değerlendirilmesi amacıyla yürütülmüştür. Tarla denemesi 2022 yılı nisan ayında tesadüf blokları deneme desenine göre dört tekrarlamalı olarak kurulmuştur. Hasat 2022 yılı ağustos ayında gerçekleştirilmiştir. Çalışmada kullanılan yaygın fiğ genotipleri arasında incelenen özellikler bakımından büyük oranda varyasyon gözlenmiştir. Genotipler arasında ortalama ilk çiçeklenme gün sayısı 53.9 gün, ilk bakla bağlama gün sayısı 64.85 gün, doğal bitki boyu 38.9 cm, yeşil ot verimi 653.2 kg/da ve kuru ot verimi 247.7 kg/da olarak saptanmıştır. Yapılan korelasyon analizi sonucunda, kuru ot verimi ile yeşil ot verimi, doğal bitki boyu ile yeşil ot verimi ve kuru ot verimi, ilk çiçeklenme gün sayısı ile ilk bakla bağlama gün sayısı arasında pozitif ve anlamlı bir korelasyon saptanmıştır. Araştırma sonucunda, değerlendirmeye alınan yaygın fiğ genotiplerinden 3 nolu genotip, çeşitli agronomik ve ot verimi ile ilgili özellikler açısından daha üstün bulunmuştur ve Sivas iklim koşullarında büyük ölçekli yetiştiricilik için değerlendirilebileceği düşünülmektedir.

Anahtar Kelimeler: *Vicia sativa*, Yem Bitkisi, Yeşil Ot, Kuru Ot

**EVALUATION OF THE PERFORMANCES OF SOME COMMON VETCH
GENOTYPES UNDER SIVAS ECOLOGICAL CONDITIONS**

ABSTRACT

Common vetch (*Vicia sativa* L.) is an annual leguminous forage crop and is widely used in plant and animal production systems in many regions of the world for green and dry herbage, green fertilization and grain purposes and is widely used in the nutrition of ruminants. The most commonly grown vetch species in Turkey is common vetch. The origin center of this crop is considered Mediterranean basin, now it is cultivated all over the world due to having high nutrition and economic and ecological advantages. Current investigation involved five common vetch genotypes for the assessment of their performance for various agronomic and hay yield traits. Field experiment was conducted in April 2022 using randomized complete block design with three replications and harvesting was performed in August 2022. A good range of variations was observed for various studied traits. Among the genotypes, the average number of first flowering days was 53.9 days, the number of first pod tying days was 64.85 days, the natural plant height was 38.9 cm, the green herbage yield was 653.2 kg/da and the hay yield was 247.7 kg/da. As a result of the correlation analysis, a positive and significant correlation was found between hay yield and green herbage yield, natural plant height with green herbage yield and hay yield, first flowering days and first pod setting days. As a result of the research, genotype 3, among the common vetch genotypes, was found to be superior in terms of various agronomic and forage yield-related characteristics and it is thought that it can be evaluated for large-scale cultivation in Sivas climate conditions.

Keywords: *Vicia sativa*, Fodder Crop, Green Herbage, Dry Herbage

GİRİŞ

Ülkemizde kaba yem üretimi, hayvancılık işletmelerinin ihtiyaçlarını karşılamakta son derece yetersiz kalmaktadır. Ülkemiz hayvancılığı çoğunlukla meraya dayalıdır. Ancak yıllar içerisinde mera alanlarının yanlış ve tek yönlü kullanımı nedeniyle bu alanlar verimliliklerini kaybetmiş, hayvanlar besleme değeri daha düşük kaynaklarla beslenmek mecburiyetinde kalmışlardır. Kaliteli yemler kullanılarak hayvan besleme yapılması, hayvansal üretimin artırılması için oldukça önemli bir konudur. Bu açıdan bakıldığı zaman tarımsal üretim sistemleri içerisinde kaliteli yem bitkilerinin dahil edilmesi zorunlu hale gelmiştir (Ünaldı, 2008).

Fiğler, hayvan besleme bakımından besin içeriklerinin yüksek olması nedeniyle yem kalitesi yüksek ot ve tohum üretmek amacıyla yetiştirilen oldukça önemli yem bitkilerindedir (Kurt, 2012). Dünyanın farklı bölgelerine yayılmış 150 kadar fiğ (*Vicia spp.*) türü bulunmaktadır (Er ve ark., 2011; Ekiz ve ark., 2011). Tarımsal üretimde ekonomik öneme sahip bazı fiğ türleri Macar fiği (*Vicia pannonica*), koca fiğ (*Vicia narbonensis*), tüylü fiğ (*Vicia villosa*), burçak (*Vicia ervilia*) ve yaygın fiğ (*Vicia sativa*)'dir. Ülkemizde genel olarak yetiştiriciliği yapılan fiğ türü yaygın fiğdir (Er ve ark., 2011). Yaygın fiğ dünyanın ekonomik açıdan en önemli tek yıllık tohumluk baklagil bitkilerinden biridir (Mikić ve ark., 2009). Yaygın fiğ otunun lezzetli ve besleyici olması nedeniyle büyükbaş ve küçükbaş hayvan beslenmesinde başarılı bir şekilde kullanılabilir (Açıkgöz, 2011).

Hayvan beslemenin yanında yaygın fiğ, sürülerek toprağa karıştırılması halinde iyi bir yeşil gübre bitkisi, tek yıllık baklagil bitkisi olması sebebiyle toprağı azot yönünden zenginleştirir, ekim nöbetlerinde yer alabilir ve bıraktığı artıklar sayesinde toprağın organik madde oranını artırır. Ülkemizde 2022 yılı verilerine göre fiğden yaklaşık 3 421 760 da alandan 4 020 433 ton yeşil ot elde edilmiştir. Dekar başına yeşil ot verimi ise ortalama 1175 kg olarak gerçekleşmiştir (TÜİK, 2022). Kuru ot verimi hakkında istatistiki bir bilgiye rastlanılmamıştır. Fakat genel olarak yem bitkilerinde kuru ot hesabı $\frac{1}{4}$ oranında yapılmaktadır. Buna göre kuru ot veriminin dekara yaklaşık olarak 294 kg olarak elde edilebileceği söylenebilir (Çaçan ve ark., 2018).

Bu çalışma, bazı yaygın fiğ çeşitlerinin Sivas ekolojik koşullarına adaptasyonunu ve agromorfolojik özellikler bakımından performanslarını değerlendirmek amacıyla yürütülmüştür.

MATERYAL VE METOT

Araştırma, Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri ve Teknoloji Fakültesi, Tarımsal Ar-Ge Merkezinde, 2022 yılı yazlık ürün yetiştirme sezonunda yürütülmüştür. Denemenin yürütüldüğü Sivas ili 39° 56' kuzey paralelleri ile 32° 51' doğu meridyenleri

arasında yer almakta olup, denizden yüksekliği 1285 m'dir. Araştırmanın yürütüldüğü Nisan 2022-Ağustos 2022 ayları arasında en düşük sıcaklık değeri Nisan ayında (-4.2°C), en yüksek sıcaklık değeri ise Ağustos ayında (36.0°C) gerçekleşmiştir. Denemenin yürütüldüğü yetiştirme sezonunda en düşük ortalama nispi nem değeri Nisan ayında (%44.5), en yüksek ortalama nispi nem değeri ise Haziran ayında (%55.8) saptanmıştır. Araştırma sürecinde gerçekleşen toplam yağış miktarlarına bakıldığında ise en düşük değer Temmuz ayında (0 mm), en yüksek değer ise Haziran ayında (116.6 mm) saptanmıştır (Anonim, 2022). Denemenin yürütüldüğü 2022 yetiştirme sezonuna ait iklim verileri Çizelge 1'de verilmiştir.

Çizelge 1. Sivas ili 2022 yetiştirme sezonuna ait iklim verileri

2022	Yağış (mm)		Sıcaklık (°C)				Nispi Nem (%)			
	Top. Yağış	Uzun Yıllar	Min. Sıcaklık	Max. Sıcaklık	Ort. Sıcaklık	Uzun Yıllar	Min. N. Nem	Max. N. Nem	Ort. N. Nem	Uzun Yıllar
Nisan	4.3	23.2	-4.2	27.9	12.2	11.1	7.0	92.0	44.5	50.0
Mayıs	5.6	18.9	0.8	30.7	12.5	13.9	10.0	91.0	53.1	53.8
Haziran	116.6	77.7	9.8	35.1	18.8	18.6	7.0	93.0	55.8	55.2
Temmuz	0.0	4.6	7.2	35.2	19.1	20.3	5.0	85.0	51.9	50.5
Ağustos	11.4	9.1	13.4	36.0	23.7	22.3	10.0	99.0	47.5	48.4

Çalışmada 5 adet yaygın fiğ (Alper, Görkem, Kubilay, Selçuk, Soner) çeşidi materyal olarak kullanılmıştır. Tarla denemeleri, tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak yürütülmüştür. Ekimler ve hasatlar el ile yapılmıştır. Ekimde her bir parsel 5 m uzunluğunda ve sıra arası 25 cm olacak şekilde 6 sıradan oluşmuştur. Yetiştirme süresi boyunca gerekli kültürel işlemler eksiksiz olarak yerine getirilmiş, dekara 4 kg azot (N) ile 10 kg fosfor (P₂O₅) olacak şekilde gübreleme yapılmıştır. Araştırmada, ilk çiçeklenme gün sayısı (ÇGS), ilk bakla bağlama gün sayısı (İBGS), doğal bitki boyu (DBB), yeşil ot verimi (YOY) ve kuru ot verimi (KOV) özellikleri incelenmiştir. Çalışma sonucunda elde edilen veriler SAS 9.3 istatistik paket programında varyans analizine tabi tutulmuştur (SAS, 2013).

BULGULAR ve TARTIŞMA

Farklı yaygın fiğ çeşitlerinde incelenen ilk çiçeklenme gün sayısı (gün), ilk bakla bağlama gün sayısı (gün), doğal bitki boyu (cm), yeşil ot verimi (kg/da) ve kuru ot verimi (kg/da) özelliklerine ait ortalama değerler Çizelge 2'de, korelasyon analizine ait veriler ise Çizelge 3'te verilmiştir.

İlk çiçeklenme gün sayısı bakımından yaygın fiğ çeşitleri arasında, istatistiki olarak 0.01 önem düzeyinde farklılık olduğu saptanmıştır. Ortalama ilk çiçeklenme gün sayısı 53.9 gün olurken, çeşitler arasında ilk çiçeklenme gün sayısı 52.0-55.25 gün arasında değişiklik göstermiştir.

Görkem çeşidi en kısa (52.0 gün) ilk çiçeklenme gün sayısı, Alper çeşidi ise en uzun (55.25 gün) ilk çiçeklenme gün sayısına sahip çeşit olmuştur (Çizelge 2). Bir başka ifade ile Görkem çeşidinin en erkenci, Alper çeşidinin ise en geççi çeşit olduğu anlaşılmıştır. Yürütülen benzer çalışmalarda çiçeklenme gün sayısını, Yücel ve ark. (2008) 123.9-133.8 gün olarak bildirirlerken, Çukurova koşullarında 110.0-136.7 gün arasında (Yücel ve ark., 2004; Yücel ve ark., 2005; Anlarsal ve ark., 2006), Harran Ovası koşullarında 125-146 gün arasında (Çil ve ark., 2006; Yücel ve ark., 2006) değiştiği bildirilmiştir.

Varyans analizi sonucunda yaygın fiğ çeşitleri arasında ilk bakla bağlama gün sayısı bakımından istatistiki olarak 0.01 önem düzeyinde fark olduğu belirlenmiştir. Çeşitler arasında ilk bakla bağlama gün sayısı 62.75-66.25 gün arasında değişiklik göstermiştir. Ortalama ilk bakla bağlama gün sayısı 64.85 gün, en kısa ilk bakla bağlama gün sayısı (62.75 gün) Görkem çeşidinde, en uzun ilk bakla bağlama gün sayısı (66.25 gün) ise Alper çeşidinde saptanmıştır. Araştırma bulguları incelendiğinde ilk çiçeklenme gün sayısı ile ilk bakla bağlama gün sayısı arasında önemli bir ilişki olduğu görülmektedir.

Doğal bitki boyu bakımından yaygın fiğ çeşitleri arasında istatistiki olarak önemli bir fark bulunamamıştır. Çeşitler arasında doğal bitki boyu 37.8-39.8 cm arasında değerler almıştır. Ortalama doğal bitki boyu 38.9 cm olurken, en kısa doğal bitki boyu (37.8 cm) Alper çeşidinden, en uzun doğal bitki boyu (39.8 cm) ise Görkem çeşidinden elde edilmiştir. Konuyla ilgili farklı çalışmalar incelendiğinde bitki boyunu, Babat ve Anlarsal (2011) 26.6-55.8 cm arasında, Kökten (2011) 20.3-26.2 cm arasında, Seydoşoğlu (2014) ise 33.9-62.6 cm arasında değerler aldığını bildirmişlerdir.

Çizelge 2. Yaygın fiğ çeşitlerinin incelenen özelliklere ait ortalama ve CV değerleri

Genotip	İÇGS (gün)	İBBGS (gün)	DBB (cm)	YOV (kg/da)	KOV (kg/da)
Alper	55,25 ^a	66,25 ^a	37,80	634,93 ^{ab}	208,68 ^b
Görkem	52,00 ^c	62,75 ^b	39,80	635,07 ^{ab}	229,44 ^b
Kubilay	55,00 ^a	65,75 ^a	39,20	761,25 ^a	309,20 ^a
Selçuk	52,75 ^{bc}	63,75 ^b	39,75	676,53 ^{ab}	255,66 ^{ab}
Soner	54,50 ^{ab}	65,75 ^a	37,95	558,13 ^b	235,42 ^b
ÖD	**	**	NS	**	**
CV	6,05	8,37	18,37	6,39	7,60

İÇGS: İlk Çiçeklenme Gün Sayısı, İBBGS: İlk Bakla Bağlama Gün Sayısı, DBB: Doğal Bitki Boyu, YOV: Yeşil Ot Verimi, KOV: Kuru Ot Verimi, ÖD: Önem düzeyi, **: 0.01 düzeyinde önemli, NS: Önemli Değil

Yeşil ot verimi bakımından yaygın fiğ çeşitleri arasında istatistiki olarak 0.01 önem düzeyinde fark olduğu belirlenmiştir. Çeşitler arasında yeşil ot verimi 558.13-761.25 kg/da arasında değişiklik göstermiştir. Ortalama yeşil ot verimi 653.2 kg/da olurken, Soner çeşidi en az (558.13 kg/da) yeşil ot verimine, Kubilay çeşidi ise en fazla (761.25 kg/da) yeşil ot verimine sahip çeşit

olmuştur. Yeşil ot verimi ile ilgili yürütülen benzer çalışmalarda, Babat ve Anlarsal (2011) 545.0-1233.0 kg/da arasında, Kökten (2011) ortalama yeşil ot verimini 792.2 kg/da olarak bildirmişlerdir. Bulgularımızın yürütülen benzer çalışmalardan daha düşük verilere sahip olmasının sebebi olarak, denemenin kurulmuş olduğu bölgenin gece-gündüz sıcaklık farklarının fazla olması, yani gündüz fotosentez yoluyla üretilen enerjinin gece solunum ile kaybedilmesi ve yağmura bağımlı şartlarda denemenin yürütülmüş olması gösterilebilir.

Varyans analizi sonucunda yaygın fiğ çeşitleri arasında kuru ot verimi bakımından istatistiki olarak 0.01 önem düzeyinde farklılıklar olduğu saptanmıştır. Çeşitler arasında kuru ot verimi 208.68-309.2 arasında farklı değerler almıştır. Ortalama kuru ot verimi 247.7 kg/da olurken, en az kuru ot verimi Alper çeşidinden, en fazla kuru ot verimi ise Kubilay çeşidinden elde edilmiştir. Yürütülen benzer çalışmalarda, Şilbır ve Sağlantimur (1991) 190.0-425.0 kg/da, Başbağ (2004) 337.1-583 kg/da, Kökten (2011) ortalama kuru ot verimini 220.1 kg/da olarak bildirmişlerdir.

Çizelge 3. Çeşitler arasında incelenen özelliklere ait korelasyon katsayıları

	İÇGS	İBBGS	DBB	YOY	KOV
İÇGS	1.000				
İBBGS	0.813**	1.000			
DBB	-0.078	-0.146	1.000		
YOY	0.063	0.012	0.705**	1.000	
KOV	0.077	0.056	0.635**	0.857**	1.000

İÇGS: İlk Çiçeklenme Gün Sayısı, İBBGS: İlk Bakla Bağlama Gün Sayısı, DBB: Doğal Bitki Boyu, YOY: Yeşil Ot Verimi, KOV: Kuru Ot Verimi, **: 0.01 düzeyinde önemli

İncelenen özellikler arasındaki ilişkileri incelemek amacıyla ortalama veriler üzerinden yapılan korelasyon analiz sonuçları Çizelge 3'te verilmiştir. İlgili çizelge incelendiğinde, ilk çiçeklenme gün sayısı ile ilk bakla bağlama gün sayısı ($r=0.813$) arasında, doğal bitki boyu ile yeşil ot verimi ($r=0.705$) ve kuru ot verimi ($r=0.635$) arasında, yeşil ot verimi ile kuru ot verimi ($r=0.857$) arasında pozitif ve anlamlı bir ilişki olduğu saptanmıştır. İlk çiçeklenme gün sayısı ile doğal bitki boyu ($r=-0.078$) arasında ve ilk bakla bağlama gün sayısı ile doğal bitki boyu ($r=-0.146$) arasında negatif fakat önemsiz bir ilişki olduğu, diğer özellikler arasında ise pozitif ancak önemsiz bir ilişki olduğu belirlenmiştir.

SONUÇ

Yem bitkileri tarımı, bitkisel ve hayvansal üretimde, yem üretiminin yanında, toprağın fiziksel ve kimyasal yapısını iyileştiren, kendisinden sonra yetiştirilecek bitkiler için zengin bir toprak bırakması açısından oldukça önemli bir yere sahiptir. Bu nedenle bölgeye uyumlu yem bitkilerinin belirlenebilmesi bakımından adaptasyon çalışmalarının yürütülmesi büyük önem

arz etmektedir. Sivas ekolojik koşullarına uyumlu olabileceği düşünölen beş yaygın fiğ çeşidi ile yürütölen çalışmada, Görkem ve Kubilay çeşitlerinin farklı özellikler bakımından üstün performans gösterdikleri saptanmıştır. Bu kapsamda deęişen iklim faktörleri göz önüne alındığında, adaptasyon çalışmalarının sürdürölmesinin faydalı olacağı düşünölmektedir.

KAYNAKLAR

- Açıkgöz, E. 2011. Yem Bitkileri Yetiştiriciliği. Süt Hayvancılığı, Eğitim Merkezi Yay. Hayvancılık Serisi.
- Anlarsal A. E., C. Yücel, D. Yücel. 2006. Çukurova koşullarında fiğ (*Vicia sativa* L.) çeşit ve hatlarının bazı tarımsal ve kalite özelliklerinin saptanması. *Çukurova Ü. Z. F. Dergisi*, 21 (2): 111-120.
- Anonim. 2022. Sivas Meteoroloji İl Müdürlüğü, 2022.
- Babat, S., Anlarsal A.E. 2011. Diyarbakır ekolojik koşullarında bazı adi fiğ (*Vicia sativa* L.) çeşitlerinin verim ve verim öğelerinin belirlenmesi üzerine bir araştırma. *Ç.Ü. Fen ve Mühendislik Bilimleri Dergisi*, 26(3): 37-46.
- Başbağ, M. 2004. Diyarbakır koşullarında bazı fiğ tür ve varyetelerinde (*Vicia* ssp.) verim ve verim unsurlarının incelenmesi. *Harran Üniversitesi Ziraat Fakültesi Dergisi*, 8(3/4):37-43.
- Çaçan, E., Kökten, K., Kaplan, M., Yılmaz, H. Ş. 2018. Bazı adi fiğ hat ve çeşitlerinin (*Vicia sativa* L.) ot verimi ve ot kalitesi açısından değerlendirilmesi. *Harran Tarım ve Gıda Bilimleri Dergisi*, 22(1), 47-61.
- Çil, A., A. N. Çil ve C. Yücel. 2006. Bazı adi fiğ (*Vicia sativa* L.) hatlarının Harran Ovası koşullarına adaptasyonu. *Harran Ü. Z. F. Dergisi*, 10 (1/2): 53-61.
- Ekiz, H., Altınok, S., Sancak, C., Sevimay, C.S., Kendir, H. 2011. Tarla bitkileri. Ankara Üniversitesi Ziraat Fakültesi Yayınları, Yayın No:1588, 491 s.
- Er, C., Başalma, D., Ekiz, H., Sancak, C. 2011. Tarla Bitkileri-II. T.C. Anadolu Üniversitesi Yayını No:2254.
- Kökten, K. (2011). Bingöl ekolojik koşullarında bazı adi fiğ (*Vicia sativa* L.) hat ve çeşitlerinde tohum verimi ve bazı tarımsal özelliklerin belirlenmesi. *Science Journal of Bingöl University*, 1, 2.
- Kurt, O. 2012. Tarla bitkileri yetiştirme tekniği. Ondokuz Mayıs Üniversitesi Ziraat Fakültesi Ders Kitabı, No:44, 171 s.
- Mikić, A., Perić, V., Đorđević, V., Srebrić, M., & Mihailović, V. 2009. Bazı baklagillerde beslenmeyi engelleyen faktörler. *Hayvan Yetiştiriciliğinde Biyoteknoloji*, 25 (5-6-2), 1181-1188.
- SAS9.3 (2013) SAS/STAT, SAS Institute Incorporation, Cary, NC, USA.
- Seydoşoğlu, S. 2014. Diyarbakır ekolojik koşullarında bazı yaygın fiğ (*Vicia sativa* L.) genotiplerinin verim ve verim unsurlarının belirlenmesi. *Türkiye Tarımsal Araştırmalar Dergisi*, (2014)1: 117-227.
- Şılbır, Y., Sağlamtimur, T. 1991. Harran ovası kıraç koşullarına uygun fiğ (*Vicia sativa* L.) çeşitlerinin saptanması. *Çukurova Üniversitesi Ziraat Fakültesi Dergisi*, 6(3): 155-166TÜİK, 2022. Türkiye İstatistik Kurumu. <https://data.tuik.gov.tr/Kategori/GetKategori?p=tarim-111&dil=1>, Erişim tarihi: 02.05.2023.
- Ünaldı, Ö. 2008. Tokat-Kazova koşullarında farklı tohumluk miktarlarının adi fiğ (*Vicia sativa* L.) hatlarında verim ve bazı agronomik özellikleri üzerine etkileri. (Yüksek lisans tezi, Gaziosmanpaşa Üniversitesi Fen Bilimleri Enstitüsü).
- Yücel, C., M. Avcı, H. Yücel ve S. Çınar. 2004. Çukurova taban koşullarında adi fiğ (*Vicia sativa* L.) hat ve çeşitlerinin ot verimi ve kalitesi ile ilişkili özelliklerin saptanması. *Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi*, cilt 13, sayı 1- 2
- Yücel. C. M. Avcı ve A. E. Anlarsal. 2005. Bazı adi fiğ (*Vicia sativa* L.) hat ve çeşitlerinin Çukurova taban koşullarında tane verimi ve verimle ilgili özelliklerinin saptanması. *Çukurova Üniversitesi Ziraat Fakültesi Dergisi*, 20 (3). Adana. s. 99-108.

- Yücel, C., A. Çil ve A. N. Çil. 2006. Harran ovası koşullarında bazı Adi Fiğ (*Vicia sativa* L.) çeşit ve hatların ot ve tane verimlerinin saptanması. Harran Üniversitesi, *Ziraat Fakültesi Dergisi*, 10 (1/2): 63-71.
- Yücel, C., Gültekin, R., İnal, İ., Avcı, M. (2008). Çukurova koşullarında bazı adi fiğ (*Vicia sativa* L.) hatlarının verim ve verim karakterlerinin belirlenmesi. *Anadolu Ege Tarımsal Araştırma Enstitüsü Dergisi*, 18(2), 38-54.

SİVAS EKOLOJİK KOŞULLARI ALTINDA BAZI MACAR FİĞİ (*Vicia Pannonica* Crantz.) GENOTİPLERİNİN AGRO-MORFOLOJİK ÖZELLİKLER BAKIMINDAN DEĞERLENDİRİLMESİ

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ÖZET

Macar fiği (*Vicia pannonica* Crantz.)'nin besin değeri oldukça yüksek olup, hayvanlar için son derece besleyici ve lezzetli bir yem bitkisidir. Toprak özellikleri bakımından pek seçici olmayıp, kuraklığa ve soğuğa karşı dayanıklıdır. Bunun yanında ot verimi ve protein içeriği bakımından yüksek olması sebebiyle hayvansal beslenmede çokça tercih edilmektedir. Bu araştırma, beş adet Macar fiği çeşidinin Sivas ekolojik koşullarında bazı agronomik özelliklerinin belirlenmesi amacıyla 2020-2021 yılları arasında yürütülmüştür. Araştırmada, Macar fiği çeşitlerinin çiçeklenme gün sayısı (gün), doğal bitki boyu (cm), yeşil ot verimi (kg/da) ve kuru ot verimi (kg/da) gibi özellikleri incelenmiştir. Araştırma sonucunda, incelenen Macar fiği çeşitlerinin Sivas ekolojik koşullarındaki performanslarında önemli farklılıklar olduğu belirlenmiştir. Çeşitler arasında çiçeklenme gün sayısı 168.25-170.25 gün arasında değişim göstermiştir. Çalışmadan elde edilen verilere göre, çeşitler arasında yeşil ot verimi 1146-1894 kg/da arasında değişim gösterirken, kuru ot verimi 244-546 kg/da arasında değişim göstermiştir. Doğal bitki boyu incelenen çeşitler arasında 54.3-67.8 cm arasında değişim göstermiş olup ortalama 61.5 cm olarak saptanmıştır. Yapılan korelasyon analizi sonucunda yeşil ot verimi ile kuru ot verimi arasında pozitif ve anlamlı bir korelasyon olduğu saptanmıştır. Macar fiği, soğuğa ve kuraklığa gösterdiği yüksek adaptasyon kabiliyeti sayesinde özellikle İç Anadolu ve Doğu Anadolu Bölgeleri'nde kaba yem ihtiyacının karşılanması noktasında değerlendirilmesi ve yetiştirilmesi gereken önemli bir bitki olup, bu bölgelere uyum sağlamış çeşitlerin geliştirilmesi büyük önem arz etmektedir.

Anahtar Kelimeler: Macar fiği, yeşil ot, verim

**EVALUATION OF SOME HUNGARIAN VETCH (*Vicia pannonica* Crantz.)
GENOTYPES IN TERMS OF AGRO-MORPHOLOGICAL TRAITS UNDER SIVAS
ECOLOGICAL CONDITIONS**

ABSTRACT

Hungarian vetch (*Vicia pannonica* Crantz.) has a very high nutritional value and is an extremely nutritious and delicious forage plant for animals. It is not very selective in terms of soil properties and is resistant to drought and cold. In addition, it is highly preferred in animal nutrition due to its high grass yield and protein content. This research was carried out between 2020-2021 to determine some agronomic characteristics of five Hungarian vetch varieties in Sivas ecological conditions. In the study, the number of flowering days (day), natural plant height (cm), green herbage yield (kg/da) and hay yield (kg/da) characteristics of Hungarian vetch cultivars were investigated. As a result of the research, it was determined that there were significant differences in the performance of the examined Hungarian vetch varieties in Sivas ecological conditions. The number of flowering days among the cultivars varied between 168.25-170.25 days. According to the data obtained from the study, green herbage yield varied between 1146-1894 kg/da, while hay yield varied between 244-546 kg/da. The plant height varied between 54.3-67.8 cm among the examined varieties, with an average of 61.5 cm. As a result of the correlation analysis, it was determined that there was a positive and significant correlation between green herbage yield and dry herbage yield. Thanks to its high adaptability to cold and drought, Hungarian vetch is an important plant that should be evaluated and grown especially in Central Anatolia and Eastern Anatolia Regions to meet the roughage need, and it is of great importance to develop varieties adapted to these regions.

Keywords: Hungarian vetch, green herbage, yield

GİRİŞ

Ülkemizde, yem bitkileri yetiştiriciliği ve üretim miktarının yeterli olmaması nedeniyle gerekli olan besin ihtiyacı doğal çayır mera alanları ve tarımsal artıklardan karşılanmaktadır (Özkan ve Şahin Demirbağ, 2016; Budak, 2017). Ülkemizde kaliteli kaba yem üretimi kuru ot bazında yaklaşık olarak 22.2 milyon tondur. Çayır mera alanlarında yanlış ve tek yönlü kullanımı, bu alanlarda ciddi azalmalara neden olmuştur. Buna bağlı olarak yeterli besin miktarının karşılanabilmesi için yem bitkileri yetiştiriciliği önemi daha da artmıştır. Özellikle baklagil yem bitkilerinin potansiyel olarak yüksek verim değerine ek olarak, havadaki serbest azotu toprağa bağlayabilmeleri, toprağın organik madde, karbon ve fosfor içeriğini zenginleştirmeleri, yabancı otları toprakta bulunan su ve besin maddeleri açısından baskı altına alabilmeleri değerlerini arttırmaktadır (Ashworth ve ark., 2012).

Fiğ (*Vicia spp.*) otlatma, yeşil gübre, tane üretimi, yeşil ve kuru ot üretimi amaçları için dünyanın birçok bölgesinde yetiştiriciliği yapılan önemli bir baklagil yem bitkisi (Bakoğlu ve ark., 2004). Fiğ, kumlu topraklardan ağır killi topraklara kadar çok farklı toprak yapısında yetiştirilebilmektedir. Bununla birlikte ekim nöbeti sistemleri içerisinde yer alarak hastalıkların gelişimini sınırlamaktadır (Tenikecier ve ark., 2020). Dünya üzerinde yayılış gösteren 150 kadar fiğ türü bulunmaktadır (Ekiz ve ark., 2011; Er ve ark., 2011). Macar fiği (*Vicia pannonica* Crantz.), yaygın olarak yetiştiriciliği yapılan fiğ türlerinden birisidir. Macar fiğinin önemli özelliklerinden bir tanesi de kışları sert geçen bölgelerde diğer fiğ türlerine göre daha toleranslı olmasıdır (Taş ve ark., 2007).

Macar fiğinin ince gövde ve yaprak bakımından zengin bir bitki yapısına sahip olması yem değerini oldukça yükseltmektedir (Aksoy ve Nursoy, 2010). Bunun yanı sıra tanesinde protein oranının yüksek olması, kesif yem olarak kullanılmalarına olanak tanımaktadır (Turan, 2019). Macar fiği ekiliş alanları ülkemizde giderek yaygınlaşmakta olup, yetiştiricilik bakımından Orta ve Doğu Anadolu bölgelerinin daha uygun olacağı belirtilmiştir (Açıkgöz, 2001). Kaliteli kaba yem ihtiyacının karşılanabilmesi yem bitkileri ekiliş alanların artırılmasına, dolayısıyla bölgelerin ekolojik koşullarına uygun yeni çeşitlerin geliştirilmesine bağlıdır. Bu çalışma ile bazı Macar fiği çeşitlerinin Sivas ili ekolojik koşullarına adaptasyonu ve ot verimlerinin değerlendirilmesi amaçlanmıştır.

MATERYAL VE METOD

Araştırma Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri ve Teknoloji Fakültesi bünyesinde yer alan Tarımsal Ar-Ge Merkezinde 2020-2021 yılı ürün yetiştirme sezonunda, 4 tekerrürlü olacak şekilde tesadüf blokları deneme desenine göre yürütülmüştür. Denemenin

yürütüldüğü 2020-2021 yetiştirme sezonuna ait iklim verileri Çizelge 1’de verilmiştir. Araştırmanın yürütüldüğü Kasım 2020-Temmuz 2021 ayları arasında en düşük sıcaklık 2021 yılı Şubat ayında -18.4°C olarak, en yüksek sıcaklık ise 2021 yılı Temmuz ayında 39.2°C olarak belirlenmiştir (Çizelge 1). En düşük ortalama nispi nem değeri 2021 yılı Mayıs ayında %44.4 olarak, en yüksek ortalama nispi nem ise yine 2020 yılı Aralık ayında %75.2 olarak saptanmıştır. Araştırma sürecinde gerçekleşen toplam yağış miktarı en düşük 2021 yılı Temmuz ayında 6.0 mm olarak; en yüksek ise 2021 yılı Ocak ayında 75.2 mm olarak kaydedilmiştir (Anonim, 2022).

Çizelge 1: Sivas ili 2020-2021 yetiştirme sezonuna ait iklim verileri

	Yıl	Aylar									Toplam veya Ortalama
		1	2	3	4	5	6	7	8	9	
Yağış (mm)	2020-2021	28.6	21.9	75.2	15.3	60.0	18.5	22.3	34.8	6.0	268.6
	Uzun Yıllar	31.9	28.8	48.8	39.4	51.3	42.1	32.2	38.8	9.2	322.4
En Düşük Sıcaklık ($^{\circ}\text{C}$)	2020-2021	-6.7	-8.6	-15.8	-18.4	-7.4	-1.6	-1.8	5.6	11.2	-4.8
En Yüksek Sıcaklık ($^{\circ}\text{C}$)	2020-2021	18.6	12.8	18.6	15.3	14.1	25.7	33.5	31.7	39.2	23.3
Ortalama Sıcaklık ($^{\circ}\text{C}$)	2020-2021	4.4	1.7	0.7	0.0	2.7	10.9	15.9	15.8	21.9	8.3
	Uzun Yıllar	5.6	2.4	-0.6	1.1	5.4	9.9	15.3	18.3	21.6	11.1
Nispi Nem (%)	2020-2021	68.1	75.2	69.5	67.6	65.1	52.7	44.4	52.9	46.1	60.2
	Uzun Yıllar	65.6	68.6	70.1	60.2	66.3	61.0	60.6	54.5	51.9	55.9

1: Kasım, 2: Aralık, 3: Ocak, 4: Şubat, 5: Mart, 6: Nisan, 7: Mayıs, 8: Haziran, 9: Temmuz

Çalışmada materyal olarak 5 farklı Macar fiği çeşidi (Budak, Aygün, Sarı Efe, Tarm Beyazı-98, Efes) kullanılmıştır. Sıra arası 25 cm, parsel sıra sayısı 6, parsel sıra uzunluğu 5 m, parsel alanı $0.25 \times 6 \times 5 = 7.5 \text{ m}^2$ olacak şekilde ekim işlemi gerçekleştirilmiştir. Araştırmada ekim, bakım vb. işlemlerin tamamı eksiksiz olarak yerine getirilmiştir. Bitkilerin yetiştirme dönemi boyunca saf olarak 4 kg/da azot (N), 10 kg/da fosfor (P_2O_5) verilmiştir. Fide döneminde, elle yolma ve çapalama suretiyle 2 kez yabancı otlarla mücadele yapılmıştır. Bakım işlemleri iklim koşullarına bağlı olarak gerektiğinde eksiksiz olarak yerine getirilmiştir. Elde edilen sonuçlar SAS 9.3 (2013) istatistik paket programı kullanılarak varyans analizine tabi tutulmuştur.

BULGULAR VE TARTIŞMA

Araştırmada, farklı Macar fiği çeşitlerinde incelenen çiçeklenme gün sayısı (gün), doğal bitki boyu (cm), yeşil ot verimi (kg/da) ve kuru ot verimi (kg/da) özelliklerine ait ortalama değerler Çizelge 2’de verilmiştir.

Çiçeklenme gün sayısı bakımından Macar fiği çeşitleri arasında, istatistiki olarak önemli bir fark bulunamamıştır. Ortalama çiçeklenme gün sayısı 169.3 gün olurken, çeşitler arasında

çiçeklenme gün sayısı 168.25-170.25 gün arasında değişiklik göstermiştir. En kısa çiçeklenme gün sayısı (168.25 gün) Sarıefe çeşidinde, en uzun çiçeklenme gün sayısı ise Budak çeşidinde gerçekleşmiştir (Çizelge 2). Tahtacıoğlu ve ark. (1996), Erzurum ekolojik koşullarında yürütmüş oldukları çalışmada bitki boyunu 72-75 cm arasında, Orak ve ark. (2004), Trakya Bölgesinde farklı Macar fiği hatlarının bölgeye adaptasyonunu belirlemek amacıyla yürüttükleri çalışmada bitki boyunun 55.87-88.03 cm arasında farklı değerler aldığını bildirmişlerdir.

Çizelge 2 incelendiğinde doğal bitki boyu bakımından çeşitler arasında istatistiki olarak önemli bir fark görülmemiştir. Ortalama doğal bitki boyu 61.5 cm, çeşitler arasında ise 54.3-64.8 cm arasında farklı değerler aldığı saptanmıştır. Budak çeşidi en kısa (54.3 cm) doğal bitki boyuna, Sarıefe çeşidi ise en uzun doğal bitki boyuna sahip çeşitler olduğu belirlenmiştir. Yürütülen benzer çalışmalarda Sayar ve ark. (2012) Mardin ili çiftçi şartlarında doğal bitki boyunu 45.6-54.3 cm arasında, Tenikecier ve ark. (2020) Kırklareli şartlarında doğal bitki boyunu 42.6-47.7 cm arasında ve Kutlu ve ark. (2022) Bingöl şartlarında Macar fiğinde doğal bitki boyunu 36.2-42.6 cm arasında bildirmişlerdir.

Çizelge 2. Macar fiği çeşitlerinin incelenen özelliklere ait ortalama ve CV değerleri

Genotip	ÇGS (gün)	DBB (cm)	YOY (kg/da)	KOV (kg/da)
Budak	170.25	54.3 ^b	1700 ^{ab}	375 ^{a-c}
Aygün	169.50	67.8 ^a	1537 ^b	489 ^{ab}
Sarıefe	168.25	64.8 ^{ab}	1146 ^c	244 ^c
Tarm Beyazı-98	170.00	64.0 ^{ab}	1894 ^a	546 ^a
Efes	168.50	56.5 ^{ab}	1502 ^b	339 ^{bc}
ÖD	NS	NS	**	**
CV	0.99	10.06	5.92	18.77

ÇGS: Çiçeklenme gün sayısı, DBB: Doğal bitki boyu, YOY: Yeşil ot verimi, KOV: Kuru ot verimi, ÖD: Önemlilik düzeyi, **: 0,01 düzeyinde önemli

Yeşil ot verimi bakımından Macar fiği çeşitleri arasında, istatistiki olarak 0.01 önem düzeyinde farklılıklar olduğu saptanmıştır. Ortalama yeşil ot verimi 1556 kg/da olurken, çeşitler arasında yeşil ot verimi 1146-1894 kg/da arasında değişiklik göstermiştir. En az yeşil ot verimi Sarıefe çeşidinden (1146 kg/da) elde edilirken, en fazla yeşil ot verimi Tarm beyazı-98 çeşidinden (1894 kg/da) elde edilmiştir (Çizelge 2). Yürütülen benzer çalışmalarda yeşil ot verimini, Kendir ve Sevimay (1996) 1586-1633 kg/da arasında, Sayar ve ark. (2012) 1227-2336 kg/da arasında ve Kaplan ve ark. (2019) 1430-1936 kg/da arasında değerler aldığını bildirmişlerdir. Kuru ot verimi bakımından Macar fiği çeşitleri arasında, istatistiki olarak 0.01 önem düzeyinde farklılıklar olduğu belirlenmiştir. Ortalama kuru ot verimi 398 kg/da olurken, çeşitler arasında kuru ot verimi 244-546 kg/da arasında farklı değerler aldığı saptanmıştır. En az kuru ot verimi

Sarıfe çeşidinden (244 kg/da), en fazla kuru ot verimi Tarm beyazı-98 çeşidinden (546 kg/da) elde edilmiştir (Çizelge 2). Farklı bölgelerde yürütülen çalışmalarda kuru ot verimini, Sayar ve ark. (2012) 295-575 kg/da arasında ve Kaplan ve ark. (2019) 298-381 kg/da arasında bildirmişlerdir.

Çizelge 3. Çeşitler arasında incelenen özelliklere ait korelasyon katsayıları

	ÇGS	DBB	YOV	KOV
ÇGS	1.000	0.043	0.388	0.217
DBB		1.000	-0.117	0.184
YOV			1.000	0.781**
KOV				1.000

ÇGS: Çiçeklenme gün sayısı, DBB: Doğal bitki boyu, YOV: Yeşil ot verimi, KOV: Kuru ot verimi, **: 0,01 düzeyinde Önemli

İncelenen özellikler arasındaki ilişkileri incelemek amacıyla ortalama veriler üzerinden yapılan korelasyon analiz sonuçları Çizelge 3'te verilmiştir. Çizelge incelendiğinde, kuru ot verimi ile yeşil ot verimi arasında ($r=0.781$) pozitif ve anlamlı bir ilişki olduğu saptanmıştır. Yeşil ot verimi ile doğal bitki boyu arasında ($r=-0.117$) negatif fakat istatistiki olarak önemsiz bir ilişki olduğu belirlenmiştir. Diğer özellikler arasında ise pozitif ancak istatistiki olarak önemsiz bir ilişki olduğu belirlenmiştir.

SONUÇ

Orta ve Doğu Anadolu bölgelerinde Macar fiğın yetiştiriciliği yaygın olarak yapılmaktadır. Bu bölgelerimizde kışları soğuk ve sert geçmesi nedeniyle geliştirilen yeni çeşitlerin sert iklim koşullarına uyum sağlaması ve üreticilere tavsiye edilmesi önemlidir. Araştırmada, Sivas ekolojik koşullarına adaptasyonu değerlendirilen beş farklı Macar fiği çeşitleri arasında, Tarm Beyazı-98 çeşidi, yeşil ve kuru ot verimi bakımından diğer çeşitlere kıyasla daha üstün performans göstermiştir. Elde edilen bulgular doğrultusunda, Tarm Beyazı-98 çeşidinin Sivas ekolojik koşullarında yetiştiriciliği için değerlendirilebileceği düşüncesini uyandırmaktadır. Bununla birlikte değişen iklim koşulları göz önüne alındığında, daha güvenilir sonuçlar elde edilebilmesi için adaptasyon çalışmalarının uzun yıllar ve farklı lokasyonlarda sürdürülmesi önem arz etmektedir.

KAYNAKLAR

- Açıkgöz E., 2001. Yem Bitkileri. Uludağ Üniversitesi Güçlendirme Vakfı, 182. Vipaş AŞ Yayın No: 58
- Aksoy, İ. ve Nursoy, H. (2010). Vejetasyonun farklı dönemlerinde biçilen Macar fiği Buğday karışımının besin madde kompozisyonu, rumende yıkılım özellikleri, in vitro sindirilebilirlik ve rölatif yem değerlerinin belirlenmesi. Kafkas Üniversitesi Veterinerlik Fakülte Dergisi, 16(6), 925-931. Erişim adresi: https://vetdergikafkas.org/uploads/pdf/pdf_KVFD_811.pdf
- Anonim. 2022. Sivas Meteoroloji İl Müdürlüğü, 2022.
- Ashworth, A.J. Keyser, P. Allen, F. Bates, G. and Harper, C. 2012. Intercropping legumes with native warm-season grasses for livestock forage production in the mid-south. University of Tennessee, Extension Bulletin.
- Bakoğlu, A., Kökten, K., & Karadavut, U. 2004. Bazı Macar fiği (*Vicia pannonica* CRANTZ) hat ve çeşitlerinin Bingöl kuru şartlarına adaptasyonu üzerine bir çalışma. 3. Bingöl Sempozyumu.
- Budak, F. 2017. Iğdır ekolojik şartlarında bazı Macar fiğ (*Vicia pannonica* Crantz) çeşitlerinin verim ve verim komponentlerinin belirlenmesi. *KSÜ Doğa Bilimleri Dergisi*, 20, 28-32.
- Ekiz, H., Altınok, S., Sancak, C., Sevimay, C.S., Kendir, H. 2011. Tarla bitkileri. Ankara Üniversitesi Ziraat Fakültesi Yayınları, Yayın No:1588, 491 s.
- Er, C., Başalma, D., Ekiz, H., Sancak, C. 2011. Tarla Bitkileri-II. T.C. Anadolu Üniversitesi Yayını No:2254.
- Kaplan, M., Kokten, K., Ozdemir, S. (2019). Variation in hay yield and quality of Hungarian vetch (*Vicia pannonica* Crantz) genotypes. *Current Trends in Natural Sciences*, 8(16), 205-211.
- Kendir H. ve Sevimay, S. C.1996. Ankara koşullarında kışlık yetiştirilen fiğ çeşitlerinin yem verimleri. Türkiye 3. Çayır-Mera ve Yem bitkileri Kongresi, 17-19 Haziran, Erzurum, s:472-478.
- Kutlu, M. A., Rıdvan, U. Ç. A. R., Özdemir, S., Ekmekçi, M., Mokhtarzadeh, S., Kökten, K., & Çağan, E. 2022. Determination of some yield characteristics of Hungarian vetch varieties and their evaluation as bee pasture. *Bee Studies*, 14(1), 1-7.
- Orak, A., Ateş, E., Varol, F., 2004. Macar fiği farklı gelişme dönemlerindeki bazı morfolojik ve tarımsal özellikleri ile besin içeriği ilişkileri. *Tarım Bilimleri Dergisi*, 10(4):410-415
- Özkan, U. ve Şahin Demirbağ, N. 2016. Türkiye’de kaliteli kaba yem kaynaklarını mevcut durumu. *Türkiye Bilimsel Derlemeler Dergisi*, 9(1): 23-27.
- SAS9.3 (2013) SAS/STAT, SAS Institute Incorporation, Cary, NC, USA.
- Sayar, M. S., Karahan, H., Yavuz, H. A. N., Tekdal, S., & Başbağ, M. 2012. Kızıltepe ekolojik koşullarında bazı Macar fiği (*Vicia pannonica* Crantz.) genotiplerinin ot verimi, ot verimini etkileyen özellikler ile özellikler arası ilişkilerin belirlenmesi. *Tarım Bilimleri Araştırma Dergisi*, (2), 126-130.
- Tahtacıoğlu L., Avcı, M., Mermer, A., Şeker, H., Aygün, C. 1996. Bazı kışlık fiğ çeşitlerinin Erzurum ekolojik koşullarına adaptasyonu. Türkiye 3. Çayır-Mera ve Yem Bitkileri Kongresi, 17-19 Haziran, Erzurum.
- Taş N., L. Tahtacıoğlu ve C. Aygün, 2007. Doğu Anadolu Bölgesi Fiğ Islah Çalışmaları. Türkiye VII. Tarla Bitkileri Kongr. 25-27 Haziran 2007 Erzurum, (Sunulu Bildiri) s: 102-105.

- Tenikecier, H. S., Adnan, O. R. A. K., Tekeli, A. S., & Gültekin, B. (2020). Bazı Macar fiđi (*Vicia pannonica* Crantz.) genotiplerinde farklı biçim zamanlarının ot verimi ve bazı kalite özelliklerine etkisi. *Türk Tarım ve Dođa Bilimleri Dergisi*, 7(4), 833-847.
- Turan, N. (2019). Macar fiđi ile arpa yař otunun farklı oranlarda karıřtırılarak elde edilen silajın kimyasal kompozisyonu ve kalite parametrelerinin belirlenmesi. *Avrupa Bilim ve Teknoloji Dergisi*, 17, 787–793. Eriřim adresi: <https://dergipark.org.tr/en/download/article-file/859525>

**SİVAS EKOLOJİK KOŞULLARINDA BAZI MÜRDÜMÜK (*Lathyrus sativus* L.)
GENOTİPLERİNİN AGRO-MORFOLOJİK PERFORMANSLARININ
DEĞERLENDİRİLMESİ**

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ÖZET

Kuraklığa, düşük sıcaklığa ve orta derecede tuzluluk stresine, sel baskınlarına da toleranslı geniş bir adaptasyon yeteneğine sahip olan mürdümük (*Lathyrus sativus* L.), baklagil familyası içerisinde yer alan yem ve tohum verimi amacıyla yetiştirilen tek yıllık serin iklim bitkisidir. Mürdümük yeşil ot, kuru ot ve tane yem olarak hayvan beslenmesinde, yeşil gübre olarak toprak yapısının iyileştirilmesinde kullanılmak üzere yetiştiriciliği yapılan önemli bir baklagil yem bitkisidir. Bitkinin en belirgin özellikleri kuraklık ve su baskınlarına karşı dirençli olmasıdır. Ürün miktarı ve kalitesinin artırılması için bölge ekolojisine uygun çeşit adaptasyon çalışmalarının tamamlanması gerekmektedir. Bu çalışmada GAP mavisini ile Gürbüz 2001 çeşidi ve Sivas Bilim ve Teknoloji Üniversitesi kapsamında geliştirilen SBTÜ 101, SBTÜ 102 ve SBTÜ 103 hat (çeşit aday) olmak üzere beş adet farklı mürdümük genotipi Sivas ekolojik koşullarında bazı agronomik özelliklerinin belirlenmesi amacıyla 2022 yılı yazlık ürün yetiştirme sezonunda tesadüf blokları deneme desenine göre 4 tekerrürlü olacak şekilde yürütülmüştür. Araştırmada mürdümük genotiplerinin çiçeklenme gün sayısı (gün) (ÇGS), bitki boyu (cm) (BB), ilk bakla yüksekliği (cm) (İBY), bitki başına bakla sayısı (adet) (BBBS), biyolojik verim (kg/da) (BV), fizyolojik olum gün sayısı (gün) (FOGS), tane verimi (kg/da) (TV), kes verimi (kg/da) (KV), bin tane ağırlığı (g) (BinTA) ve hasat indeksi (%) (Hİ) özellikleri incelenmiştir. Çiçeklenme gün sayısı, fizyolojik olum gün sayısı ve bin tane ağırlığı istatistiksel olarak önemli bulunurken, diğer incelenen özellikler istatistiksel olarak önemli bulunmamıştır. Çalışma sonucunda ortalama ÇGS 49 gün, BB 43.8 cm, İBY 12.26 cm, BBBS 33.23 adet, BV 324.82 kg/da, FOGS 112.6 gün, TV 148.53 kg/da, KV 176.29 kg/da, BinTA 149.72 gr ve Hİ %45.91 olarak saptanmıştır. Yapılan korelasyon analizi sonucunda BB ile BBBS, ÇGS ile FOGS, TV ile BV, KV ile BV ve TV arasında pozitif ve anlamlı, Hİ ile BV, TV ve KV arasında ise negatif ve anlamlı bir ilişki olduğu saptanmıştır.

Anahtar Kelimeler: Yem bitkileri, *Lathyrus sativus*, morfoloji, adaptasyon

**EVALUATION OF AGRO-MORPHOLOGICAL PERFORMANCE OF SOME
GRASSPEA (*Lathyrus sativus* L.) GENOTYPES UNDER SIVAS ECOLOGICAL
CONDITIONS**

ABSTRACT

Grasspea (*Lathyrus sativus* L.), which has a wide range of adaptation abilities tolerant to drought, low temperature, and moderate salinity stress and floods, is an annual cool climate plant grown for forage and seed yield in the legume family. Grasspea is an important legume fodder plant that is cultivated for animal nutrition as green herbage, hay, and grain feed and for improving soil texture as green manure. The most prominent characteristics of the plant are its resistance to drought and flooding. To increase the quantity and quality of the product, variety of adaptation studies suitable for the ecology of the region should be completed. In this study, GAP mavisı and Gurbüz 2001 cultivars and five different grasspea genotypes including SBTÜ 101, SBTÜ 102 and SBTÜ 103 lines (cultivar candidate) developed within Sivas of Science and Technology University were used. The study was carried out in the summer crop growing season of 2022 with 4 replications according to the coincidence blocks experimental design to determine some agronomic characteristics in Sivas ecological conditions. In the study, days to flowering (day) (DF), plant height (cm) (PH), first pod height (cm) (FPH), number of pods per plant (piece) (NPP), biological yield (kg/da) (BY), number of days to physiological maturity (day) (NDPM), grain yield (kg/da) (GY), straw yield (kg/da) (SY), thousand kernel weight (g) (TKW) and harvest index (%) (HI) traits of grasspea varieties were investigated. While days to flowering, days to physiological maturity, and thousand-grain weight were found to be statistically significant, the other traits were not statistically significant. As a result of the study, the average DF was 49 days, PH 43.8 cm, FPH 12.26 cm, NPP 33.23 pieces, BY 324.82 kg/da, NDPM 112.6 days, GY 148.53 kg/da, SY 176.29 kg/da, TKW 149.72 g and HI 45.91%. As a result of the correlation analysis, it was determined that there was a positive and significant relationship between PH and NPP, DF and NDPM, GY and BY, SY and BY, GY and a negative and significant relationship between HI and BY, GY and SY.

Keywords: Fodder crops, *Lathyrus sativus*, Morphology, Adaptation

GİRİŞ

Protein oranı yüksek olması, bünyelerinde mineral ve vitamin içermeleri ve yetiştiriciliği yapılan alanları organik madde içeriğince zenginleştirmeleri gibi nedenlerden dolayı baklagil yem bitkileri hayvanların kaliteli beslenebilmesi amacıyla yaygın olarak kullanılan bir kaba yem kaynağıdır. Baklagiller (*Fabaceae*) familyası içerisinde birçok tek yıllık ve çok yıllık yem bitkisi bulunmakta olup, yem ve tohum verimi amacıyla yetiştirilen tek yıllık serin iklim bitkisi mürdümük bunlardan birisidir (Tekele-Haimanot ve ark., 1990). Mürdümük türlerinin taneleri ara sıra insan beslenmesi için kullanılmasının yanı sıra, daha çok hayvan beslenmesi amacıyla yetiştirilmektedir. Baklagiller zengin protein ihtiva ettikleri için tek başlarına silolanma güçlüğü oluşturmaktadır. Hayvanların yeterli ve dengeli beslenebilmesi için önemli bir husus olan enerji/protein dengesinin oluşturulabilmesi için ya tek başına silolanan yemlere katkı ilave edilerek ya da baklagillerle buğdaygillerin birlikte silolanması gerekmektedir (Seydoşoğlu ve Gelir, 2019). Tane, yeşil ve kuru ot olarak hayvanlar için, yemeklik tane baklagil ve sebze olarak ise insanların beslenmesi için yararlanılabilen bir baklagil bitkisi olan mürdümük (*Lathyrus sativus* L.), *Fabaceae* (*Leguminosea*) familyasının, 15 bölüme sahip, 187 taksonlu kalabalık bir cinse mensuptur (Allkin ve ark., 1983). Türkiye doğal florasında toplam 58 mürdümük türünün varlığı ve bunların 18'inin endemik olduğu belirlenmiştir (Davis, 1970). Dünya genelinde *Lathyrus* cinsine ait en fazla kültürü yapılan tür *L. sativus*'tur. Ot ve tohumları ile hayvan beslenmesinde *L. sativus*, *L. cicera* vb. gibi türler, süs bitkisi olarak ise *L. odoratus* ekonomik öneme sahiptir (Vaz Patto ve Rubiales, 2014). Mürdümük türlerine ait ilk belirtiler Hindistan bölgesinde M.Ö. 4000-3500 yılları arasına, Batı Asya bölgesinde ise M.Ö. 3800-3200 yılları arasına dayanmaktadır (Saraswat, 1980). Irak ve Türkiye'de gerçekleştirilen arkeolojik kazılar sonucu mürdümük tohumlarına rastlanılmıştır. Mürdümük Asya ülkeleri olan özellikle Pakistan, Çin, Bangladeş, Hindistan, Nepal vb. ülkelerde önemli bir ana ürün durumunda iken, Güney Avrupa (Fransa ve İspanya), Orta Doğu (Afganistan, Irak, İran, Suriye ve Lübnan) ve Afrika (Etyopya, Fas, Cezayir, Mısır ve Libya)'da daha az dağılım göstermektedir (Milczak ve ark., 2001).

Son yıllarda meydana gelen artan nüfus, küresel ısınmaya bağlı iklim değişikliği, kuraklığın belirtilerini göstermesi, doğal afet olaylarının sık görülmesi ile birlikte dünyada gıda ve gıda güvenliği sorunu bazı bölgelerde kritik bir hal almış durumdadır. Ortalama yıllık yağış miktarının 250 mm'ye kadar azaldığı bölgelerde yetiştirilebilen mürdümük bu özelliğiyle kuraklığa dayanıklılık gösteren kültür bitkilerinin ilk sıralarında yer almaktadır (Tekele-Haimanot ve ark., 1990). Ayrıca, mürdümük yıllık yağış miktarının yüksek olduğu

lokasyonlarda dahi yetiŖebilme özelliđine sahiptir. Mürdümük kuraklık, düşük sıcaklık ve tuzluluk (orta derecede) stresine dayanıklı olup, adaptasyon kabiliyeti yüksek bir bitkidir (Sönmez ve Türk, 2022). Kurak iklim bölgelerine adapte kabiliyetleri yüksek olan mürdümük aynı zamanda sel baskınlarına da toleranslı olan bir baklagil yem bitkisidir (Özdemir ve ark., 2022). Mürdümük farklı iklim ve toprak ve Ŗartlarına uyumlu olup, bu Ŗartlar içerisinde gübre verilmesine ve pestisit gibi kimyasal uygulamalara gerek duymadan iyi bir verim ortaya koyabilmesi nedeniyle sürdürülebilir tarım ve münavebe için de önemlidir. İlave olarak mürdümük canlı ve cansız stres etmenlerine karşı gösterdiđi başarı nedeniyle baklagil ıslahında oldukça önemli bir genetik kaynak olarak görülmektedir. TÜİK (2022) verilerine göre ülkemizde mürdümük (*L. sativus* L.) ekim alanı 83 140 dekar'dır. Ot üretim miktarı 55 208 ton, tane üretim miktarı ise 2 056 tondur. YeŖil ot verimi ortalama olarak 824.07 kg/da, tane verimi de 127.33 kg/da'dır. *Lathyrus* türlerine Türkiye'de birçok bölgede özellikle de baklagillerin en fazla yayılıŖ gösterdiđi Güneydođu ve Dođu Anadolu Bölgelerinde rastlanmaktadır. Türkiye'de en fazla mürdümük Balıkesir, Diyarbakır, Adıyaman, Elâzığ, Kütahya, KahramanmaraŖ, Tunceli ve UŖak illerinde yetiŖtirilmektedir (Özdemir ve ark., 2022). Ayrıca ülkemiz içerisinde bazı bölgelerde ve az bir miktarda *Lathyrus* türlerinden sadece *L. sativus* ve *L. cicera*'nın tarımı yapılmaktadır (Genç ve Ŗahin, 2001).

Bu araŖtırma, mürdümük çeŖidi olan GAP mavisi ve Gürbüz 2001'in, Sivas Bilim ve Teknoloji Üniversitesi kapsamında geliŖtirilen tescile sunulacak olan SBTÜ 101, SBTÜ 102 ve SBTÜ 103 hatlarının (çeŖit adayı) çiçeklenme gün sayısı, bitki boyu, ilk bakla yüksekliđi, bitki başına bakla sayısı, biyolojik verim, fizyolojik olum gün sayısı, tane verimi, kes verimi, bin tane ađırlıđı, hasat indeksi gibi agro-morfolojik özellikleri belirlenerek Sivas ekolojik koŖullara uyum sađlayabilecek çeŖit veya çeŖit adayı hatların tespit edilmesi amacıyla yapılmıŖtır.

MATERYAL VE METOT

ÇalıŖma Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri Teknoloji Fakültesi, Tarımsal AR-GE Merkezinde 2022 yılı yetiŖtirme sezonunda yürütölmüŖtür. Deneme alanı rakımı 1285 m olup, N39,720656-E36,917248 konumunda yer almaktadır. Denemenin yürütöldüđu 2022 yılı yetiŖtirme sezonuna ait iklim verileri Çizelge 1'de verilmiŖtir. Sivas ili iklim özelliđi kışları sođuk ve karlı, yazları ise sıcak ve kurak geçmektedir. Mürdümük vejetasyon süreci boyunca sıcaklık nisan ayında-4.2 (°C)'de minimum, ađustosta ise 23.7 (°C)'de maksimum deđer göstermiŖtir. Nisan-ađustos vejetasyon ayları arasındaki toplam yađıŖ 137.9 mm ile uzun dönem ortalamasının (133.5 mm) üzerinde seyretmiŖtir. Aylara göre ortalama bađıl nem deđerleri %44.5-55.8 arasında deđiŖmiŖ ve uzun dönem ortalamasının (%51.6) altında kalmıŖtır.

Çizelge 1. Sivas ilinin deneme yılı ve uzun yıllar ortalamasına ait bazı iklim verileri*

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Ay	Yağış (mm)		Sıcaklık (°C)				Nispi Nem (%)			
	2022	UYO	Min.	Max.	2022	UYO	Min.	Max.	2022	UYO
Nisan	4.3	23.2	-4.2	12.2	12.2	11.1	7.0	92.0	44.5	50.0
Mayıs	5.6	18,9	0.8	12.5	12.5	13.9	10.0	91.0	53.1	53.8
Haziran	116.6	77.7	9.8	18.8	18.8	18.6	7.0	93.0	55.8	55.2
Temmuz	0.0	4.6	7.2	19.1	19.1	20.3	5.0	85.0	51.9	50.5
Ağustos	11.4	9.1	13.4	23.7	23.7	22.3	10.0	99.0	47.5	48.4
Top./Ort.	137.9	133.5			86.3	86.2			50.56	51.6

* Tarım ve Orman Bakanlığı Meteoroloji Genel Müdürlüğü UYO: Uzun Yıllar Ortalaması

Çizelge 2. Denemenin alanı toprağının fiziksel ve kimyasal özellikleri

Derinlik	Yapı	pH	Kireç (%CaCO ₃)	Salinity (%)	P ₂ O ₅ (kg/da)	K ₂ O (kg/da)	Organik madde (%)
0-30 cm	Siltli killi tınlı	7.28	19.6	0.33	3.40	93.59	1.7

Çalışma alanının toprağı siltli-killi-tınlı tesktür yapısına sahip olup, pH değeri 7.28'dir. Kireç (%19.6), potasyum içeriği yüksek (93.59 kg/da), fosfor (3.40 kg/da), tuz (0.33 mmhos/cm) ve organik madde (%1.7) içeriği ise düşüktür (Çizelge 2). Deneme alanının drenajı yapısı iyi ve taban suyu problemi bulunmamaktadır. Araştırmada, GAP mavisini ve Gürbüz 2001 çeşidi ve SBTÜ 101, SBTÜ 102 ve SBTÜ 103 hattı olmak üzere 5 adet mürdümük genotipi deneme materyali olarak kullanılmıştır. Ekimde her bir parsel 5 m uzunluğunda ve sıra arası 25 cm olacak şekilde 12 sıradan oluşmuştur. Ekimden önce taban gübresi olarak dekara 4 kg N (azot) ile 10 kg P₂O₅ (fosfor) olacak şekilde gübreleme gerçekleştirilmiştir. Deneme parselinde mürdümük yetiştirme süresi boyunca yabancı ot mücadelesi elle ve çapa yardımı ile yapılmıştır. Araştırmada, çiçeklenme gün sayısı, bitki boyu, ilk bakla yüksekliği, bitki başına bakla sayısı, biyolojik verim, fizyolojik olum gün sayısı, tane verimi, kes verimi, bin tane ağırlığı, hasat indeksi gibi agro-morfolojik özellikler incelenmiştir. Elde edilen sonuçlar SAS 9.3 istatistik paket programı kullanılarak varyans analizine tabi tutulmuştur (SAS, 2013).

BULGULAR VE TARTIŞMA

Denemede materyal olarak kullanılan GAP mavisini, Gürbüz 2001, SBTÜ 101, SBTÜ 102, SBTÜ 103 genotiplerine ait çiçeklenme gün sayısı, bitki boyu, ilk bakla yüksekliği, bitki başına bakla sayısı, biyolojik verim, fizyolojik olum gün sayısı, tane verimi, kes verimi, bin tane ağırlığı, hasat indeksi Çizelge 3'de, özellikler arasında genotipik düzeyde korelasyon katsayılarının tahmin değerleri Çizelge 4'de verilmiştir.

Mürdümük genotiplerinin Sivas ekolojik koşullarına uyumu çalışması kapsamında çiçeklenme gün sayısı, fizyolojik olum gün sayısı ve bin tane ağırlığı interaksyonu bakımından çeşitler arasında önemli bir varyasyon olduğu tespit edilmiştir (P<0.01). Çiçeklenme gün sayısı bakımından sırasıyla Gürbüz 2001 (47.3 gün), SBTÜ 102 (47.8 gün), SBTÜ 103 (49.3 gün), SBTÜ 101 (50.0 gün), GAP mavisini (50.8 gün); fizyolojik olum gün sayısı bakımından sırasıyla

Gürbüz 2001 (111.5 gün), SBTÜ 102 (112.0 gün), GAP mavisi (113.0 gün), SBTÜ 103 (113.5 gün), SBTÜ 101 (114.3 gün); bin tane ağırlığı bakımından sırasıyla GAP mavisi (155.6 g), SBTÜ 102 (155.2 g), SBTÜ 101 (148.9 g), SBTÜ 103 (146.6 g), Gürbüz 2001 (142.4 g) en yüksek değerlere sahip genotiplerdir. Çiçeklenme ve fizyolojik olum gün sayısı bakımında erkencilik açısından Gürbüz 2001 çeşidi ve SBTÜ 102 hattı ön plana çıkmaktadır. Çiçeklenme ve fizyolojik olum gün sayısı ve bin tane ağırlığı göz önüne alındığında, çeşit adayı hat SBTÜ 102 üstün özellik göstermektedir. Küresel ısınmaya bağlı olarak iklimsel olayların değişikliğiyle hastalık ve zararlı etmenler göz önünde de bulundurulduğunda, Sivas ekolojik koşullarında erkencilik sağlanması düşünüldüğünde çiçeklenme gün sayısı ile fizyolojik olum gün sayısı ve bin tane ağırlığı açısından Gürbüz 2001 çeşidi ve SBTÜ 102 hattı uygun görülmektedir. Bitki boyu, ilk bakla yüksekliği, bitki başına bakla sayısı, biyolojik verim, tane verimi, kes verimi ve hasat indeksi istatistiki olarak önem arz etmediği görülmektedir. Her ne kadar çeşit ve çeşit adayı hatlar arasında tane verimi ve kes verimi açısından istatistiki olarak bir fark olmasa da GAP mavisi çeşidi ve SBTÜ 102 çeşit adayı hattın bin tane ağırlığı bakımından istatistiki olarak diğer çeşit veya çeşit adayı hatlara göre üstün olduğu tespit edilmiş olup, Sivas ekolojisinde GAP mavisi ve SBTÜ 102 genotiplerinin yetiştirilebileceği kanısına varılmıştır.

Çizelge 3. Mürdümük çeşitlerine ait ortalama değerler

Genotip	ÇGS (gün)	BB (cm)	İBY (cm)	BBBS (adet)	BV (kg/da)	FOS (gün)	TV (kg/da)	KV (kg/da)	BinTA (gr)	Hİ (%)
GAP mavisi	50.8 ^a	42.7	11.6	36.7	331.0	113.0 ^{a-c}	152.3	178.7	155.6 ^a	46.1
Gürbüz 2001	47.3 ^c	42.8	13.9	26.2	312.5	111.5 ^c	145.0	167.5	142.4 ^c	46.4
SBTÜ 101	50.0 ^a	42.5	12.2	27.1	330.8	114.3 ^a	150.2	180.6	148.9 ^b	45.8
SBTÜ 102	47.8 ^{bc}	48.1	13.2	37.8	337.8	112.0 ^{bc}	151.3	186.5	155.2 ^a	45.1
SBTÜ 103	49.3 ^{ab}	43.0	10.6	38.4	312.0	113.5 ^{ab}	143.8	168.1	146.6 ^b	46.2
ÖD	**	NS	NS	NS	NS	**	NS	NS	**	NS
CV	1.42	18.63	15.51	29.48	15.12	1.53	11.72	18.08	0.70	3.75

ÇGS: Çiçeklenme gün sayısı, BB: Bitki boyu, İBY: İlk bakla yüksekliği, BBBS: Bitki başına bakla sayısı, BV: Biyolojik verim, FOS: Fizyolojik olum gün sayısı, TV: Tane verimi, KV: Kes verimi, BinTA: Bin tane ağırlığı, Hİ: Hasat indeksi, ÖD: Önem düzeyi, NS: Önemli değil, **: 0.01 düzeyinde önemli

Çalışma sonucunda incelenen genotiplerin ortalama çiçeklenme gün sayısı 49 gün, bitki boyu 43.8 cm, ilk bakla yüksekliği 12.26 cm, bitki başına bakla sayısı 33.23 adet, biyolojik verim 324.82 kg/da, fizyolojik olum gün sayısı 112.6 gün, tane verimi 148.53 kg/da, kes verimi 176.29 kg/da, bin tane ağırlığı 149.72 g ve hasat indeksi ise %45.91 olarak saptanmıştır. Çizelge 2’de genotiplerin morfolojik özellikleri arasındaki korelasyon görülmektedir. Mürdümük değişkenler arasındaki korelasyon analizinde ÇGS’nin, FOS ile arasında pozitif; BB’nin, BBBS

ile pozitif; BV'in, TV ve KV ile pozitif Hİ ile negatif; TV'in, KV ile pozitif Hİ ile negatif; KV'nin ise Hİ ile negatif anlamlı ilişkileri bulunmaktadır.

Çizelge 4. Mürdümük genotipleri arasında özelliklerin genotipik düzeyde korelasyon katsayıları

	ÇGS	BB	İBY	BBBS	BV	FOGS	TV	KV	BinTA	Hİ
ÇGS	1.0000	-0.0009	-0.3490	0.1524	0.0394	0.7782	0.0705	0.0225	0.3598	0.0620
BB		1.0000	0.3830	0.6123	0.3567	-0.0920	0.3416	0.3618	0.0535	-0.3222
İBY			1.0000	-0.0233	0.3485	-0.3977	0.3467	0.3467	-0.0818	-0.3119
BBBS				1.0000	0.2575	0.0545	0.2616	0.2532	0.2347	-0.1970
BV					1.0000	0.0842	0.9900	0.9972	0.2076	-0.9209
FOS						1.0000	-0.2358	-0.2378	0.1039	0.2622
TV							1.0000	0.9766	0.1951	-0.8617
KV								1.0000	0.2126	-0.9450
BinTA									1.0000	-0.1959
Hİ										1.0000

ÇGS: Çiçeklenme gün sayısı, BB: Bitki boyu, İBY: İlk bakla yüksekliği, BBBS: Bitki başına bakla sayısı, BV: Biyolojik verim, FOS: Fizyolojik olum gün sayısı, TV: Tane verimi, KV: Kes verimi, BinTA: Bin tane ağırlığı, Hİ: Hasat indeksi, **: 0.01 düzeyinde önemli

Sönmez ve Türk (2022), 2020-2021 yetiştirme sezonunda Isparta ekolojik koşullarında bazı mürdümük genotiplerinin bazı agronomik özelliklerinin ve tohum veriminin belirlenmesi amacıyla, 120 adet genotipi ve 4 adet (İptaş, Gürbüz, Corea ve Karadağ) çeşidi bitki materyali olarak kullanmışlardır. Araştırma kapsamında bitkide bakla sayısı, bitki boyu, bakla eni, bakla boyu, 1000 tane ağırlığı, baklada tane sayısı, biyolojik ve tohum verimi incelenen özellikler bakımından genotipler arasında istatistiki olarak önemli anlamda farklılıklar olduğunu bildirmişlerdir. Araştırma sonuçlarına göre; genotip bitki boyları 14.48-76.80 cm, bakla boyu 2.10-4.10 cm, bitki bakla sayısı 2.81-62.00 adet, baklada tane sayısı 1.23-4.32 adet, bakla eni 0.71-1.40 cm, biyolojik verim 3.06-82.40 g/bitki, 1000 tane ağırlığı 41.69-238.00 g, tohum verimi ise 0.34-33.00 g/bitki arasında değişmiş ve Isparta ili toprak ve iklim koşullarında GP18, GP40, GP145 ve GP161 mürdümük genotiplerinin diğerine göre daha üstün olduğu tespit edilmiştir. Özdemir ve ark. (2022), 2014 ve 2015 yıllarında ilkbahar ekimlerinde bazı mürdümük genotiplerinin kes kalitelerinin belirlenmesi amacıyla 31 adet mürdümük genotipi kullanmışlardır. İki yıllık yapılan çalışmada incelenen tüm özellikler açısından genotipler arasında istatistiki olarak çok önemli düzeyde farklılıklar tespit edilmiştir. Tohum amacıyla hasat edilen mürdümük genotiplerinin keslerine ait ham kül oranı, ham protein oranı ve verimi, nötral deterjan lif (NDF), asit deterjan lif (ADF), kuru madde tüketimi (KMT) ve sindirilebilir kuru madde (SKM) oranları, nispi yem değeri (NYD), sindirilebilir enerji (SE) ve metabolik enerji (ME) değerleri sırasıyla %7.12-9.52, %4.71-7.36, 6.03-11.9 kg/da, %50.53-62.66, %39.73-47.42, %1.92-2.38, %51.96-57.95, 77.46-106.47, 2.49-2.75 Mcal/kg ve 2.05-2.26

Mcal/kg arasında deęişim göstermiştir. Eren ve Biflorus mürdümük genotiplerinin daha üstün özellik göstermiş olduęu tespit edilmiş olup, Elâzığ İli ve benzer ekolojik koşullarda kes kalitesi amacıyla yetiştiricilięinin yapılması önerilmiştir. Türkoęlu ve ark. (2021), Orta Anadolu ekolojik koşullarına adaptasyon kabiliyeti ve verim performansının belirlenmesi amacıyla 2018 yılında Kahramanmaraş (Elbistan) mürdümük (*Lathyrus sativus* L.) popülasyonunu Tarla bitkileri Merkez Araştırma Enstitüsünün Ankara-Gölbaşı-İkizce istasyonunda yürüttükleri çalışmada bitkinin morfolojik, fenolojik ve tarımsal özelliklerini incelemiştir. Bir bitkide incelenen morfolojik özelliklerden ana sap kalınlığı, sap sayısı, ana sap uzunluęu ve doęal bitki boyunu sırayla 1.43 mm, 2.66 adet, 33.86 cm ve 27.58 cm olarak bulmuşlardır. Tarımsal özelliklerden bitkideki bakla sayısı, bakladaki tohum sayısı, yeşil ot verimi, biyolojik verim, tane verimi, kes verimi, hasat indeksi sırayla 13.82 adet, 2.85 adet, 7.41 g/bitki, 12.01 g/bitki, 5.13 g/bitki, 6.54 g/bitki, %43.66 olarak tespit edilmiş olup, çalışma sonuçlarına göre Elbistan popülasyonlarının Orta Anadolu ekolojik koşullarına uyum sağladığı ve verim performansının da iyi olduğunu bildirilmiştir. Özdemir ve ark. (2020), Elâzığ ekolojik koşullarında 2014-2015 yıllarında yazlık ekimi yapılan mürdümük genotiplerinde biyolojik verim, tane verimi, dolu bakla sayısı, boş bakla sayısı, bakla boyu, bakla genişliği, bitkide tane sayısı, bitkide tane aęırlığı gibi agro-morfolojik özellikleri incelemiştir. İki yıllık çalışmada her iki yılda da biyolojik verim dışında incelenen dięer tüm özellikler bakımından genotipler arasında istatistiki anlamda önemli fark mevcuttur. Araştırma sonucunda genotiplerin tane verimi 75.10-117.72 kg/da, biyolojik verimi 188.72-271.18 kg/da, boş bakla sayısı 0.06-1 adet, dolu bakla sayısı 7.16-16.15 adet, bakla genişliği 0.83-1.23 cm, bakla boyu 2.78-3.45 cm, bitkide tane sayısı 16.73-45.08 adet ve bitkide tane aęırlığı 2.03-4.23 g arasındadır. Sonuçlara göre Elâzığ ili toprak ve iklim koşullarında tohum üretimi için “Hat-17” genotipinin dięerlerine göre verim bakımından üstün olduęu tespit edilmiştir. Özyazıcı ve Açıkbaş (2019), 2016-2017 yıllarında 22 yaygın mürdümük (*Lathyrus sativus* L.) genotipleri ve 2 adet tescilli çeşit kullanarak Siirt Üniversitesi Ziraat Fakültesi, Araştırma ve Uygulama Arazisinde yarı kurak iklimine sahip olan Güneydoęu Anadolu Bölgesi koşullarında yetiştirilebilmesi amacıyla bazı agronomik parametreleri ile tohum ve ot verimlerini belirlemiştir. Deneme parsellerin yarısı ot, dięer yarısı da tohum verimine ait özelliklerin belirlemek için ikiye ayrılmıştır. Tohum verim özellikleri kapsamında ana sap uzunluęu, doęal bitki boyu, kuru ot verimi, ana sap sayısı, bitkide bakla sayısı, yeşil ot verimi, tohum verimi, biyolojik verim, baklada tane sayısı, bin tane aęırlığı ve hasat indeksi verileri alınmıştır. Araştırma sonucuna göre, doęal bitki boyunun 38.35-44.87 cm, ana sap sayısının 3.20-4.70 adet/bitki, ana sap uzunluęunun 55.25-61.82 cm, kuru ot veriminin 331.1-448.4 kg/da, yeşil ot veriminin 1348.1-1890.4 kg/da, baklada tane

sayısının 2.0-3.1 adet, bitkide bakla sayısının 11.3-17.7 adet, bin tane ağırlığının 79.36-125.87 g, biyolojik verimin 444.8-707.5 kg/da, tohum veriminin 101.3-194.5 kg/da ve hasat indeksinin % 18.3-36.4 arasında değiştiğini tespit etmişler ve ot üretimi için ETH WIR-70 ile IFLS 257, tohum üretimi için ise Sel 1794 genotiplerinin Güneydoğu Anadolu Bölgesi koşullarına uygun olacağını bildirmişlerdir.

SONUÇ VE ÖNERİLER

Bu araştırmada mürdümük çeşidi olan GAP mavisi ve Gürbüz 2001'in, Sivas Bilim ve Teknoloji Üniversitesi kapsamında geliştirilen tescile sunulacak olan SBTÜ 101, SBTÜ 102 ve SBTÜ 103 hatlarının (çeşit adayı) agro-morfolojik özellikleri bakımından Sivas ekolojik koşullarına uyum sağlayabilecek çeşit veya çeşit adayı hatların tespit edilmesi amacıyla yapılmış çalışmada, incelenen genotipler içerisinde ümitvar olanlar bulunmaktadır. Sivas ekolojik koşullarında güneşlenme gün sayısı ve güneş ışığı geliş açısı düşüklüğüyle vejetasyon süresinin kısa olması nedeniyle erkenci çeşitlerin tercih edilme olasılığı artmaktadır. Küresel ısınmaya bağlı olarak iklimsel olayların değişikliğiyle hastalık ve zararlı etmenler göz önünde de bulundurulduğunda Sivas İli ve benzer ekolojik koşullarında erkencilik sağlanması düşünüldüğünde çiçeklenme gün sayısı ile fizyolojik olum gün sayısı ve bin tane ağırlığı açısından Gürbüz 2001 çeşidi ve SBTÜ 102 hattı ön plana çıkmaktadır. Çiçeklenme ve fizyolojik olum gün sayısı ve bin tane ağırlığı göz önüne alındığında SBTÜ 102 hattı üstün özellik göstermektedir. Bitki boyu, ilk bakla yüksekliği, bitki başına bakla sayısı, biyolojik verim, tane verimi, kes verimi ve hasat indeksi istatistiki olarak önem arz etmediği görülmektedir. Her ne kadar çeşit ve hatlar arasında tane verimi ve kes verimi açısından istatistiki olarak bir fark olmasa da GAP mavisi çeşidi ve SBTÜ 102 hattın bin tane ağırlığı bakımından istatistiki olarak diğer çeşit veya çeşit adayı hatlara göre üstün olduğu tespit edilmiş olup, Sivas ekolojisinde GAP mavisi ve SBTÜ 102'in yetiştirilebileceği kanısına varılmıştır. Verim ve verim özellikleri bakımından Gölyazı çeşidi Sivas ekolojik koşullarına uygun olduğu belirlenmiştir. Genotipler karşılaştırıldığında, Sivas ili iklim ve toprak koşullarında SBTÜ 102 hattı mürdümük genotipinin diğer genotiplere göre üstün olduğu belirlenmiştir. İslah materyali olarak diğer çalışmalarda da kullanılmasının uygun olduğu sonucuna varılmış ve bu açıdan da tohumluk için önemli ıslah materyalleri olabileceği düşünülmektedir. Böylece, Sivas İli ve benzer ekolojik koşullar için üretimi yaygın olmayan alanlarda mürdümük bitkisinin bölge tarım ve ekonomisine kazandırılmasıyla geniş alanlarda üretiminin yapılmasına katkı sağlanacağı düşünülmektedir. Yapılan çalışmalar kapsamında öne çıkan veya ümitvar söz konusu olan genotiplerin tarla deneme çalışmalarının sürdürülmesinin uygun olacağı ve bölge ekolojik koşullara uygun yeni çeşitlerin geliştirebileceği öngörülmektedir.

KAYNAKLAR

- Allkin, R., Macfarlane, T.D., White, R.J., Bisby T.A., Adey, M.E. (1983). Names and Synonyms of Species and Subspecies in The Viciae Issue, Viciae. Database Project, 2 (2).
- Davis, P.H. (1970). Flora of Turkey and East Aegean Islands. Edinburgh, Scotland, Edinburgh University Press.
- Genç, H., Şahin, A., (2001). Batı Akdeniz ve Güney Ege Bölgesinde yetişen bazı *Lathyrus* L. türleri üzerinde sitotaksonomik araştırmalar. Süleyman Demirel Üniversitesi Fen Bilimleri Dergisi, (5):1, 98-112.
- Milczak, M., Pedzinski, M., Mnichowska, H., Szwed-Urbas, K., Rybinski, W. (2001). Creative breeding of grasspea (*Lathyrus sativus* L.) in Poland. *Lathyrus* Lathyrism Newsletter, 2 (2): 85-88.
- Özdemir, S., Kökten, K., Kaplan, M., Uçar, R. (2020). Elâzığ koşullarında bazı mürdümük (*Lathyrus sativus* L.) genotiplerinin tohum verimi ve tohum verimini etkileyen bazı özelliklerinin belirlenmesi. Türk Tarım ve Doğa Bilimleri Dergisi, 7 (2): 445-452
- Özdemir, S., Kökten, K., Uçar, R., Kaplan, M. (2022). Bazı mürdümük (*Lathyrus sativus* L.) genotiplerinin kes kalitelerinin belirlenmesi. Türk Tarım ve Doğa Bilimleri Dergisi, 9 (2): 295-307.
- Özyazıcı, M.A., Açıkbay, S. (2019). Yaygın mürdümük (*Lathyrus sativus* L.) genotiplerinin yarı kurak iklim koşullarında bazı tarımsal özellikleri ile verim performanslarının belirlenmesi. Avrupa Bilim ve Teknoloji Dergisi, (17): 1058-1068.
- Saraswat, K.S. (1980). The ancient remains of the crop plants at Atranjikhhera.
- SAS9.3 (2013) SAS/STAT, SAS Institute Incorporation, Cary, NC, USA.
- Seydoşoğlu, S., Gelir, G. (2019). Farklı oranlarda karıştırılan mürdümük (*Lathrus sativus* L.) ve arpa (*Hordeum vulgare* L.) hâsıllarının silaj özellikleri üzerinde bir araştırma. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 9 (1): 397-406.
- Sönmez, T.A., Türk, M. (2022). Isparta koşullarında bazı mürdümük (*Lathyrus sativus* L.) genotiplerinin tohum verimi ve bazı agronomik özelliklerinin belirlenmesi. Türk Bilim ve Mühendislik Dergisi, 4 (2): 88-93.
- Tekele-Haimanot, R., Kidane, Y., Wuhib, E., Kalissa, A., Alemu, T., Zein, Z.A., Spencer, P.S. (1990). *Lathyrism* in rural Northwestern Ethiopia: a highly prevalent neurotoxic disorder. Int. J. Epidemiol., 19: 664-672.
- TÜİK (2022). Tarımsal Ürünler İstatistiği, İstatistiklerle Türkiye. Türkiye İstatistik Kurumu
- Türkoğlu, M.İ., Ünal, S., Efe, B., Mintaş, H. (2021). Orta Anadolu şartlarında Kahramanmaraş Elbistan mürdümük (*Lathyrus sativus* L.) popülasyonunda morfolojik, fenolojik ve tarımsal özelliklerin belirlenmesi. MAS Journal of Applied Sciences, 6 (4): 997-1008.
- Vaz Pato, M.C., Rubiales, D. (2014). *Lathyrus* diversity: available resources with relevance to crop improvement *L. sativus* and *L. cicera* as case studies. Annals of Botany, 113 (6): 895-908.

**TÜRKİYE'DE YETİŞEN SARIMSAK GENOTİPLERİNİN SÜRGÜN UCU
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ÖZET

Alliaceae familyasına ait olan sarımsak (*Allium sativum* L.) ÷lkemizde ve dñnyada yetiřtiricilięi yapılan önemli bir sebze türüdür. Sarımsaęın besin deęeri aısından zengin, iřtah aıcı ve bir ok hastalıęa karřı koruyucu özellięi bulunmaktadır. Sarımsak yetiřtiricilięi bařı oluřturan diřlerle vejetatif olarak yapılmaktadır. Buna göre bu alıřmada, farklı genotiplerdeki sarımsakların sürgün ucu alınarak *in vitro* kořullar altında oęaltılması hedeflenmiřtir. alıřma Sivas Bilim ve Teknoloji Üniversitesi Tarım Bilimleri ve Teknoloji Fakóltesine ait bitki doku kùltürü laboratuvarında yürütölmüřtür. Arařtırma kapsamında ÷lkemizde yaygın olarak yetiřtiricilięi yapılan Tařköprü sarımsaęı ile Alata sarımsaęı, Kırklareli ve Kilis illerinden toplanan yerel sarımsaklar kullanılmıřtır. Denemede bařlangı ortamı olarak, MS (Murashige ve Skoog 1962) + 30 g Őeker + 7 g Agar, kardeřlendirme ařamasında, Baktemur ve ark. (2010)'na göre, MS + 30 g Őeker + 2 mg/l BAP + 0.5 mg/l IBA + 7 g Agar, köklendirme ařamasında MS + 30 g Őeker + 1 mg/l IBA + 7 g Agar ieren besin ortamları kullanılmıřtır. Arařtırma süresince enfeksiyon oranları (%), bařlangı ortamında geliřen bitki sayılarının oranı (%), kardeř sayıları (adet), kök sayıları (adet), köklenme oranları (%) ve kök uzunlukları (mm) belirlenmiřtir. Arařtırma sonuçlarına göre bařlangı ortamında en fazla geliřim Alata sarımsaęı (%95.00) ve Kırklareli'den toplanan (%94.00) sarımsaklardan elde edilmiřtir. Kök sayısı bakımından en fazla Kilis'den toplanan (8.00 adet) sarımsaklar ile Tařköprü sarımsaęından (6.40 adet) elde edilmiřtir.

Anahtar Kelimeler: *In vitro*, sürgün ucu, sarımsak

PROPAGATION OF GARLIC GENOTYPES GROWN IN TURKEY BY SHOOT TIP CULTURE

ABSTRACT

Garlic (*Allium sativum* L.), which belongs to the Alliaceae family, is an important vegetable species grown in our country and in the world. Garlic is rich in nutritional value, appetizing and has a protective feature against many diseases. Garlic cultivation is done by vegetative methods with the clove forming the head. Accordingly, the experiment was carried out in the form of shoot tip culture in different genotypes *in vitro*. The study was carried out in the Plant Tissue Culture Laboratory of Sivas Science and Technology University, Faculty of Agricultural Sciences and Technology. Within the scope of the research, Taşköprü garlic, which is widely grown in our country, and Alata garlic, local garlic collected from Kırklareli and Kilis provinces were used. MS (Murashige and Skoog 1962) + 30 g Sugar + 7 g Agar was used as the starting medium, shoot proliferation phase, Baktemur et al. According to (2010), nutrient media containing MS + 30 g Sugar + 2 mg/l BAP + 0.5 mg/l IBA + 7 g Agar, for rooting MS + 30 g Sugar + 1 mg/l IBA + 7 g Agar were used. During the research, infection rates (%), number of plants growing in the starting medium (%), number of siblings (number), root number (number), rooting rate (%) and root length (mm) were determined. According to the results of the research, the highest growth in the starting medium was obtained from the garlic of Alata (95.00%) and the garlic collected from Kırklareli (94.00%). In terms of root number, the highest number of garlics collected from Kilis (8.00 number) and Taşköprü garlic (6.40 number) were obtained.

Keywords: *In vitro*, shoot tip, garlic

Giriş

Sarımsak (*Allium sativum* L.), Alliaceae familyasına ait olup, Akdeniz bölgelerine yayıldığı Orta Asya kökenli (Tindal, 1986), dünyada ve ülkemizde yetiştiriciliği yapılan soğanlı bitkilerden birisidir. Sarımsak (*Allium sativum* L.), besleyici, antimikrobiyal ve antioksidan özellikleri nedeniyle eski çağlardan beri geleneksel tıpta kullanılan en önemli türlerinden birisidir (Hirata 2016; Reiter2017). Dünya genelinde taze ve kuru olarak sarımsak, iki şekilde üretilmektedir. Yeşil yapraklı, gövde ve baş yüzeyinin taze olması ve dişlerin tam olgunlaşmadığı dönemde hasat edilmesi sebebiyle taze sarımsak veya yeşil sarımsak olarak adlandırılmaktadır. Hasat sonrası doğal küreme yapılarak yaprak, gövde ve başların tamamen kurduğu ürünlere ise kuru sarımsak denir (Akan ve ark., 2019a; Anonymous, 2019). Sarımsak vejetatif olarak çoğaltılan bir türdür. Vejetatif yöntemlerden biri olan doku kültürü çalışmaları sarımsak bitkisinde son zamanlarda hız kazanmıştır. Doku kültürü, hücre, doku, organ veya bütün bitki gibi bitki parçalarından besin ortamında steril koşullar altında yeni doku, bitki veya bitki üretimleri olarak tanımlanabilir. Ayrıca doku kültürü bitkilerin çoğaltılması zor olan veya çözümü uzun zaman/emek gerektiren sorunları klasik tekniklerle çözmeyi amaçlamıştır. Bu çalışmada ülkemizde yaygın olarak yetiştiriciliği yapılan Taşköprü sarımsağı ile birlikte Alata sarımsağı, Kırklareli ve Kilis illerinden toplanan yerel sarımsakların *in vitro* koşullar altında sürgün ucu kültürü ile çoğaltılması hedeflenmiştir.

Materyal ve Metot

Materyal

Bu çalışma Sivas Bilim ve Teknoloji Üniversitesi Tarım Bilimleri ve Teknoloji Fakültesine ait bitki doku kültürü laboratuvarında yürütülmüştür. Araştırmada Taşköprü Sarımsağı, Alata Sarımsağı, Kırklareli ve Kilis illerinden toplanan yerel sarımsaklar materyal olarak kullanılmıştır. Deneme de kullanılan Alata Sarımsağı, Kırklareli ve Kilis illerinden toplanan yerel sarımsaklar Alata Bahçe Kültürleri Araştırma Enstitüsü Müdürlüğünden temin edilmiştir.

Metot

Deneme kapsamında başlangıç ortamı olarak MS (Murashige ve Skoog 1962) besin ortamı kullanılmıştır. Besin ortamında karbon kaynağı olarak sakkaroz, katılaştırmak için agar ilave edilmiştir. Ortam pH'ı 5.8 olacak şekilde ayarlanarak kaynatmaya bırakılmıştır. Kaynayan ortam belli oranlarda kavanozlara dökülerek, sterilizasyon amaçlı 121°C sıcaklıkta 1.2 atmosfer basınçta 15 dakika süre ile otoklavda bekletilmiştir. Otoklav sonrası ortamlar soğuyup katılaşması beklenilmiştir. Sarımsak dişleri %25' lik sodyum hipoklorit çözeltisinde 20 dakika bekletilmiştir. Süre sonunda steril saf su ile 4-5 defa çalkalanarak materyaller steril hale

getirilmiştir. Sterilize edilen sarımsak dişleri steril pens ve bistüri yardımı ile steril kabin içerisinde daha önce hazırlanan MS (Murashige ve Skoog 1962) besin ortamına dikilerek bitki büyütme odasında belirli ışık ve sıcaklıktaki $25 \pm 2^{\circ}\text{C}$ sıcaklık 3.000 lüks' lük ışık altında 16 saat aydınlık 8 saat karanlık periyotta bekletilmiştir.

Sürgünlerin gelişimi ile birlikte bitkiciklerin kardeşlenmesi için Baktemur ve ark. (2010)'na göre MS + 30 g Şeker 2 mg/l BAP + 0.5 mg/l IBA + 7 g Agar içeren besin ortamına aktarılmıştır. Kardeşlendirme ortamında bitkiler 3-4 hafta tutularak 2 alt kültür gerçekleştirilmiştir. Bitkiciklerin kardeşlenmesi ile birlikte MS + + 30 g Şeker 1 mg/l IBA + 7 g Agar içeren köklendirme ortamına alınmıştır.

Araştırmada; başlangıç ortamında gelişen bitki sayılarının oranı (%), enfeksiyon oranı (%), kardeş sayısı (adet), kök sayısı (adet), köklenme oranı (%), kök uzunluğu (mm) belirlenmiştir.

İstatistik Analiz

Çalışma 4 tekerrür ve her tekerrürde 5 kavanoz olacak şekilde, tesadüf parselleri deneme desenine göre kurulmuştur. Araştırmada elde edilen verilere varyans analizleri gerçekleştirilmiş ve önemli çıkan ortalamalar arasındaki farklılıklar LSD testi ile belirlenerek harflendirme yapılmıştır. İstatistik analizlerinde JMP 8.01 programı kullanılmıştır.

Bulgular ve Tartışma

Farklı sarımsak genotiplerinin başlangıç ortamında gelişimi Çizelge 1'de verilmiştir. Çizelgeye göre en fazla gelişim Alata sarımsağı (%95.00) ve Kırklareli (%94.00) ilinden toplanan sarımsakta gözlenirken, en az gelişim ise Taşköprü (%72.00) sarımsağında saptanmıştır.

Çizelge 1. Farklı sarımsak genotiplerinin başlangıç ortamı gelişen bitki sayısı (%)

Genotipler	Başlangıç Ortamı (%)
Taşköprü	72.00c
Alata	95.00a
Kırklareli	94.00a
Kilis	85.00b
LSD	1.88***

Çizelge 2'de farklı sarımsak genotiplerinin iki alt kültürdeki kardeş sayıları (adet) belirlenmiştir. Çalışma boyunca yapılan alt kültürler istatistiksel olarak önemli bulunmuştur. Birinci alt kültürde en fazla kardeş sayısı Alata (6.83 adet) sarımsağında elde edilmiştir. Bu genotipi Taşköprü (3.70 adet) sarımsağı izlemiştir. İkinci alt kültürde kardeşlenme sayıları incelendiğinde en fazla gelişim sırasıyla Alata (3.78 adet) ve Taşköprü (3.00 adet) sarımsağında görülmüştür. En az gelişim ise Kilis sarımsağında tespit edilmiştir.

Humberto ve ark. (2004), sarımsakta (*A. sativum*) 5 çeşitle sürgün ucu kültürü yöntemiyle farklı büyüme düzenleyicilerin kombinasyonlarını denedikleri çalışmada, kardeşlenme oranı en yüksek %89 ile NAA (0.1 mg/l) + kinetin (0.1 mg/l) bulunan besin ortamında elde edildiğini bildirmişlerdir. Baktemur ve ark. (2010) üç farklı sarımsak tipinin sürgün ucu kültürü ile çoğaltılmasını hedefledikleri çalışmada, en fazla kardeşlenmenin 14.10 bitki ile *Allium tuncelianum*'da olduğunu bunu 7.17 bitki ile Andırın 2 sarımsağının takip ettiğini bildirmiştir. Acay (2018), yaptığı tez çalışmasında Tunceli sarımsağı'nın (*Allium tuncelianum*) farklı hormon uygulamaları ile olgunlaşmamış embriyoların mikroçoğaltımı sonrası uygun hormon ve dozunu tespit ettikleri çalışmada, 2,4-D uygulamasında diğer uygulamalara göre yüksek düzeyde kallus oluşumunu saptamıştır. Kallus oranı en yüksek %20 ile 0.3 ve 1.2 mg/L dozlarından belirlemiştir. Olgunlaşmamış embriyodan direkt rejenerasyon ile soğan oluşumu BAP, BAP + 0.5 mg/L NAA, BAP + 300 mg/L Putresin, BAP + 300 mg/L Putresin + 0.5 mg/L NAA ortamlarında elde etmiştir. Karjadi ve Gunaeni (2021), yaptıkları çalışmada farklı sarımsak çeşitlerinin büyüme düzenleyicilerle takviyeli MS besin ortamı kullanarak meristem ve sürgün ucu yöntemiyle çoğaltmayı hedeflemişlerdir. Buna göre MS besin ortamına; Sukroz 30 gL⁻¹ + IAA 2 mgL⁻¹ + Kinetin 2 mgL⁻¹ + GA3 0.01 mgL⁻¹ + gelgro 2 gL⁻¹ ilave etmişlerdir. Sonuç olarak tüm çeşitlerde sürgün ucu ile çoğaltma meristem kültürüne göre daha yüksek olduğunu bildirmişlerdir.

Çizelge 2. Farklı sarımsak genotiplerinin iki alt kültürdeki kardeş sayıları (adet)

Genotipler	Birinci alt kültür (adet)	İkinci alt kültür (adet)
Taşköprü	3.70b	3.00ab
Alata	6.83a	3.78a
Kırklareli	1.55c	2.00bc
Kilis	1.80c	1.00c
LSD	1.18***	1.09***

Sürgün ucu kültürü ile farklı genotiplerin köklendirme ortamı sonrası gelişimi Çizelge 3'de belirtilmiştir. Kök sayısı, kök uzunluğu ve köklenme oranı elde edilen sonuçlara göre, istatistiksel olarak önemli bulunmuştur. Kök sayısı bakımından en fazla gelişim Kilis (8.00 adet) ve Taşköprü (6.40 adet) sarımsaklarından elde edilmiştir. Kök uzunluğu incelendiğinde istatistiksel olarak aynı grupta yer alan Taşköprü (39.36 mm) ve Kilis (33.30 mm) sarımsaklarından elde edilmiştir. Köklenme oranı bakımından ise en fazla Taşköprü (%87.80) sarımsağı en az köklenme Alata (%32.54) sarımsağında elde edilmiştir.

Ayed ve ark. (2018), Tunus yerel sarımsağının (*Allium sativum* L.) sürgün ucu kültürüyle *in vitro* çoğaltılmasını amaçladığı çalışmada, herhangi bir büyüme düzenleyicisi (M0) içermeyen MS ortamının, sürgün ucu başlangıcı (%96 eksplant gelişimi) ve bitkicik uzaması (56.26 mm) bakımından en uygun ortam olarak tesğit etmiştir.

Çizelge 3. Farklı sarımsak genotiplerinde köklendirme ortamı sonrası kök sayısı (adet), kök uzunluğu (mm) ve köklenme oranı (%) değerleri

Genotipler	Kök Sayısı (adet)	Kök Uzunluğu (mm)	Köklenme Oranı (%)
Taşköprü	6.40a	39.36a	87.80a
Alata	3.80b	21.42b	32.54d
Kırklareli	2.25b	23.18b	71.20b
Kilis	8.00a	33.30a	50.40c
LSD	2.53***	6.08***	1.54***

Çalışma kapsamında farklı sarımsak genotiplerinde enfeksiyon oranları belirlenmiş ölçülmüş (Çizelge 4) ve genotipler arasındaki farklar istatistiksel olarak önemli bulunmuştur. Başlangıç ortamında enfeksiyon oranı en fazla Taşköprü (%27.00) sarımsağında olurken, en az Alata (%5.00) sarımsağı ve Kırklareli (%5.00) ilinden toplanan sarımsaklardan elde edilmiş ve istatistiksel olarak aynı grupta yer aldığı belirlenmiştir. Birinci alt kültür sonucu en fazla enfeksiyon Kırklareli (%35.71) sarımsağı, ikinci alt kültürde ise en fazla Kilis (%51.00) ilinden toplanan sarımsaklarda görülmüştür. Alata sarımsağının birinci ve ikinci alt kültür aşamalarında ve Kırklareli sarımsağının ikinci alt kültür aşamasında enfeksiyon ile karşılaşılmasıdır.

Çizelge 4. Farklı sarımsak genotiplerinde başlangıç, 1 ve 2. Alt kültür sonrası enfeksiyon oranları (%)

Genotipler	Başlangıç Enfeksiyon Oranı (%)	Birinci Alt Kültür Enfeksiyon (%)	İkinci Alt Kültür Enfeksiyon (%)
Taşköprü	27.00a	21.43b	7.67b
Alata	5.00c	-	-
Kırklareli	5.00c	35.71a	-
Kilis	12.00b	13.64c	51.00a
LSD	1.88***	1.63***	1.33***

Sonuç

Araştırmada 4 farklı sarımsak genotipinin sürgün ucu kültürü ile çoğaltılması araştırılmıştır. Çalışma süresince en fazla kardeşlenme Alata (6.83 adet) ve Taşköprü (3.70 adet)

sarımsaklarından elde edilmiştir. Köklenme oranı en yüksek Taşköprü (%87.80) sarımsağı olarak tespit edilmiştir.

Teşekkür

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Kaynaklar

- Acay, Ü. (2019). Endemik Tunceli sarımsağının (*Allium Tuncelianum*) olgunlaşmamış embriyolarının in vitro rejenerasyonu üzerine çalışmalar. Yüksek Lisans Tezi, Dicle Üniversitesi.
- Akan, S., Ö. Horzum and N. T. Güneş. 2019a. The effect of modified atmosphere packaging on keeping quality in green garlic (*Allium sativum* L.) leaves. MKU J. Agric. Sci. 23: 165-173 (5).
- Anonymous. 2019. Common Quality Standard for Garlic Regulation. Available from: <http://www.garlicworld.co.uk/reports/EC2288.pdf>.
- Ayed, C., Bayoudh, C., Rhimi, A., Mezghani, N., Haouala, F., & AL Mohandes Dridi, B. (2018). In vitro propagation of Tunisian local garlic (*Allium sativum* L.) from shoot tip culture. *Journal of Horticulture and Postharvest Research*, 1(2), 75-86.
- Baktemur, G., Taşkın, H., Yücel, N.K., Büyükalaca. S. (2010). VIII. "Farklı Sarımsak Tiplerinin Sürgün Ucu Kültürü ile in vitro Çoğaltılması" VIII. Sebze Tarımı Sempozyumu. 591-595 Van, Türkiye,
- Hirata, S., Abdelrahman, M., Yamauchi N., Shigyo M. (2016). Characteristics of chemical components in genetic resources of garlic *Allium sativum* collected from all over the world. *Genet Resour Crop Evol* (2016) 63:35–45
- Humberto, I. O., Yovany, Q. O., Rosalina, D. C., Dolores, P. A., Maria, C. G., Sergio, G. S. and Olimpia, G. C. (2004). Micropropagation Del Ajo (*Allium sativum* L.). *Alimentaria*, 65.
- Karjadi, A. K., & Gunaeni, N. (2021). The influence of variety and explant size on Garlic (*Allium sativum* L) proliferation using Murashige and Skoog media. In *IOP Conference Series: Earth and Environmental Science* (Vol. 653, No. 1, p. 012062). IOP Publishing.
- Murashige, T. and Skoog, F. (1962). A revised medium for rapid growth and bioassays with tobacco tissue cultures. *Physiol. Plant.* 15: 473-497.
- Reiter, J., Levina, N., Van der Linden, M., Gruhlke, M., Martin, C., & Slusarenko, A. J. (2017). Diallylthiosulfinate (Allicin), a volatile antimicrobial from garlic (*Allium sativum*), kills human lung pathogenic bacteria, including MDR strains, as a vapor. *Molecules*, 22(10), 1711.
- Tindal H. D. (1986). *Vegetables in the Tropics* (p. 533). Macmillan Education Limited Hound Mills Basing Toke, Hamshire, England.

**IPBS-RETROTRANSPOZON VARYASYONLARI: ULUSLARARASI ŐEKER
PANCARI GERMPLAZMINDA GENETİK ÇEŐİTLİLİK VE POPÜLASYON
YAPISININ DEĐERLENDİRİLMESİ**

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ÖZET

Şeker pancarı dünyada şeker, biyoetanol ve hayvan yemi ihtiyacının karşılandığı önemli bir tarla bitkisidir. Şeker pancarı üreticileri şeker pancarında kök verimi ve şeker içeriği yüksek çeşitleri tercih etmektedirler. Bu nedenle bitki ıslahçıları bu özellikleri iyileştirmeye çalışmakta ve bu doğrultuda ıslah yapmaktadırlar. Ancak bu iki özellik de genetik olarak karmaşık bir altyapıya sahiptir. Bu durum moleküler destekli ıslah çalışmalarını oldukça önemli bir noktaya getirmektedir. Moleküler markörler, bitki ıslahı çalışmalarında ıslah sürecine doğrudan etki etmektedirler. Bu durumda moleküler markörler, bitki tohum koleksiyonlarını karakterize etmede önemli rol oynamaktadırlar. Bu çalışma, Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri ve Teknoloji Fakültesi bünyesinde, şeker pancarı ıslah çalışmalarında kullanılması amacıyla yürütülmüştür. Araştırmada, USDA (ABD Tarım Bakanlığı) gen bankasından temin edilen 20 farklı genotip ile 4 adet tescilli çeşit bitki materyali olarak kullanılmış ve 6 adet IPBS retro-transposon markörü ile taranmıştır. Çalışma sonucunda, 6 primerden toplamda 119 adet polimorfik bant elde edilmiş ve primer başına ortalama bant sayısı 19.83 adet olarak saptanmıştır. En az bant üreten primer 2382 olurken (14 adet), en fazla bant üreten primer ise 2385 (22 adet) olmuştur. Ortalama polimorfizm bilgi içeriği (PIC) değeri %69.98 olarak hesaplanmıştır. Tüm genotipler arasında en az genetik benzerlik Genotip 10 ile Genotip 18 arasında (%41.3), en fazla genetik benzerlik ise Genotip 22 ile Genotip 24 arasında (%80.8) saptanmıştır.

Anahtar kelimeler: Şeker pancarı, IPBS retro-transposon, moleküler markör

**IPBS-RETROTRANSPOSONS VARIATIONS: THE EVALUATION OF GENETIC
DIVERSITY AND POPULATION STRUCTURE IN INTERNATIONAL SUGAR
BEET GERMPLASM**

ABSTRACT

Sugar beet is an important field crop where sugar, bioethanol and animal feed needs are met in the world. Sugar beet producers prefer varieties with high root yield and sugar content in sugar beet. For this reason, plant breeders are trying to improve these characteristics and they are breeding in this direction. However, both of these features have a genetically complex background. This situation brings molecular assisted breeding studies to a very important point. Molecular markers directly affect the breeding process in plant breeding studies. In this case, molecular markers play an important role in characterizing plant seed collections. This study was carried out as a parent in sugar beet breeding studies at Sivas Science and Technology University, Faculty of Agricultural Sciences and Technology. In the study, 20 different genotypes and 4 registered cultivars obtained from the USDA (US Department of Agriculture) gene bank were used as plant material and were screened with 6 iPBS retro-transposon markers. As a result of the study, a total of 119 polymorphic bands were obtained from 6 primers and the average number of bands per primer was determined as 19.83. While the primer producing the least band was 2382 (14), the primer producing the most band was 2385 (22). The mean polymorphism information content (PIC) value was calculated as 89.39%. The least genetic similarity among all genotypes was found between Genotype 10 and Genotype 18 (41.3%), and the highest genetic similarity was found between Genotype 22 and Genotype 24 (80.8%).

Keywords: Sugar beet, IPBS retro-transposon, molecular marker

GİRİŞ

Şeker pancarı (*Beta vulgaris* L.), Amaranthaceae (eski adıyla Chenopodiaceae) familyası ve C₃ fotosentetik sisteme sahip Caryophyllales takımının üyeleri arasında yer alan iki yıllık önemli bir endüstri bitkisidir (Zicari vd., 2019). Bitki ilk yıl köklerinde sukroz biriktirmeye başlamakta, ikinci yılda ise vernalize olduktan sonra köklerinde depoladığı sukrozu kullanarak sapa kalkmakta ve tohum bağlamaktadır.

Şeker pancarı ekonomik açıdan önemli olan sukrozu vakuollerinde depolamaktadır. Bitkinin sukroz içeriği, 18. ve 19. yüzyıllarda yem pancarları arasından morfolojik ve fizyolojik özellikler dikkate alınarak yapılan seleksiyon çalışmaları sonucu, %6'lardan %18'lere kadar artırılmıştır (Fasahat vd., 2022). Yaklaşık 200 yıllık bir yetiştirme süresine sahip olan şeker pancarının şeker içeriği yanında üretici, tüketici ve şeker pancarı endüstrisi için önemli olan birçok özelliği klasik ıslah yöntemleri ile önemli ölçüde geliştirilmiştir. Ancak son yıllarda biyoteknolojik uygulamaların klasik ıslah programlarına dâhil edilmesi ile ıslah sürecini daha etkin bir hale getirmek amaçlanmaktadır. Markör destekli seleksiyon, biyoteknolojik uygulamalar arasında yer alan genotipler arasındaki vasyosyonu genotip x çevre interaksiyonundan etkilenmeksizin belirleyerek hızlı ve güvenilir bir şekilde belirlenmesini sağlayan önemli bir uygulamadır.

Bitki genotipleri arasındaki genetik varyasyonlar günümüzde en yaygın olarak DNA markörleri ile belirlenmektedir. DNA markörlerinden yararlanılarak, hangi lokusta olduğuna bakılmaksızın bitkiler arasında farklılık gösteren DNA lokuslarının oranı belirlenmektedir. Bu analizlerden elde edilen sonuçlar, bitki ıslah programına alınacak ebeveynlerin seçiminde kullanılmaktadır. Böylece, varyasyonu yüksek olan genotiplerin kullanımı ile ıslahçıların geliştirilmesi istenen özellikleri seçme ihtimalleri artmaktadır. Çalışmada bazı avantajları nedeni ile iPBS retrotranspozon markör sistemi kullanılmıştır. Bu avantajlar, retrotranspozonların bitki genomunun büyük bir kısmına yayılması sebebi ile genomun büyük bir bölümünün taransaması (Kalendar vd., 2010), tüm bitki türlerinde kullanılması yani evrensel bir nitelik taşıması, PCR ve standart agaroz jel elektroforez yöntemlerinin kullanılarak uygulanabilmesi şeklinde sıralanabilmektedir.

Şeker pancarı Türkiye'de tarım sektöründe ve tarıma dayalı sanayi üretiminde önemli bir rol oynamakta ve ülke için önemli katma değer sağlamaktadır. Ayrıca tarım sektörünün yanı sıra hayvancılık, gıda, kimya, ilaç, tarımsal makine ve taşımacılık sektörüne de ekonomik katkı sağlamaktadır (Eştürk, 2018). Bu sebepler ile yetiştiriciliğinin yapılacağı bölgenin ekolojisine uygun, verimi ve kalitesi yüksek hem üreticinin hem de tüketicinin ihtiyaçları dâhilinde yeni şeker pancarı çeşitlerinin geliştirilmesi önemli bir konudur. Bu çalışmada farklı orijine sahip

genotipler ve yetiştiriciliği yapılan ticari şeker pancarı çeşitlerinde genetik çeşitliliği belirleyerek yürütülecek şeker pancarı ıslah programlarında uygun ebeveynlerin seçilerek nihayetinde istenilen özelliğe sahip çeşitlerin geliştirilebilmesinde moleküler olarak kimliklendirilerek elde edilen verilerden yararlanmak hedeflenmiştir.

MATERYAL VE METOT

Bu çalışma, Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri ve Teknoloji Fakültesi bünyesinde yürütülen şeker pancarı ıslahı kapsamında şeker pancarı genotipleri arasındaki genetik varyasyonu belirlemek amacıyla yürütülmüştür. Bitki materyali olarak USDA (ABD Tarım Bakanlığı) gen bankasından temin edilen 10 farklı ülke orijinli (Türkiye, Çin, İngiltere, Fransa, Amerika, İran, Karadağ, Hindistan, İrlanda, Şili) 20 adet genotip ile 4 adet tescilli şeker pancarı çeşidi (Serenada, Varias, Evelina, Jaguar) kullanılmış (Çizelge 1) ve 6 adet IPBS retrotransposon markörü ile taranmıştır (Çizelge 2). DNA izolasyonu için CTAB yöntemi (Doyle ve Doyle, 1987) ve Diversity Arrays Technology tarafından tavsiye edilen metodoloji (<https://www.diversityarrays.com/orderinstructions/plant-dnaextraction-protocol-for-dart/>) kullanılmıştır. Elde edilen DNA, ultra saf su (ddH₂O) ile seyreltilerek denatürasyonu engellemek için -20 °C’ de muhafaza edilmiştir. Genomik DNA’ nın konsantrasyon ve kalitesini kontrol etmek için Nanodrop ölçümleri yapılmıştır. Ayrıca DNA kalitesi %0,8’lik bir agaroz jel kullanılarak kontrol edilmiştir.

Çizelge 1. Çalışmada kullanılan 20 şeker pancarı genotipine ait bilgiler

Genotip	Tür Adı	İsim	Orijin
Ames 8283	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	İngiltere 1	İngiltere
Ames 8279	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	İngiltere 2	İngiltere
PI 611060	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Çin 1	Çin
NSL 188575	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Çin 2	Çin
PI 142814	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	İran 1	İran
PI 140354	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	İran 2	İran
PI 120695	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Türkiye 1	Türkiye
PI 120693	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Türkiye 2	Türkiye
PI 163176	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Hindistan 1	Hindistan
PI 179844	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Hindistan 2	Hindistan
PI 590616	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Fransa 1	Fransa
PI 590614	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Fransa 2	Fransa
NSL 176303	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Karadağ 1	Karadağ
NSL 176412	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Karadağ 2	Karadağ
Ames 8448	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	İrlanda 1	İrlanda
Ames 8447	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	İrlanda 2	İrlanda
PI 590851	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Amerika 1	Amerika
PI 590831	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Amerika 2	Amerika
PI 610304	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Şili 1	Şili
PI 590666	<i>B. vulgaris</i> L. subsp. <i>vulgaris</i>	Şili 2	Şili

Şeker pancarında polimorfizm gösteren iPBS retrotranspozon primerlerini belirlemek için Kalendar vd. (2010) tarafından geliştirilen primerlerden 40 tanesi, rastgele seçilen 4 adet

genotipte taranmıştır. Tarama sonucunda, yüksek polimorfik bant üreten 6 adet iPBS retrotranspozon primeri çalışmada incelenen tüm şeker pancarı genotiplerinin moleküler karakterizasyonunu yapmak ve genetik çeşitliliğini belirlemek için kullanılmıştır.

Çizelge 2. Şeker pancarı genotipleri arasındaki varyasyonu belirlemede kullanılan primerler

Primer No	Sekans	Optimum Bağlanma Sıcaklığı (C°)
2245	GAGGTGGCTCTTATACCA	50.0
2402	TCTAAGCTCTTGATACCA	50.0
2246	ACTAGGCTCTGTATACCA	49.0
2382	TGTTGGCTTCCA	50.5
2385	CCATTGGGTCCA	51.2
2389	ACATCCTTCCCA	50.0

PCR reaksiyonu; 2 µL dNTP, 0.2 µL U Taq DNA polimeraz, 2 µL PCR tamponu, 2 µL MgCl₂, 3.2 µL primer (5mM), 3 µL DNA (5ng), 7.6 µL ultra saf su olacak şekilde toplam hacim 20 µL' dir.

Amplifikasyon döngüleri; 94 °C' de 3 dakika süreyle ilk denatürasyon; 94 °C' de 15 saniye süreyle denatürasyon; 49 °C - 51.2 °C arasında 1 dakika 30 döngü ve son uzama 72 °C' de 5 dakika süre olacak şekildedir. PCR ürünleri %2 agaroz jel kullanılarak 110 W' t'a 2.5 saat süreyle analiz edilmiş ve jel boyama için etidyum bromür kullanılmıştır. Jel görüntüsü için moleküler ağırlık belirteci olarak 3000 bp'lik bir lamda DNA ve Gel Doc XR sistemi kullanılmıştır.

Şekerpancarı genotiplerinin genetik benzerlikler ve alleller hakkında bilgi, NTSYSpc 2.21q (Rohlf, 2005) programında Dice indeks kullanılarak hesaplanmıştır. Jel görüntüsünde bantların varlığı 1 ile, yokluğu ise 0 ile ifade edilerek jel skorlaması yapılmıştır. 0 veya 1 olarak kodlanılan ikili (binary) veri matrisi UPGMA (Unweighted Pair Group Method Arithmetic Average) kullanılarak genotiplerin birbiriyle olan benzerliklerini gösteren dendogram oluşturulmuştur. Moleküler analizlerde kullanılan her bir DNA markörü için polimorfizm bilgi içerikleri Weir (1996)'e göre aşağıdaki formülle hesaplanmıştır.

$$PIC=1-\sum Pi^2$$

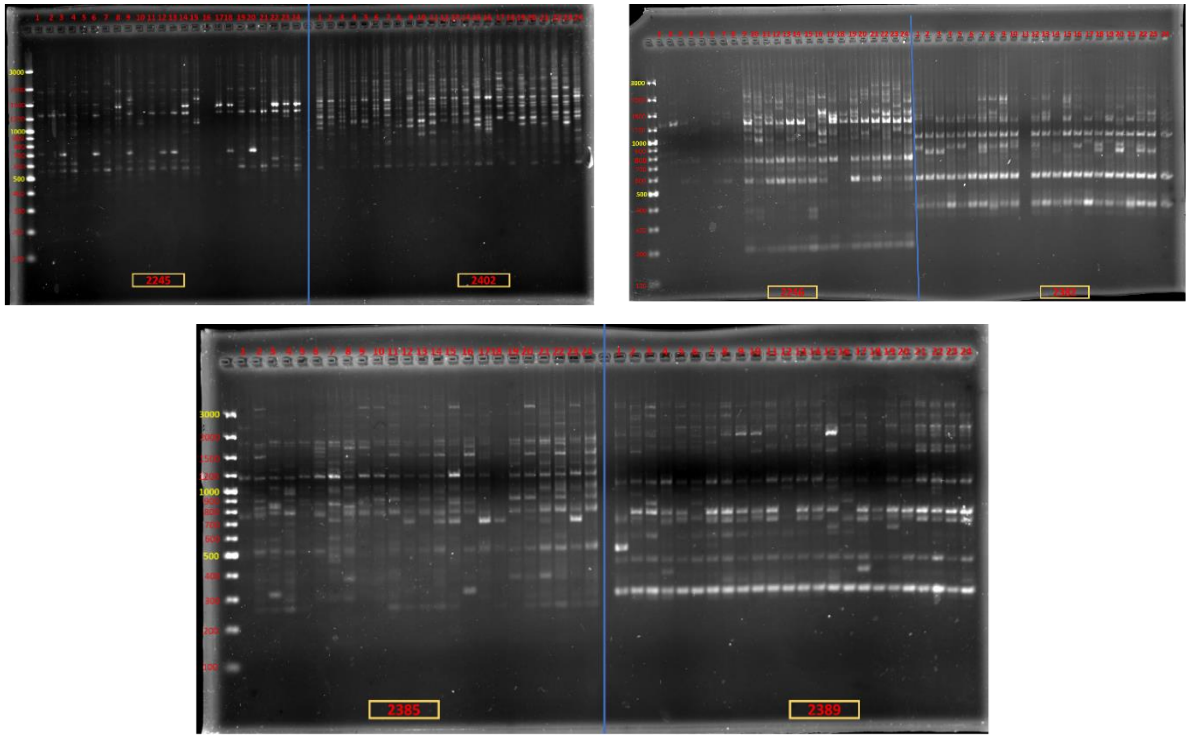
Pi; araştırmada çalışılan 24 şekerpancarı genotipinde i'inci allelin frekansıdır.

BULGULAR VE TARTIŞMA

Genotipler arasındaki genetik varyasyonun belirlenmesi ıslah çalışmaları için kritik öneme sahiptir. Şeker pancarı germplazmındaki genetik değişkenliği belirlemek için farklı moleküler

belirteçler kullanılmıştır (De Riek vd., 2001; Li vd., 2010; Simko vd., 2012; Izzatullayeva vd., 2014; Srivastava vd., 2017). iPBS-retrotranspozon DNA markörleri genetik çeşitliliğin değerlendirilmesinde bitkiler aleminde başarıyla kullanılmaktadır (Comertpay vd., 2016). iPBS-retrotranspozon belirteci birçok çalışmada genetik çeşitliliği belirlemek için kullanılmıştır (Barut vd., 2020; Öztürk, 2020; Yıldız vd., 2020; Nadeem, 2021).

Çalışmada kullanılan USDA (ABD Tarım Bakanlığı) gen bankasından temin edilen 10 farklı ülke orijinli (Türkiye, Çin, İngiltere, Fransa, Amerika, İran, Karadağ, Hindistan, İrlanda, Şili) 20 adet genotip ile 4 adet tescilli şeker pancarı çeşidi (Serenada, Varias, Evelina, Jaguar) arasındaki benzerlik ilişkisi, 6 adet IPBS retro-transposon markörü ile taranmıştır. IPBS retro-transposon markörü ile taranan 24 adet genotip jel görüntüleri Şekil 1’ de verilmiştir.



Şekil 1. Şeker pancarı genotiplerinde iPBS retrotranspozon primeri jel görüntüsü

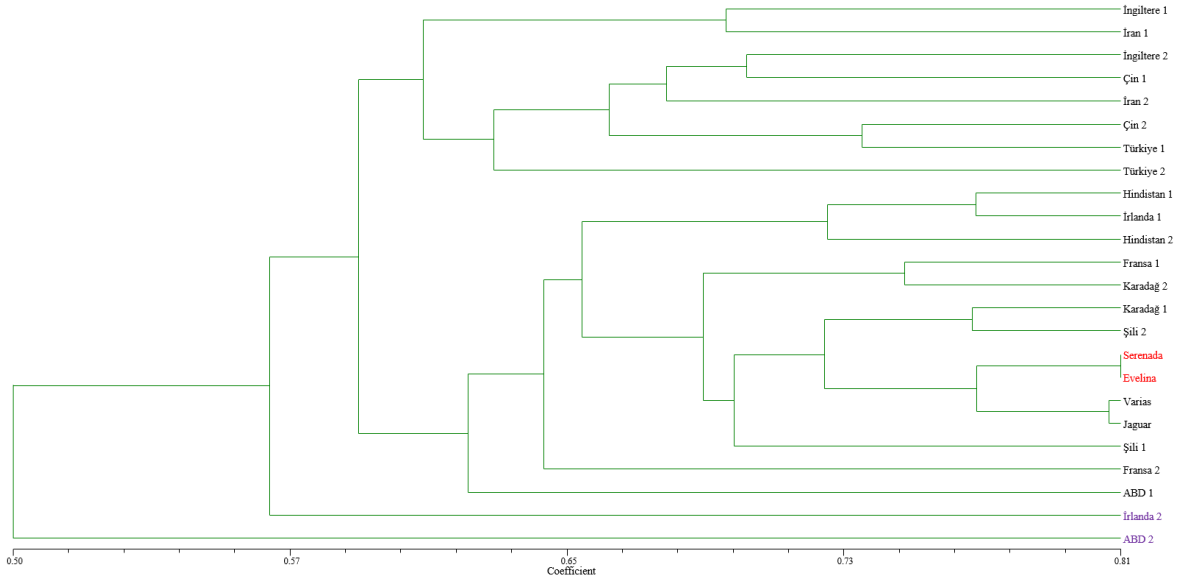
Çalışmada iPBS retrotranspozon primeri 2245, 2402 ve 2246’da 21, 2382’de 14, 2385’de 22 ve 2389’da 20 olmak üzere toplam 119 adet polimorfik bant bulunmuştur. En fazla allel üreten primer 2385 (CCATTGGGTCCA) olurken en az allel polimorfizim üreten primer 2382 (TGTTGGCTTCCA)’dir. Primer başına düşen allel sayısı 19.83 iken genotip başına düşen allel sayısı ise 4.96’dır. TaskiAjdukovic vd. (2017), şeker pancarı genotiplerinde genetik çeşitliliği araştırdıkları bir çalışmada, SSR markörlerini kullanarak toplam 129 allel ve primer başına 3.2 allel tespit etmişlerdir. El-Mouhamady vd. (2021) ise ISSR markörleri ile şeker pancarında

genetik varyasyonu arařtırdıkları bir arařtırmada toplamda 169 allel belirlemiřlerdir. Benzer bir alıřmada ise ISSR markörlerini kullanarak toplam 178 allel elde edilmiřtir (Izzatullayeva vd., 2014). alıřmalarda farklı sayıda allel elde edilmesinin sebebi alıřmada kullanılan genotip sayıları kullanılan DNA markörü ve sayısı ile ilgili olabilmektedir.

izelge 3. IPBS retrotransposon primerlerine ait allel sayısı ve PIC deęerleri

Primer No	Allel Sayısı	PIC
2245	21	0.77
2402	21	0.64
2246	21	0.81
2382	14	0.56
2385	22	0.71
2389	20	0.72
Ortalama	19.83	0.70

Genotiplerin taranmasında kullanılan DNA markörlerinin allel sayıları ve polimorfizm bilgi ierięi (PIC) deęerleri izelge 3’de gösterilmiřtir. Arařtırmada ortalama polimorfizm bilgi ierięi (PIC) deęeri ortalama 0.70 olarak hesaplanmıřtır. En yüksek PIC deęeri 0.81 olarak hesaplanırken, en düşük PIC deęeri 0.56 olarak hesaplanmıřtır. Izzatullayeva vd. (2021), 42 adet řeker pancarı genotipinde benzer bir alıřma yapmıř, ISSR markörleri tarafından ortaya ıkarılan polimorfizm düzeyinin (%97.2) RAPD primerlerinden (%93) daha yüksek olduęunu belirtmiřlerdir. Yapılan farklı bir alıřmada 10 adet řeker pancarı genotipinde 6 adet ISSR markörü kullanılarak yüksek bir polimorfizm (%86.3) elde edildięi belirtilmiřtir (Srivastava vd., 2007). ISSR markörlerinin kullanılarak yapılan bir bařka alıřmada ise řeker pancarı genotipleri iin ortalama polimorfizm oranı %87.5 olarak belirtilmiřtir 20 adet genotip ile 4 adet eřit toplam 24 genotipin 6 adet IPBS retro-transposon DNA markörleri ile tarandıktan sonra elde edilen veriler UPGMA (Unweighed Pair Group Method of Arithmetic Averages) yöntemi kullanılarak Weir, (1996)’nın genetik mesafe matrisine göre filogenetik aęaç oluřturulmuřtur. (řekil 2).



Şekil 2. iPBS-retrotranspozonların şekerpancari genotiplerine göre oluşturulmuş filogenetik ağaç

Şekerpancari genetik varyasyon özelliği bakımından verilerin analizi sonucunda oluşan filogenetik ağaç ilk basamakta iki ana gruba ayrılmıştır. İkinci grup ise iki alt gruba (Alt Grup 1 ve Alt Grup 2) ayrılmıştır. Grup 1, ABD 2 genotipinden oluşurken, Grup 2, İngiltere 1, İran1 İngiltere 2, Çin 1, İran 2, Çin 2, Türkiye1, Türkiye 2, Hindistan 1, İrlanda 1, Hindistan 2, Fransa 1, Karadağ 2, Karadağ 1, Şili 2, Serenada, Evelina, Varias, Jaguar, Şili 1, Fransa 2, ABD 1, İrlanda 2 ve ABD 2 genotiplerinden oluşmuştur.

Genetik benzerlik, Weir 1996'ya göre hesaplanarak, genotipler arasındaki benzerlik katsayısı yüzde (%) olarak hesaplanmıştır. Tüm genotipler arasında en az genetik benzerlik %42.4 ile İrlanda 2-ABD 2 genotipleri arasında, en fazla genetik benzerlik ise % 81.2 ile Serenada ile Evelina (KWS çeşidi) genotipleri arasında gözlemlenmiştir. Tecilli çeşitler dışındaki USDA genotiplerinde ise en fazla %75,73 ile Hindistan 1 ve İrlanda 1 genotipleri arasında gözlemlenmiştir. İslah çalışmaları kapsamında genetik varyasyonu sağlayabilmek için genetik benzerliği birbirine en uzak olan İrlanda 2 ve ABD 2 genotipleri tercih edilmektedir.

SONUÇ VE ÖNERİLER

Germplasmadaki varyasyonun değerlendirilmesi, ıslah programlarında önemli bir adımdır çünkü daha yüksek çeşitliliğe ve belirli koşullar altında daha iyi performansa sahip çeşitlerin ve hatların seçilmesine yardımcı olabilir. Genetik varyasyon araştırmaları, özellikle melezleme çalışmalarında üzerinde durulan özelliğe uygun ebeynlerin seçilmesini kolaylaştırır. Ayrıca mevcut genetik temeli genişletmek için kullanılır. Moleküler belirteçler ıslah çalışmaları için önemli araçlar haline gelmiş ve ıslah çalışmalarının daha kısa sürede sonuçlandırılmasına

olanak sağlamıştır. Moleküler belirteçler çevresel koşullardan bağımsızdır ve DNA düzeyinde genetik varyasyonun doğrudan tahminini sağlar. Çalışmada genotipler arasındaki genetik çeşitliliğin belirlenmesi yürütülen şeker pancarı ıslah çalışmaları açısından önem arz etmektedir.

TEŞEKKÜR

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KAYNAKLAR

- Barut, M., Nadeem, M.A., Karaköy, T., Baloch, F.S. (2020). iPBS-retrotranspozon markör sistemi kullanılarak dünya kinoa germplazmasının DNA parmak izi ve genetik çeşitlilik analizi. *Türk Tarım ve Orman Dergisi*, 44 (5), 479-491.
- Comertpay, G., Baloch, F.S., Derya, M., Andeden, E.E., Alsaleh, A., Surek, H., Özkan, H. (2016). Population structure of rice varieties used in Turkish rice breeding programs determined using simple sequence repeat and inter primer binding site retrotransposon data. *Genetics and Molecular Research*, 15 (1), 15017158.
- De Riek, J., Calsyn, E., Everaert, I., Van Bockstaele, E., De Loose, M. (2001). AFLP based alternatives for the assessment of distinctness, uniformity and stability of sugar beet varieties. *Theoretical & Applied Genetics*, 103(8).
- Doyle J.J, Doyle J.L. (1987). A rapid DNA isolation procedure for small quantities of fresh leaf tissue. *Phytochem Bulletin*, 19:11–15.
- El-Mouhamady, A.B.A., Al-Kordy, M.A., Elewa, T.A.F. (2021). Elucidation of genetic diversity among some accessions of sugar beet (*Beta vulgaris* L.) using inter-simple sequence repeats (ISSR) markers. *Bulletin of the National Research Centre*, 45(1), 1-17.
- Taški-Ajduković, K., Nagl, N., Ćurčić, Ž., & Zorić, M. (2017). Estimation of genetic diversity and relationship in sugar beet pollinators based on SSR markers. *Electronic Journal of Biotechnology*, 27, 1-7.
- Eştürk, Ö. (2018). Türkiye’de şeker sektörünün önemi ve geleceği üzerine bir değerlendirme. *Anadolu İktisat ve İşletme Dergisi*, 2(1), 67-81.
- Fasahat, P., Hosseinpour, M., Kakueinezhad, M., Townson, P. (2022). Physiological and Molecular Aspects of Sucrose Accumulation in Sugar Beet. In *Sugar Beet Cultivation, Management and Processing* (pp. 27-48). Singapore: Springer Nature Singapore.
- Izzatullayeva, V., Akparov, Z., Babayeva, S., Ojaghi, J., Abbasov, M. (2014). Efficiency of using RAPD and ISSR markers in evaluation of genetic diversity in sugar beet. *Turkish Journal of Biology*, 38(4), 429-438.
- Kalendar, R., Antonius, K., Smýkal, P., Schulman, A.H. (2010). iPBS: a universal method for DNA fingerprinting and retrotransposon isolation. *Theoretical and Applied Genetics*, 121, 1419-1430.
- Li, J., Schulz, B., Stich, B. (2010). Population structure and genetic diversity in elite sugar beet germplasm investigated with SSR markers. *Euphytica*, 175, 35-42.
- Liu, Q., Cheng, D., Yang, L., Luo, C., Kong, F., Wu, Y. (2012). Construction of digital fingerprinting and cluster analysis using ISSR markers for sugar beet cultivars (lines). *Transactions of the Chinese Society of Agricultural Engineering*, 28(1), 280-284.

- Nadeem, M. A. (2021). Deciphering the genetic diversity and population structure of Turkish bread wheat germplasm using iPBS-retrotransposons markers. *Molecular Biology Reports*, 48, 6739-6748.
- Öztürk, H. İ., Dursun, A., Hosseinpour, A., Haliloğlu, K. (2020). Genetic diversity of pinto and fresh bean (*Phaseolus vulgaris* L.) germplasm collected from Erzincan province of Turkey by inter-primer binding site (iPBS) retrotransposon markers. *Turkish Journal of Agriculture and Forestry*, 44(4), 417-427.
- Rohlf, F.J. (2005). NTSYS-pc: Numerical Taxonomy and Multivariate Analysis System Version 2.2. Setauket, Exeter Publishing, New York, USA.
- Simko, I., Eujayl, I., van Hintum, T.J. (2012). Empirical evaluation of DArT, SNP, and SSR marker-systems for genotyping, clustering, and assigning sugar beet hybrid varieties into populations. *Plant Science*, 184, 54-62.
- Srivastava, S., Gupta, P. S., Saxena, V. K., Srivastava, H.M. (2007). Genetic diversity analysis in sugarbeet (*Beta vulgaris* L.) using isozymes, RAPD and ISSR markers. *Cytologia*, 72(3), 265-274.
- Srivastava, S., Pathak, A.D., Kumar, R., Joshi, B.B. (2017). Genetic diversity of sugar beet genotypes evaluated by microsatellite DNA markers. *Journal of Environmental Biology*, 38(5), 777.
- Weir, B.S. 1996. *Genetik Veri Analizi II*, 2. baskı. Sinauer Associates Inc, Sunderland, MA.
- Yildiz, M., Kocak, M., Nadeem, M. A., Cavagnaro, P., Barboza, K., Baloch, F. S., Argun, D., Keleş, D. (2020). Genetic diversity analysis in the Turkish pepper germplasm using iPBS retrotransposon based markers. *Turkish Journal of Agriculture and Forestry*, 44(1), 1-14.
- Zicari, S., Zhang, R., Kaffka, S. (2019). Sugar Beet. In *Integrated processing technologies for food and agricultural by-products* (pp. 331-351). Academic Press, United Kingdom.

**SİVAS EKOLOJİK KOŞULLARINDA BAZI YEM BEZELYESİ (*Pisum arvense* L.)
GENOTİPLERİNİN AGRO-MORFOLOJİK PERFORMANSLARININ
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ÖZET

Geniş bir adaptasyon yeteneğine sahip olan yem bezelyesi (*Pisum arvense* L.), baklagil familyası içerisinde yer alan tek yıllık bir türdür. Yem bezelyesinin azotlu gübre ihtiyacının fazla olmaması, azot bağlayarak toprağı zenginleştirmesi ve geniş bir uyum yeteneğine sahip olması sebebi ile önemli bir serin iklim yem bitkisidir. Ürün miktarı ve kalitesinin artırılması için bölge ekolojisine uygun çeşit adaptasyon çalışmalarının tamamlanması gerekmektedir. Bu çalışmada, Sivas ekolojik koşullarında bazı yem bezelyesi genotiplerinin morfolojik özellikleri yanında ot verimlerinin değerlendirilmesi amaçlanmıştır. Deneme tesadüf blokları deneme desenine göre 4 tekerrürlü olacak şekilde yürütülmüştür. Araştırmada yem bezelyesi genotiplerine ait çiçeklenme gün sayısı (gün) (ÇGS), ilk bakla bağlama gün sayısı (gün) (İBGS), doğal bitki boyu (cm) (DBB), ana sap uzunluğu (cm) (ASU), yeşil ot verimi (kg/da) (YOV), kuru ot verimi (kg/da) (KOV), dal sayısı (adet) (DS) ve bakla sayısı (adet) (BS) özellikleri incelenmiştir. Yem bezelyesi genotiplerinde yeşil ot verimi ve kuru ot verimi haricinde diğer bütün özellikler istatistiki olarak önemli bulunmuştur. Çalışma sonucunda yem bezelyesi genotiplerinin ortalama çiçeklenme gün sayısı 61.38 gün, ilk bakla bağlama gün sayısı 69.8 gün, doğal bitki boyu 68.4 cm, ana sap uzunluğu 77.7 cm, yeşil ot verimi 1020 kg/da, kuru ot verimi 254 kg/da, dal sayısı 3.6 adet ve bakla sayısı 9.2 adet olarak saptanmıştır. Yapılan korelasyon analizi sonucunda yeşil ot verimi ile kuru ot verimi ve dal sayısı arasında pozitif ve anlamlı bir korelasyon olduğu tespit edilmiştir.

Anahtar Kelimeler: Yem bitkileri, *Pisum arvense*, ot verimi, korelasyon

EVALUATION OF AGRO-MORPHOLOGICAL PERFORMANCE OF SOME
FORAGE PEA (*Pisum arvense* L.) GENOTYPES UNDER SIVAS ECOLOGICAL
CONDITIONS

ABSTRACT

Forage pea (*Pisum arvense* L.), which has a wide adaptation ability, is an annual species in the legume family. It is an important cool-climate fodder plant because it does not need much nitrogen fertilizer, enriches the soil by binding nitrogen, and has a wide adaptability. In order to increase the amount and quality of the product, it is necessary to complete the adaptation studies in accordance with the ecology of the region. In the study, it was aimed to evaluate the herbage yields as well as some morphological traits of some forage pea genotypes in Sivas ecological conditions. The experiment was carried out in a randomized complete block design with 4 replications. In the study, the number of flowering days (day) (NFD), number of days to first pod (piece) (NDFP), natural plant height (cm) (NPH), main stem length (cm) (MSL), green herbage yield (kg/da) (GHY), hay yield (kg/da) (HY), number of branches per plant (piece) (NBPP) and number of pods per plant (piece) (NPP) characteristics of forage pea genotypes were investigated. Except for green herbage yield and hay yield, all other characteristics were found to be statistically significant in forage pea genotypes. At the end of this study, the average number of flowering days is 61.38 (day), number of days to first pod 69.8 (day), natural plant height 68.4 (cm), main stem length is 77.7 (cm), green herbage yield is 1020 (kg/da), hay yield is 254 (kg/da), number of branches per plant 3.6 (piece) and number of pods per plant 9.2 (piece) were found in forage pea genotypes. As a result of the correlation analysis, it was determined that there was a positive and significant correlation between green herbage yield, dry grass yield and number of branches.

Keywords: Fodder crops, *Pisum arvense*, forage yield, correlation

GİRİŞ

Hayvansal ürünler, insanların dengeli ve düzenli beslenmesinde önemli bir role sahiptir. Hayvansal üretimin yeterli bir şekilde gerçekleştirilebilmesi için hayvancılığın temel girdisi olan kaba yemin, ekonomik bir şekilde üretilmesi ile mümkündür. Geviş getiren hayvanların (ruminantların) üretiminde yemleme girdileri maliyetlerinin yaklaşık %50 ila 70'ini oluşturmaktadırlar (Alçıçek ve Karaayvaz, 2002; Yılmaz vd., 2020). Kaliteli kaba yemler ekonomik şekilde temin edildiği sürece hayvancılık işletmelerinde verimliliği dolayısıyla kârlılığı artırmaktadır (Tan ve Menteşe, 2003). İşletmeler için ekonomik olmasının yanı sıra protein, selüloz, yağ, mineral ve vitamin içerikleri ile rumen gelişimini destekleyerek kaliteli hayvansal üretim sağlamaktadırlar (Alçıçek ve Karaayvaz, 2003; Gümüş, 2018). Yem bitkilerinde üretimin artırılabilmesi için kaliteli kaba yem üretimi açısından mevcut ekolojilere uyumlu potansiyeli yüksek bitkilerin tarımının yaygınlaştırılması gereklidir. Bu nedenle Sivas ekolojisine ve bölgenin ürün desenine uygun olarak planlanacak ekim nöbeti sistemlerinde tek yıllık yem bitkileri hayati role sahiptir.

Yem bezelyesi (*Pisum arvense* L.) otu ve tanesi için yetiştirilen değerli bir yem bitkisidir. Ülkemizin Kuzeydoğu Anadolu Bölgesinde yetiştiriciliği yapılan yem bezelyesi, serin ve nemli ortamları seven tek yıllık bir baklagil bitkisidir (Tekeli ve Ateş, 2003). Bitkinin en önemli özelliklerinden biri otunun %15-20 ham protein içermesidir (Tan vd., 2011; Seydoşoğlu, 2019). Bununla birlikte fosfor, kalsiyum, A ve D vitaminleri yönünden zengin bir içeriğe sahiptir (Tekeli ve Ateş, 2003). Tohumları ise önemli bir esansiyel amino asit olan lizin yönünden zengindir (Çeri ve Acar, 2019). Bitki özellikle hayvancılık sektörünün geliştiği bölgelerde kesif yem üretiminde kullanılmaktadır. Ancak yem bezelyesi önemli ölçüde kaba yem üretim potansiyeline de sahiptir. Bitkinin sindirilebilirliğinin %70-80 gibi yüksek bir değerde olması, ruminantların yemden yeterli enerjiyi karşılamasını sağlamaktadır (Fraser vd., 2001; Uzun vd., 2005). Yem bezelyesi ot ve tane üretiminin yanında kes, yeşil gübre, silaj ve otlatma amacıyla da üretilebilmektedir (Açıkgöz vd., 2005). Diğer taraftan, bitki hem tahıllarla karışık ekime uygun hem de ekim nöbetinde başarıyla kullanılabilir. Protein içeriğinin ve dolayısıyla sindirilebilirliğinin yüksek olması sebebiyle karışık ekimlerde kullanılması ile ruminantlar için üretilen kaba yemin daha dengeli olmasını sağlamaktadır. Baklagil bitkisi olması sebebiyle kendinden sonraki bitki için daha uygun bir ortam oluşturmakta ve hastalık, zararlı ve yabancı otların kontrolünde etkin rol alabilmektedir.

Bu çalışmada, Sivas ekolojik koşullarında bazı yem bezelyesi genotiplerinin morfolojik özellikleri ve ot verimlerinin değerlendirilmesi amaçlanmıştır.

MATERYAL VE METOT

Çalışma Sivas Bilim ve Teknoloji Üniversitesi, Tarım Bilimleri ve Teknoloji Fakültesi, Tarımsal Ar-Ge Merkezinde 2022 yılı yetiştirme sezonunda yürütülmüştür. Denemenin yürütüldüğü alanın denizden yüksekliği 1285 m olup, N39,720656-E36,917248 konumunda yer almaktadır. Denemenin yürütüldüğü 2022 yılı yetiştirme sezonuna ait iklim verileri Tablo 1’de verilmiştir. Sivas ilinde kışları soğuk ve karlı, yazları sıcak ve kurak geçen karasal bir iklim hakimdir. En düşük sıcaklık değeri (-4.2 °C) Nisan ayında, en yüksek sıcaklık değeri ise (23.7 °C) Ağustos ayında gözlemlenmiştir. Nisan-Ağustos ayları arasındaki toplam yağış (137.9 mm), uzun yıllar ortalamasının (133.5 mm) üzerinde seyretmiştir. Aylara göre ortalama bağıl nem değeri %44.5 ile %55.8 arasında değişmiş ve uzun dönem ortalamasının (%51.6) altında kalmıştır.

Çalışma alanının toprağı siltli killi tın bünyeye sahip olup, pH değeri 7.28, kireçli (%19.6), potasyum içeriği (K₂O) yüksek (93.59 kg/da), fosfor içeriği (P₂O₅) düşük (3.40 kg/da), tuzsuz (0.33 mmhos/cm) ve organik maddece (%1.7) düşüktür (Tablo 2). Deneme alanının drenajı iyi ve taban suyu problemi bulunmamaktadır.

Tablo 1. Sivas ilinin deneme yılı ve uzun yıllar ortalamasına ait bazı iklim verileri*

	Yağış (mm)		Sıcaklık (°C)		Nispi Nem (%)					
	2022	UYO	Min.	Max.	2022	UYO	Min.	Max.	2022	UYO
Nisan	4.3	23.2	-4.2	12.2	12.2	11.1	7.0	92.0	44.5	50.0
Mayıs	5.6	18,9	0.8	12.5	12.5	13.9	10.0	91.0	53.1	53.8
Haziran	116.6	77.7	9.8	18.8	18.8	18.6	7.0	93.0	55.8	55.2
Temmuz	0.0	4.6	7.2	19.1	19.1	20.3	5.0	85.0	51.9	50.5
Ağustos	11.4	9.1	13.4	23.7	23.7	22.3	10.0	99.0	47.5	48.4
Top./Ort.	137.9	133.5			86.3	86.2			50.6	51.6

* Tarım Ve Orman Bakanlığı Meteoroloji Genel Müdürlüğü, UYO: Uzun Yıllar Ortalaması

Tablo 2. Deneme alanı toprağının fiziksel ve kimyasal özellikleri

Derinlik	Tekstür	pH	Kireç (%CaCO ₃)	Tuzluluk (%)	P ₂ O ₅ (kg/da)	K ₂ O (kg/da)	Organik madde (%)
0-30 cm	Siltli kili tın	7.28	19.6	0.33	3.40	93.59	1.7

Araştırmada, GAP Pembesi, Taşkent, Kirazlı, Töre, Gölyazı yem bezelyesi çeşitleri ve Sivas Bilim ve Teknoloji Üniversitesi ıslah çalışmalarında kullanılmak üzere geliştirilen SBTÜ 1002 hattı olmak üzere 6 adet yem bezelyesi genotipi kullanılmıştır. Yem bezelyesi ekimleri 25 Nisan tarihinde yapılmıştır. Ekimde her bir parsel 5 m uzunluğunda ve sıra arası 25 cm olacak şekilde 12 sıradan oluşmuştur. Deneme tesadüf blokları deneme desenine göre 4 tekerrürlü olacak şekilde kurulmuştur. Ekimle birlikte dekara 4 kg N (azot) ile 10 kg P₂O₅ (fosfor) olacak şekilde

gübreleme yapılmıştır. Yetiştirme süresi boyunca deneme alanında yabancı ot mücadelesi elle ve çapa ile yapılmıştır. Araştırmada, yem bezelyesi genotiplerine ait çiçeklenme gün sayısı (gün), ilk bakla bağlama gün sayısı (gün), doğal bitki boyu (cm), ana sap uzunluğu (cm), yeşil ot verimi (kg/da), kuru ot verimi (kg/da), dal sayısı (adet), bakla sayısı (adet) parametreleri incelenmiştir. Elde edilen sonuçlar SAS 9.3 istatistik paket programı kullanılarak varyans analizine tabi tutulmuştur (SAS, 2011).

BULGULAR VE TARTIŞMA

Yem bezelyesi genotiplerinde incelenen çiçeklenme gün sayısı (gün), ilk bakla bağlama gün sayısı (gün), doğal bitki boyu (cm), ana sap uzunluğu (cm), yeşil ot verimi (kg/da), kuru ot verimi (kg/da), dal sayısı (adet), bakla sayısı (adet) özelliklerine ait ortalama değerler Tablo 3'te verilmiştir.

Tablo 3. Yem bezelyesi genotiplerinde incelenen özelliklere ait ortalama değerler

Genotip	ÇGS (gün)	İBGS (gün)	DBB (cm)	ASU (cm)	YOV (kg/da)	KOV (kg/da)	DS (adet)	BS (adet)
GAP Pembesi	61.50 ^c	70.0 ^b	67.45 ^{ab}	77.40 ^b	1009	242	3.40 ^c	9.70 ^b
Taşkent	62.00 ^{bc}	69.0 ^c	71.20 ^{ab}	79.05 ^b	998	245	2.10 ^d	9.60 ^b
Kirazlı	62.75 ^{ab}	72.0 ^a	68.80 ^{ab}	62.50 ^d	837	216	3.05 ^c	7.15 ^b
Töre	59.75 ^d	69.0 ^c	62.30 ^b	79.95 ^b	1046	258	4.05 ^b	8.25 ^b
Gölyazı	63.50 ^a	72.0 ^a	77.70 ^a	95.70 ^a	1140	285	5.00 ^a	7.75 ^b
SBTÜ 1002	58.75 ^d	67.0 ^d	62.85 ^b	69.55 ^c	1087	276	4.05 ^b	12.55 ^a
ÖD	**	**	*	**	NS	NS	**	**
CV	0.52	4.02	8.54	2.32	16.97	14.53	3.64	11.67

ÇGS: Çiçeklenme gün sayısı, İBGS: İlk bakla bağlama gün sayısı, DBB: Doğal bitki boyu, ASU: Ana sap uzunluğu, YOV: Yeşil ot verimi, KOV: Kuru ot verimi, DS: Dal sayısı, BS: Bakla sayısı, ÖD: Önem düzeyi, NS: Önemli değil, *: 0.05 düzeyinde önemli, **: 0.01 düzeyinde önemli

Çalışmada incelenen yem bezelyesi çeşitlerinde en erken çiçeklenme gün sayısına sahip Töre çeşidi (59.75 gün) ve SBTÜ 1002 hattı (58.75 gün) olup, en geç çiçeklenen çeşit ise Gölyazı (63.5 gün) olmuştur. Sonuçlar SBTÜ 1002 hattının diğer çeşitlerden daha erkenci olduğunu göstermiştir. Özdemir ve Tamkoç (2019), yazlık ürün yetiştirme döneminde ikinci ürün olarak ekimi yapılan yem bezelyesi çeşitlerinde çiçeklenme gün sayılarının 51.6 gün ile 72.0 gün arasında değiştiğini belirtmiştir. Araştırmacılar ile bulgularımız benzerlik göstermiştir. Diyarbakır'da ana ürün koşullarında yapılan bir araştırmada ise çiçeklenme gün sayısı 157.8-175.5 gün (Seydoşoğlu, 2013) olarak bulunmuş olup, bulgularımızla farklılık göstermektedir. Çiçeklenme gün sayısı ekolojik koşullara, çalışmanın yürütüldüğü yıllara ve kullanılan çeşitlere göre değişim gösterebilmekte olup, olgunlaşma süresini belirleyerek üretim desenindeki yerinin belirlenebilmesi için önemli bir kriterdir (Tan ve Kadioğlu, 2018). Çalışmada kullanılan

genotipler arasında ilk bakla bağlama gün sayısı 67-72 gün arasında değişim göstermiştir. Geç çiçeklenme gösteren Gölyazı çeşidi daha geç olgunlaşarak en uzun bakla bağlama gün sayısına (72 gün) sahip olmuştur. Doğal bitki boyu bakımından değerlendirilme yapıldığında en kısa boylu yem bezelyesi çeşidi (67.45 cm) GAP Pembesi olarak belirlenmiş, ancak istatistiksel açıdan GAP Pembesi ve Taşkent çeşitleri Kirazlı çeşidi ile aynı grupta yer almıştır. En uzun doğal bitki boyuna sahip çeşit ise (77.70 cm) Gölyazı olmuştur. Yemlik olarak yetiştirilen bezelye için daha uzun boylu çeşitler tercih edilmektedir (Koivisto vd., 2003). Ekolojik koşullara iyi uyum sağlayan çeşitlerin daha fazla boylandığını belirten Tan ve Kadioğlu (2018), Taşkent ve Özkaynak çeşitlerinde bitki boyunu sırası ile 109.6 cm ve 128.4 cm olarak tespit etmişlerdir. Elde edilen sonuçlar bu çalışma ile farklılık sergilemiştir. Bu farklılığın bitkilerin yetiştirildiği dönem (kışlık-yazlık) veya çalışmada kullanılan çeşitlerin farklılığından ileri geldiği belirtilebilmektedir. Gölyazı çeşidi ana sap uzunluğu bakımından en yüksek değere (95.70 cm) sahip olurken, Kirazlı çeşidi en düşük değere (62.50 cm) sahip olmuştur. Ana sap uzunluğu ile doğal bitki boyu arasındaki bu farklılık tüm yem bezelyesi çeşitlerinde yaygın olarak özellikle bakla doldurma dönemiyle birlikte görülen yatmadan kaynaklanmaktadır (Sayar, 2021). Yaş ot verimi bakımından çeşitler arasında istatistiksel olarak bir fark bulunmamıştır. Ateş ve Tekeli (2017), Edirne ekolojik koşullarında yaptıkları bir çalışmada Töre yem bezelyesi çeşidinin ortalama yeşil ot veriminin 5215 kg/da olduğunu belirtmişlerdir. Bahsedilen farklılığın sebebi araştırmacıların sonbaharda ekim yapmasından kaynaklı olarak, bitkilerin daha uzun fotosentez süresine sahip olmaları ve daha az biyokütle üretmeleri ile ilgili olduğu belirtilebilmektedir. Konuk ve Tamkoç (2018), Konya’da yem bezelyesinin ekim zamanı ile ilgili yaptıkları bir çalışmada yazlık ekimlerdeki yaş ot veriminin 1453- 4444 kg/da arasında değiştiğini ifade etmişlerdir. Çalışmamız ile bahsedilen çalışma arasındaki farklılığın ekolojik koşullardan ileri geldiği belirtilebilmektedir. Kuru ot verimi bakımından çeşitler arasında istatistiksel açıdan bir fark bulunamamıştır. Yapılan benzer bir çalışmada araştırmacılar, yem bezelyesinde kuru ot verimini 204-398 kg/da olarak tespit etmişlerdir (Temel ve Yazıcı, 2021). Temel vd. (2021) ise yazlık olarak ekilen yem bezelyesi ile ilgili yaptıkları çalışmada kuru ot veriminin 288-372 kg/da arasında değiştiğini belirtmişlerdir. Çaçan vd (2019) ise kuru ot veriminin 129-232 kg/da arasında değiştiğini belirtmişlerdir. Çalışmada en fazla dal sayısına sahip çeşit Gölyazı (5 adet) olurken, en düşük dal sayısına sahip çeşit Taşkent (2.10 adet) olmuştur. Yapılan benzer çalışmalarda dal sayısının, Tan ve Kadioğlu (2018) 2-3.7 adet arasında; Ateş ve Tekeli (2017) 4-6 adet arasında; Temel ve Yazıcı (2021) 2.1-3 adet arasında değişim gösterdiğini bildirmişlerdir. Çeşitler arasında bakla sayısı 7.15-12.55 adet arasında değişmiş ve yüksek bakla sayısına SBTÜ 1002 hattı sahip olmuştur. Diğer çeşitler istatistiksel

açından aynı grupta yer almıştır. Bezelye ile yapılan çalışmalarda bitkideki bakla sayısının 7.6-18.5 adet arasında değiştiği belirtilmiştir (Uzun ve Açıkgöz, 1998; Uzun vd., 2005; Tamkoç, 2007; Sayar vd., 2009).

Tablo 4. Yem bezelyesi genotiplerinde incelenen özelliklere ait korelasyon katsayıları*

	ÇGS	İBGS	DBB	ASU	YOV	KOV	DS	BS
ÇGS	1.0000	0.8768**	0.6663**	0.3476	-0.1166	-0.1589	-0.0762	-0.5741
İBGS		1.0000	0.5164**	0.2377	-0.1882	-0.1931	0.1436	-0.7374**
DBB			1.0000	0.4515*	0.1817	0.2287	0.0920	-0.2859
ASU				1.0000	0.4708*	0.4526*	0.5180**	-0.1532
YOV					1.0000	0.9413**	0.3774	0.3140
KOV						1.0000	0.4545*	0.2917
DS							1.0000	-0.0684
BS								1.0000

ÇGS: Çiçeklenme gün sayısı, İBGS: İlk bakla bağlama gün sayısı, DBB: Doğal bitki boyu, ASU: Ana sap uzunluğu, YOV: Yeşil ot verimi, KOV: Kuru ot verimi, DS: Dal sayısı, BS: Bakla sayısı, *: 0.05 düzeyinde önemli, **: 0.01 düzeyinde önemli

İncelenen özellikler arasındaki korelasyon katsayıları Tablo 4’te verilmiştir. Tablo 4’e göre çiçeklenme gün sayısı ile ilk bakla yüksekliği (0.8768) arasında %1 düzeyinde önemli ve anlamlı bir korelasyon saptanmıştır. Doğal bitki boyu ile çiçeklenme gün sayısı (0.6663) ve ilk bakla bağlama gün sayısı (0.5164) arasında pozitif ve %1 düzeyinde önemli bir ilişki belirlenmiştir. Ana sap uzunluğu ile doğal bitki boyu arasında (0.4515) arasında pozitif ve %5 düzeyinde önemli bir korelasyon bulunmuştur. Yaş ot verimi ile ana sap uzunluğu arasında (0.4708) pozitif ve önemli düzeyde (%5) ilişki belirlenmiştir. Bunun yanında kuru ot verimi ile ana sap uzunluğu arasında pozitif ve %5 düzeyinde, yaş ot verimi ile (0.9413) pozitif ve %1 düzeyinde önemli bir korelasyon bulunmuştur. Dal sayısı ile ana sap uzunluğu arasında (0.5180) %1 düzeyinde, kuru ot verimi ile (0.4545) %5 düzeyinde pozitif bir korelasyon belirlenmiştir. Bakla sayısı ile ilk bakla gün sayısı arasında ise (-0.7374) negatif ve önemli düzeyde (%1) ilişki belirlenmiştir.

SONUÇ VE ÖNERİLER

Elde edilen sonuçlar bir bütün olarak değerlendirildiğinde, yem bezelyesinin yaş veya kuru ot için üretiminde GAP Pembesi, Taşkent, Kirazlı, Töre Gölyazı çeşitlerinin kullanılabilirliği belirlenmiştir. Sivas Bilim ve Teknoloji Üniversitesi tarafından ıslah çalışmalarında kullanılmak üzere geliştirilen SBTÜ 1002 çeşit adayının ot verimi bakımından önemli bir potansiyel taşıdığı tespit edilmiştir.

KAYNAKLAR

- Açıkgöz, E., Hatipoğlu, R., Altınok, S., Sancak, C., Tan, A., Uraz, D. (2005). Yem bitkileri üretimi ve sorunları. *Türkiye Ziraat Mühendisliği VI. Teknik Kongresi*, 503(518), 3-7.
- Alçıçek, A., Karaayvaz, B.K. (2002). Çiftçi koşullarında silo yemi yapımında karşılaşılan sorunlar ve çözüm önerileri. *TC Tarım ve Köyişleri Bakanlığı, Ege Tarımsal Araştırma Enstitüsü Müdürlüğü*, 106, 136-147.
- Alçıçek, A., Karaayvaz, K. (2003). Sığır besisinde mısır silajı kullanımı. *Animalia*, 20(3), 18-76.
- Ateş, E., Tekeli, A.S. (2017). Farklı taban gübresi uygulamalarının yem bezelyesi (*Pisum arvense* L.)'nin ot verimi ve kalitesine etkisi. *Kahramanmaraş Sütçü İmam Üniversitesi Doğa Bilimleri Dergisi*, 20, 13-16.
- Çaçan, E., Kökten, K., Bakoğlu, A., Kaplan, M., Bozkurt, A. (2019). Evaluation of some forage pea (*Pisum arvense* L.) lines and cultivars in terms of herbage yield and quality. *Harran Tarım ve Gıda Bilimleri Dergisi*, 23(3), 254-262.
- Çeri, S., Acar, R. (2019). Serin iklim tahıllarının hayvan beslemede yeşil ve kuru ot olarak kullanımı. *Bahri Dağdaş Bitkisel Araştırma Dergisi*, 8(1), 178-194.
- Fraser, M.D., Fychan, R., Jones, R. (2001). The effect of harvest date and inoculation on the yield, fermentation characteristics and feeding value of forage pea and field bean silages. *Grass and Forage Science*, 56(3), 218-230.
- Gümüş, E. (2018). Buzağılarda preruminant dönem beslenmesinin rumen gelişimi üzerine etkisi. *Atatürk Üniversitesi Veteriner Bilimleri Dergisi*, 13(1), 98-105.
- Koivisto, J.M., Benjamin, L.R., Lane, G.P.F., Davies, W.P. (2003). Forage potential of semi-leafless grain peas, *Grass and Forage Science*. 58, 220-223.
- Konuk, A., Tamkoç, A. (2018). Yem bezelyesinde kışlık ve yazlık ekimin bazı tarımsal özellikler üzerine etkisi. *Bahri Dağdaş Bitkisel Araştırma Dergisi*, 7(1), 39-50.
- Özdemir, B., Tamkoç, A. (2019). İkinci ürün için uygun olan yem bezelyesi hatlarının belirlenmesi. *Bahri Dağdaş Bitkisel Araştırma Dergisi*, 8(2), 299-305.
- SAS Institute, 2011, Base SAS 9.3 Procedures Guide (computer program), 536 p.
- Sayar, M. (2021). Yem bezelyesi tarımı ve GAP Pembesi yem bezelyesi çeşidinin önemli tarımsal özellikleri. *Dicle Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 10(1), 85-94.
- Sayar, M. S., Anlarsal, A. E., Açıkgöz, E., Başbağ, M., Gül, İ. (2009). Diyarbakır koşullarında bazı yem bezelyesi (*Pisum arvense* L.) hatlarının verim ve verim unsurlarının belirlenmesi. *Türkiye VIII. Tarla Bitkileri Kongresi*, 19(22), 646-650.
- Seydoşoğlu, S. (2013). Diyarbakır ekolojik koşullarında bazı yem bezelyesi (*Pisum sativum* L.) genotiplerinin verim ve verim unsurları. *Türk Doğa ve Fen Dergisi*, 2(2), 21-27.
- Seydoşoğlu, S. (2019). Farklı oranlarda karıştırılan yem bezelyesi (*Pisum sativum* L.) ve arpa (*Hordeum vulgare* L.) hâsıllarının silaj ve yem kalitesine etkisi. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 56(3), 297-302.
- Tamkoç, A. (2007). Kışlık olarak ekilen yem bezelyesi hatlarının verim ve bazı bitkisel özellikleri. *Türkiye VII. Tarla Bitkileri Kongresi. Çayır Mera, Yem Bitkileri ve Endüstri Bitkileri*. 95-97. 25-27 Haziran 2007, Erzurum.
- Tan, M., Kadioğlu, S. (2018). Erzurum şartlarında bazı yem bezelyesi hat ve çeşitlerinin tohum verimleri ile bazı özelliklerinin belirlenmesi. *Atatürk Üniversitesi Ziraat Fakültesi Dergisi*, 49(2), 143-149.
- Tan, M., Koç, A., Çomaklı, B., Elkoca, E. (2011). Doğu Anadolu Bölgesinden toplanan yem bezelyesi popülasyonlarının bazı özellikleri. *Uluslararası Katılımlı I. Ali Numan Kıraç Tarım Kongresi ve Fuarı*, 27- 30 Nisan 2011, Eskişehir, 161-167.

- Tan, M., Mentese, Ö. (2003). Yem bitkilerinde anatomik yapı ve kimyasal kompozisyonun besleme değerine etkileri. *Atatürk Üniversitesi Ziraat Fakültesi Dergisi*, 34(1), 97-103.
- Tekeli, A.S., Ateş, E. (2003). Yield and its components in field pea (*Pisum arvense* L.) lines. *Journal of Central European Agriculture*, 4(4), 313-317.
- Temel, S. Keskin, B., Tosun, R., Çakmakçı, S. (2021). Yazlık olarak ekilen yem bezelyesi çeşitlerinde ot verim ve kalite performanslarının belirlenmesi. *Türk Tarım ve Doğa Bilimleri Dergisi*, 8(2), 411-419.
- Temel, S., Yazıcı, E. (2021). Ağrı-Eleşkirt koşullarında yazlık olarak farklı zamanlarda ekilen yem bezelyesi çeşitlerinin ot verimi ve bazı kalite özelliklerinin belirlenmesi. *Uluslararası Tarım ve Yaban Hayatı Bilimleri Dergisi*, 7(2), 306-314.
- Uzun, A., Açıkgöz, E. (1998). Effect of sowing season and seeding rate on the morphological traits and yields in pea cultivars of differing leaf types. *Journal of Agronomy and Crop Science*, 181(4), 215-222.
- Uzun, A., Bilgili, U., Sincik M., Filya, I., Açıkgöz, E. (2005). Yield and quality of forage type pea lines of contrasting leaf types. *European Journal of Agronomy*, 22(1), 85-94.
- Yılmaz, A., Yenice, E., Yavaş, İ., Çenesiz, A. (2020). Hayvan beslemede mevcut durum ve gelecek. *Türkiye Ziraat Mühendisliği IX. Teknik Kongresi Bildiriler Kitabı-2*, 261.

**MICROELEMENT CONTENTS OF SOME ALFALFA (*Medicago sativa* L.)
CULTIVARS**

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ABSTRACT

This study was conducted to determine and compare the some microelement contents of alfalfa cultivars. A total of 16 alfalfa cultivars were used as plant material in the study. Fe, Cu, Zn and Cu contents of microelements were investigated in this 16 alfalfa cultivars. Microelement contents of alfalfa samples taken from the second harvest of the third year of experiment, and was determined with the help of an ICP-MS device. It was determined that the differences among the microelement contents of cultivars were statistically significant. The Fe contents of alfalfa cultivars varied between 208-307 mg kg⁻¹, Cu contents 26.3-38.1 mg kg⁻¹, Zn contents 24.9-50.1 mg kg⁻¹ and Mn contents 30.4-49.0 mg kg⁻¹. It has been determined that these contents are within the limit values that should be in plants. In addition, as a result of the correlation analysis, it was seen that there was a statistically significant and positive relationship between Mn and Cu and Mn and Zn.

Keywords: *Medicago sativa*, iron, copper, zinc, manganese

Introduction

Alfalfa is considered the most important forage plant globally due to its high adaptability, high yield and quality, and lots of cutting (Bhattarai et al., 2021). It is cultivated on 35 million hectares of land in many continents and more than 80 countries around the World (Radovic et al., 2009). Alfalfa cultivation is done in every region of Turkey and it is known as the queen of forage crops in Turkey because it is a very valuable forage plant (Tongel and Ayan, 2010).

One of the most important features of alfalfa is that it contains protein, energy, vitamin, and mineral substances for farm animals (Bouton, 2001). Among the mineral substances, those that are needed more than 100 ppm are called macro elements (Ca, Mg, P, K, Na, Cl, and S), those that are needed below this amount are called micro minerals (Fe, Cu, Zn, Mn, I, Co, Se, Cr, Fl, Pb, V, As, Mo, Li, Si, Sn, Ni, and Br) (Kutlu et al. 2005). These minerals are present in different amounts and ratios both in animal tissues and in all feeds.

The mineral content of alfalfa is generally satisfactory, and it has high yield and quality thanks to the presence of useful elements (Gjoroska et al., 2019). The mineral content of alfalfa may differ according to the cultivars (Tongel and Ayan, 2010). For this reason, this study was carried out to determine and compare the microelement contents of some alfalfa cultivars.

Material and Methods

Material

A total of 16 cultivars were used as material in the study. The seeds of the cultivars used in the research were obtained from some public and private institutions (Table 1).

Table 1. Alfalfa cultivars used in the study

1	Alsancak	9	Magnum-V
2	Basbag	10	Nimet
3	Bilensoy 80	11	Omerbey
4	Elci	12	Ozpinar
5	Gea	13	Savas
6	Gozlu-1	14	Sunter
7	Kayseri	15	Verdor
8	Magna-601	16	Verko

The research was carried out in irrigated conditions at Bingol University Agricultural Application and Research Center in 2014-2016. The Agricultural Application and Research Center is 15 km away from the city center of Bingol, and its area is 1091 m above sea level.

Climate data were obtained from the Bingol Provincial Meteorology Directorate. The average temperature of the province of Bingol for long years (1990-2015) was 12.3 °C, the precipitation

amount was 917.8 mm, and the humidity was 56.6%. July and August are the months when the temperature is the highest, the precipitation and humidity are the lowest. It has been recorded that most of the precipitation falls in the winter months and the lowest temperature values and the highest humidity values are obtained from these months.

According to the results of the analysis made in the Soil-Plant Analysis Laboratory of the Faculty of Agriculture of Bingol University; the soil structure of the experimental area was loamy (saturation 43.31%), pH slightly acidic (6.37), salt-free (0.0066%), organic matter content was low (1.26%), slightly calcareous (0.15%), potassium content was low (24.45 kg da⁻¹) and phosphorus rate was found to be medium (7.91 kg da⁻¹).

Method

The experiment was conducted in randomized blocks design with three replications between 2014 and 2016. In the experiments, the plot length was 5 m, the spacing between the rows was 20 cm and the sowing was done with the help of a hand marker, with 6 rows in each plot. Seeds of 3 kg per decare were used in sowing. Before sowing, 4 kg of nitrogen (N) and 10 kg of phosphorus (P₂O₅) fertilizer were given over the pure substance per decare (Basbag et al., 2009). Irrigation of the experiment was done by sprinkler irrigation. The harvest was done in the period when the plots were 10% flowering (Avcioglu et al., 2009), and 3 harvests were made in the first year and 4 in the other years in experiment.

Plant samples were taken in the third year of experiment and before the second cutting. 0.5 kg samples were taken from the green forage samples harvested from each plot and dried in the drying oven at 70 °C for 48 hours (Anonim, 2001). The dried forage samples were ground and made ready for analysis. Analyzes were made at Bingol University Central Laboratory Application and Research Center. In the study; Iron (Fe), Copper (Cu), Zinc (Zn), and Manganese (Mn) contents of microelements were determined in alfalfa cultivars. ICP-MS (Inductively Coupled Plasma-Mass Spectroscopy) device was used to determine the elemental contents of alfalfa cultivars. The findings obtained as a result of the study were applied to the analysis of variance by the randomized block design with three replications with the help of the JMP statistical package program. According to the results of the analysis of variance, statistically, significant means were compared with the Tukey test (JMP, 2018).

Results

Microelement contents of alfalfa cultivars

The contents of Fe, Cu, Zn, and Mn from microelements detected in alfalfa cultivars were given in Table 2. It was seen that the difference between the cultivars in terms of microelement contents was statistically significant. It was seen that the average Fe content was 250 mg kg⁻¹, Cu content was 32.3 mg kg⁻¹, Zn content was 37.4 mg kg⁻¹ and Mn content was 41.2 mg kg⁻¹ in alfalfa cultivars. The highest Fe content was obtained from Nimet, the highest Cu content was obtained from Omerbey, the highest Zn content was obtained from Magna-601 and the highest Mn content was obtained from Nimet cultivars. The lowest Fe content was obtained from Omerbey, the lowest Cu content was obtained from Kayseri, the lowest Zn content was obtained from Ozpinar and the lowest Mn content was obtained from Sunter (Table 2).

Table 2. Microelement contents of alfalfa cultivars

Cultivars	Fe (mg kg⁻¹)	Cu (mg kg⁻¹)	Zn (mg kg⁻¹)	Mn (mg kg⁻¹)
Alsancak	261 abc	29.7 cde	34.7 d-g	45.8 abc
Basbag	274 abc	30.7 b-e	34.9 d-g	42.9 a-d
Bilensoy 80	262 abc	30.4 b-e	28.6 fg	32.9 cd
Elci	234 bc	26.7 de	49.1 ab	42.1 a-d
Gea	237 bc	35.8 abc	30.9 efg	35.7 a-d
Gozlu-1	233 bc	29.6 cde	41.7 a-d	35.5 a-d
Kayseri	251 abc	26.3 e	40.5 a-e	38.9 a-d
Magna-601	232 bc	35.0 abc	50.1 a	48.7 ab
Magnum-V	254 abc	34.5 abc	46.1 abc	45.9 abc
Nimet	307 a	32.9 a-d	39.1 b-e	49.0 a
Omerbey	208 c	38.1 a	33.8 d-g	47.1 ab
Ozpinar	295 ab	30.5 b-e	24.9 g	34.7 bcd
Savas	241 abc	32.2 a-e	36.1 c-f	46.7 abc
Sunter	252 abc	32.1 a-e	39.0 b-e	30.4 d
Verdor	228 bc	36.9 ab	35.5 def	40.7 a-d
Verko	237 bc	35.8 abc	33.5 d-g	42.0 a-d
Average	250	32.3	37.4	41.2
Significant	**	*	**	**
CV (%)	8.8	12.1	9.0	11.2

*: $P \leq 0.05$, **: $P \leq 0.01$, CV: Coefficient of variation

In alfalfa, Fe content should be between 20-400 mg kg⁻¹, Cu content should be between 5-50 mg kg⁻¹, Zn content should be between 10-100 mg kg⁻¹ and Mn content should be between 20-250 mg kg⁻¹ (Jones, 1967).

In alfalfa cultivars, Fe contents varied between 208-307 mg kg⁻¹, Cu content between 26.3-38.1 mg kg⁻¹, Zn contents between 24.9-50.1 mg kg⁻¹ and Mn contents between 30.4-49.0 mg kg⁻¹

(Table 2). It was seen that the Fe, Cu, Zn and Mn contents obtained in alfalfa cultivars were within the limit values determined by Jones (1967).

In the previous studies; it was reported the Fe content as 185.38-275.06 mg kg⁻¹, Cu content as 14.50-16.16 mg kg⁻¹, Zn content as 23.37-33.26 mg kg⁻¹ and Mn content as 43.55-54.27 mg kg⁻¹ in Serbia by Marković et al. (2009). It was reported the Fe content as 104.7 mg kg⁻¹, Cu content 4.3 mg kg⁻¹, Zn content as 13.5 mg kg⁻¹ and Mn content as 23.5 mg kg⁻¹ in Serbia by Zivkov-Balos et al. (2011). It was reported the Cu content as 3.9 mg kg⁻¹, Zn content as 11.8 mg kg⁻¹ and Mn content as 25.1 mg kg⁻¹ in Turkey by Cevheri et al.(2013). It was reported the Cu content as 8.86 ppm, Zn content as 19.21 ppm and Mn content as 27.11 ppm in Turkey by Gürsoy and Macit (2017). It was determined Fe content as 213-491 mg kg⁻¹, Cu content as 4-5 mg kg⁻¹, Zn content as 16-21 mg kg⁻¹ and Mn content as 20-26 mg kg⁻¹ in North Macedonia by Gjoroska et al. (2019).

It was seen that these results obtained in previous studies were within the limits given by Jones (1967) similar to the results of the study.

Correlation analysis between microelement contents of alfalfa cultivars

The correlation analysis between microelement contents of alfalfa cultivars was given in Table 3. It was seen that there was a positive and significant relationship between Mn and Cu, and between Mn and Zn in alfalfa cultivars. There is a negative relationship between Fe and Cu, Fe and Zn, and Zn and Cu, and a positive relationship between Fe and Mn. However, these relationships are statistically insignificant (Table 2). It was reported by other researchers that there was a significant relationship between Fe and Mn in some alfalfa cultivars and genotypes (Sengul and Haliloglu, 2008).

Table 3. Correlation analysis of microelement contents of cultivars

	Fe (mg kg ⁻¹)	Cu (mg kg ⁻¹)	Zn (mg kg ⁻¹)
Cu (mg kg ⁻¹)	-0.0844	---	---
Zn (mg kg ⁻¹)	-0.2605	-0.1473	---
Mn (mg kg ⁻¹)	0.0483	0.3201*	0.3207*

*: $P \leq 0.05$

Conclusion

In this study, the lowest and highest values of microelement contents were determined in different cultivars. it was determined that the Fe, Cu, Zn and Mn contents of alfalfa cultivars were within the limit values. In addition, as a result of the correlation analysis, it was seen that there was a statistically significant and positive relationship between Mn and Cu, and Mn and Zn.

References

- Anonim (2001). Tarımsal değerleri ölçme denemeleri teknik talimatı, yonca türleri (*Medicago* L. species). Tarım ve Köyişleri Bakanlığı, Tohumluk Tescil ve Sertifikasyon Merkezi Müdürlüğü Yayınları, s.5, Ankara
- Avcıoğlu R, Hatipoğlu R, Karadağ Y (2009). Baklagil yem bitkileri Cilt II. Tarım ve Köyişleri Bakanlığı, Tarımsal Üretim ve Geliştirme Genel Müdürlüğü, İzmir
- Basbag, M., Demirel, R., & Avcı, M. (2009). Determination of some agronomical and quality properties of wild alfalfa (*Medicago sativa* L.) clones in Turkey. *Journal of Food, Agriculture and Environment*, 7(2), 357-359.
- Bhattarai S, Liu N, Karunakaran C, Tanino K K, Fu Y B, Coulman B, Warkentin T, Biligetu B (2021). Tissue specific changes in elements and organic compounds of alfalfa (*Medicago sativa* L.) cultivars differing in salt tolerance under salt stress. *Journal of Plant Physiology* 264: 153485
- Bouton JH (2001). Alfalfa. XIX International Grassland Congress, February 11-21, Brazil
- Cevheri C, Küçük Ç, Avcı M, Atamov V (2013). Element content, botanical composition and nutritional characteristics of natural forage of Şanlıurfa, Turkey. *Journal of Food, Agriculture and Environment* 11(3-4): 790-794
- Gjoroska V B, Krstik M, Gudeva LK, Cvetanovska L (2019). Determination of mineral composition in the alfalfa (*Medicago sativa* L.) collected from different regions in the Republic of North Macedonia. *Journal of Agriculture and Plant Sciences* 17(1): 57-65
- Gürsoy E, Macit M (2017). Determination of mineral contents of some legume and cereal forages grown as naturally in pastures of Erzurum province. *Alinteri Journal of Agricultural Sciences*, 32(1): 1-9 <https://doi.org/10.28955/alinterizbd.279756>
- JMP (2018). Statistical Discovery from SAS, USA
- Jones J B J (1967). Interpretation of plant analysis for several agronomic crops. In: Soil Testing and Plant Analysis Part II. Plant Analysis. Soil Science Society of America, Inc, Publisher Madison, Wisconsin, USA
- Kutlu H R, Görgülü M, Baykal Çelik L (2005). Genel hayvan besleme. Çukurova Üniversitesi ZM-208 Ders Notu, Adana
- Marković J, Štrbanović R, Cvetković M, Anđelković B, Živković B (2009). Effects of growth stage on the mineral concentrations in alfalfa (*Medicago sativa* L.) leaf, stem and the whole plant. *Biotechnology in Animal Husbandry* 25(5-6): 1225-1231
- Radovic J, Sokolovic D, Markovic J (2009). Alfalfa-most important perennial forage legume in animal husbandry. *Biotechnology in Animal Husbandry* 25(5-6): 465-475 <https://doi.org/10.2298/bah0906465r>
- Sengul S, Haliloglu K (2008). Determination of mineral concentration and cell-wall energy content of some alfalfa cultivars and genotypes (*Medicago sativa* L.). *Asian Journal of Chemistry* 20(4): 3231-3240
- Tongel M O, Ayan I (2010). Nutritional contents and yield performances of lucerne (*Medicago sativa* L.) cultivars in southern Black Sea shores. *Journal of Animal and Veterinary Advances* 9(15): 2067-2073
- Zivkov-Balos M, Mihaljev Z, Cupic Z (2011). Content of trace elements and some radionuclides in lucerne (*Medicago sativa*). *Biotechnology in Animal Husbandry* 27(3): 591-598 <https://doi.org/10.2298/bah1103591z>

**MICROELEMENT CONTENTS OF ALFALFA (*Medicago sativa* L.) POPULATIONS
CULTIVATED IN THE EASTERN ANATOLIAN REGION OF TURKEY**

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ABSTRACT

This study was conducted to determine and compare the microelement contents of alfalfa populations cultivated in the Eastern Anatolian Region. A total of 29 alfalfa populations were used as plant material in the study. Fe, Cu, Zn and Cu contents were investigated in these 29 alfalfa populations. Microelement contents of alfalfa samples taken from the second harvest of the third year of experiment, and was determined with the help of an ICP-MS device. It was determined that the differences among the microelement contents of populations were statistically significant. The Fe contents of alfalfa populations varied between 209-621 mg kg⁻¹, Cu contents 12.3-29.2 mg kg⁻¹, Zn contents 17.6-80.4 mg kg⁻¹ and Mn contents 18.8-60.9 mg kg⁻¹. In the study, it was determined that the Fe content of some of the alfalfa populations was above the limit values and only Cu content of one population (Celtiksuyu-1) was below the limit value. It was determined that the Fe and Cu contents of the remaining populations and the Zn and Mn contents of all populations were within the limit values that should be in alfalfa.

Keywords: *Medicago sativa*, iron, copper, zinc, manganese

Introduction

In our country, there is a livestock population equivalent to 19 million animal units (AU) and the amount of roughage required for these animals is 86 million tons (Acar et al., 2020). The roughage needs of our current livestock population are met through pasture and meadow areas, and forage crops grown in field fields. Among the forage crops, alfalfa is one of the most commonly grown plants for agriculture both worldwide and in our country.

The highest quality roughage used in animal feeding is alfalfa, and it is grown in many countries around the world. In our country, alfalfa cultivation is mainly carried out with populations. Although there are improved varieties of alfalfa, their numbers are limited (Oten and Albayrak, 2014).

Local varieties (populations) that have emerged through conscious and natural selection over thousands of years and have a great genetic diversity are very valuable materials for breeding programs. With the development of commercial varieties that have high yields, populations are facing the danger of extinction. Therefore, it is necessary to conserve and develop local varieties (Ertus et al., 2012).

In our country and the world, many studies have been carried out to determine the forage yield and quality of alfalfa (Cacan et al. 2018, 2020; Karayilanli and Ayhan, 2016; Singh and Garg, 2015; Turan et al., 2017), as well as to determine the element contents (Engin and Mut, 2018; Ferreira et al., 2015; Gjoroska et al., 2019; Touil et al., 2009). However, the studies on the nutrient content of the alfalfa populations grown in our region is insufficient. For this reason, this study was conducted to determine and compare the microelement contents of some alfalfa populations cultivated in the Eastern Anatolian Region.

Material and Methods

Material

A total of 29 populations were used as material in the study. Seeds belonging to the populations were obtained from producers engaged in alfalfa cultivation in the villages and neighborhoods of Bingol and Mus provinces and their districts. The populations were named after the village or neighborhood where were taken. Populations taken from the same village but different farmers were numbered within themselves (Celtiksuyu, Mesedali, Saricicek, Sungu, and Senkoy) (Table 1).

The research was carried out in irrigated conditions at Bingol University, Vocational School of Genc, Agricultural Application and Research Area in 2016-2018. The Genc district is 20 km

away from the city center of Bingol, and its area is 986 m above sea level. The research area is located at the coordinates of 38° 44' 58.41" north latitude and 40° 32' 15.29" east longitude.

Climate data were obtained from the Bingol Provincial Meteorology Directorate. The average temperature of the province of Bingol for long years (1990-2015) was 12.3 °C, the precipitation amount was 917.8 mm, and the humidity was 56.6%. July and August are the months when the temperature is the highest, the precipitation and humidity are the lowest. It has been recorded that most of the precipitation falls in the winter months and the lowest temperature values and the highest humidity values are obtained from these months.

Table 1. Alfalfa populations used in the study

1	Bingol-Arslanbeyli	16	Bingol-Saricicek-1
2	Bingol-Bagliisa	17	Bingol-Saricicek-2
3	Bingol-Celtiksuyu-1	18	Bingol-Saricicek-3
4	Bingol-Celtiksuyu-2	19	Bingol-Senkoy-1
5	Bingol-Celtiksuyu-3	20	Bingol-Senkoy-2
6	Bingol-Cevirme	21	Bingol-Servi
7	Bingol-Garip	22	Bingol-Taslicay
8	Bingol-Kadran	23	Bingol-Yelesen
9	Bingol-Kucuktekoren	24	Mus-Sungu-1
10	Bingol-Kultur	25	Mus-Sungu-2
11	Bingol-Kumgecit	26	Mus-Sungu-3
12	Bingol-Mesedali-1	27	Mus-Ucdere
13	Bingol-Mesedali-2	28	Mus-Varto
14	Bingol-Mutluca	29	Mus-Ziyaret
15	Bingol-Ortakoy		

According to the results of the analysis made in the Soil-Plant Analysis Laboratory of the Faculty of Agriculture of Bingol University; the soil structure of the experimental area was sandy (59.5%), slightly alkaline (pH: 7.26), unsalted (0.34 mS cm⁻¹), organic matter content was medium (2.1%) and calcareous (3.48%), potassium (43.6 kg da⁻¹) and phosphorus contents were found to be low (5.1 kg da⁻¹).

Method

The experiment was conducted in randomized blocks design with three replications between 2016 and 2018. In the experiment, the plot length was 5 m, the spacing between the rows was 20 cm and the sowing was done with the help of a hand marker, with 6 rows in each plot. Seeds of 3 kg per decare were used in sowing. Before sowing, 4 kg of nitrogen (N) and 10 kg of phosphorus (P₂O₅) fertilizer were given over the pure substance per decare (Basbag et al., 2009). Irrigation of the experiment was done by sprinkler irrigation. The harvest was done in

the period when the plots were 10% flowering (Avcioglu et al., 2009), and 3 harvests were made in the first year and 4 in the other years in experiment.

Plant samples were taken in the third year of experiment and before the second cutting. 0.5 kg samples were taken from the green forage samples harvested from each plot and dried in the drying oven at 70 °C for 48 hours (Anonim, 2001). The dried forage samples were ground and made ready for analysis. Analyzes were made at Bingol University Central Laboratory Application and Research Center. In the study; Iron (Fe), Copper (Cu), Zinc (Zn), and Manganese (Mn) contents of microelements were determined in alfalfa populations. ICP-MS (Inductively Coupled Plasma-Mass Spectroscopy) device was used to determine the elemental contents of alfalfa populations.

The findings obtained as a result of the study were applied to the analysis of variance by the randomized block design with three replications with the help of the JMP statistical package program. According to the results of the analysis of variance, statistically, significant means were compared with the Tukey test (JMP, 2018).

Results

Microelement contents of alfalfa populations

The contents of Fe, Cu, Zn, and Mn from microelements detected in alfalfa populations were given in Table 2. It was seen that the difference between the populations in terms of microelement contents was statistically significant.

In terms of microelement contents, it was seen that Fe content was 377 mg kg⁻¹, Cu content was 21.4 mg kg⁻¹, Zn content was 35.7 mg kg⁻¹ and Mn content was 41.5 mg kg⁻¹ in alfalfa populations. The highest Fe content was obtained from Garip, the lowest Fe content was obtained from Cevirme and Saricicek-1, the highest Cu content was obtained from Arslanbeyli and Varto and the lowest Cu content was obtained from Sungu-3 populations. The highest Zn content was obtained from Ucdere, the lowest Zn content was obtained from Celtiksuyu-3, the highest Mn content was obtained from Kucuktekoren, and the lowest Mn content was obtained from Celtiksuyu-1 populations (Table 2).

In alfalfa, Fe content should be between 20-400 mg kg⁻¹, Cu content should be between 5-50 mg kg⁻¹, Zn content should be between 10-100 mg kg⁻¹ and Mn content should be between 20-250 mg kg⁻¹ (Jones, 1967).

In alfalfa populations, Fe contents varied between 209-621 mg kg⁻¹, Cu content between 12.3-29.2 mg kg⁻¹, Zn contents between 17.6-80.4 mg kg⁻¹ and Mn contents between 18.8-60.9 mg kg⁻¹ (Table 2). It was seen that the Cu and Zn contents obtained in alfalfa populations were within the limit values reported by Jones (1967). However, the Fe contents of Arslanbeyli,

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Celtiksuyu-2, Garip, Kadran, Kucuktekoren, Kultur Mesedali-1, Mesedali-2, Servi, Senkoy-2 and Ucdere populations were found to be above the limit values reported by Jones (1967), and the Cu content of Celtiksuyu-1 was below the limit values reported by Jones (1967).

Table 2. Microelement contents of alfalfa populations

Populations	Fe (mg kg ⁻¹)	Cu (mg kg ⁻¹)	Zn (mg kg ⁻¹)	Mn (mg kg ⁻¹)
Arslanbeyli	505 a-e	29.2 a	31.3 cde	47.2 a-e
Bagliisa	281 hij	26.1 a-d	24.6 c-f	42.9 b-g
Celtiksuyu-1	340 e-j	18.3 g-j	23.1 c-f	18.8 j
Celtiksuyu-2	432 c-h	18.3 g-j	20.7 def	22.1 ij
Celtiksuyu-3	347 e-j	17.9 g-j	17.6 f	37.7 d-i
Cevirme	216 j	14.1 jk	31.3 cde	32.1 e-j
Garip	621 a	22.5 c-g	24.9 c-f	49.0 a-e
Kadran	601 ab	21.7 d-h	27.5 c-f	56.5 abc
Kumgecit	388 d-i	19.6 f-i	21.2 c-f	53.3 a-d
Kucuktekoren	530 a-d	21.7 d-h	27.7 c-f	60.9 a
Kultur	538 a-d	20.4 e-i	26.7 c-f	58.5 ab
Mesedali-1	577 abc	23.7 b-f	27.4 c-f	48.8 a-e
Mesedali-2	477 a-f	25.2 a-d	26.5 c-f	53.7 a-d
Mutluca	240 ij	27.4 ab	30.2 c-f	43.9 a-f
Ortakoy	274 hij	16.5 ijk	32.3 cd	23.7 hij
Saricicek-1	209 j	16.0 ijk	23.1 c-f	21.0 ij
Saricicek-2	324 f-j	17.9 g-j	25.0 c-f	26.6 f-j
Saricicek-3	342 e-j	17.1 h-k	22.4 c-f	22.6 ij
Servi	423 c-h	26.8 abc	27.3 c-f	58.5 ab
Sungu-1	309 f-j	19.4 f-i	73.5 ab	48.7 a-e
Sungu-2	307 g-j	13.5 jk	75.2 ab	41.0 c-h
Sungu-3	336 f-j	12.3 k	72.7 ab	41.0 c-h
Senkoy-1	353 e-j	23.6 b-f	19.5 ef	38.4 d-i
Senkoy-2	405 d-i	25.0 a-e	24.1 c-f	50.9 a-d
Taslicay	349 e-j	25.7 a-d	27.9 c-f	54.1 a-d
Ucdere	451 b-g	28.2 ab	80.4 a	44.0 a-f
Varto	251 ij	29.2 a	64.4 b	40.3 c-h
Yelesen	246 ij	17.1 h-k	33.7 c	26.0 g-j
Ziyaret	270 hij	27.1 abc	74.5 ab	40.5 c-h
Average	377	21.4	35.7	41.5
Significant	**	**	**	**
CV (%)	13.9	6.9	11.0	13.1

***P*≤0.01, CV: Coefficient of variation

In previous studies, the Fe content of alfalfa was reported as 60 ppm, Cu content as 48.5 ppm, Zn content as 40.0 ppm, and Mn content as 35.0 ppm by Yildirim et al. (2006). Juknevicus and Sabiene (2007) reported the Cu content as 5.10 mg kg⁻¹ and Zn content as 18.0 mg kg⁻¹ in alfalfa. Dugalic et al. (2008) reported the Fe content as 201.7 mg kg⁻¹, Zn content as 32.3 mg

kg⁻¹, and Mn content as 72.5 mg kg⁻¹ in alfalfa. Sosnowski et al. (2014) reported the Cu content as 6.39 mg kg⁻¹, Zn content as 23.7 mg kg⁻¹, and Mn content as 47.8 mg kg⁻¹ in alfalfa. Petkovic et al. (2019) reported the Fe content as 113-417 mg kg⁻¹, Cu content as 6.41-7.19 mg kg⁻¹, and Mn content as 26.17-54.65 mg kg⁻¹ in alfalfa. Lakic et al. (2020) reported the Fe content as 76-132 mg kg⁻¹, Cu content as 3.0-9.6 mg kg⁻¹, Zn content as 18-23 mg kg⁻¹, and Mn content as 16-22 mg kg⁻¹ in alfalfa. Samoraj et al. (2023) reported the Cu content as 11.1 mg kg⁻¹, Zn content as 29.4 mg kg⁻¹, and Mn content as 32.2 mg kg⁻¹ in alfalfa. It was observed that these results were in line with the limits given by Jones (1967), which is similar to the findings of the present study.

Correlation analysis between microelement contents of alfalfa populations

The correlation analysis between microelement contents of alfalfa populations was given in Table 3. It was seen that there was a positive and significant relationship between Cu and Fe, between Mn and Fe, and between Mn and Cu in alfalfa populations. There was a negative relationship between Zn and Fe, and a positive relationship between Zn and Cu, and between Mn and Zn. However, these relationships were statistically insignificant (Table 3).

	Fe (mg kg ⁻¹)	Cu (mg kg ⁻¹)	Zn (mg kg ⁻¹)
Cu (mg kg ⁻¹)	0.2581*		
Zn (mg kg ⁻¹)	-0.2025	0.0424	
Mn (mg kg ⁻¹)	0.5306**	0.4867**	0.0710

*: $P \leq 0.05$, **: $P \leq 0.01$

Conclusion

In the study, it was determined that the Fe content of some of the alfalfa populations was above the limit values and only Cu content of one population (Celtiksuyu-1) was below the limit value. It was determined that the Fe and Cu contents of the remaining populations and the Zn and Mn contents of all populations were within the limit values that should be in alfalfa. In addition, as a result of the correlation analysis, it was seen that there was a positive and significant relationship between Cu and Fe, between Mn and Fe, and between Mn and Cu in alfalfa populations.

References

- Acar, Z., Tan, M., Ayan, İ., Önal Aşçı, Ö., Mut, H., Başaran, U., Gülümser, E., Can, M., & Kaymak, G. (2020). The situation of forage crops agriculture and its development opportunities in Turkey. Agricultural Engineers of Turkey IX. Technical Congress. 13-17 January Ankara, 529-553.
- Anonim (2001). Tarımsal değerleri ölçme denemeleri teknik talimatı, yonca türleri (*Medicago L. species*). Tarım ve Köyişleri Bakanlığı, Tohumluk Tescil ve Sertifikasyon Merkezi Müdürlüğü Yayınları, s.5, Ankara
- Avcıoğlu R, Hatipoğlu R, Karadağ Y (2009). Baklagil yem bitkileri Cilt II. Tarım ve Köyişleri Bakanlığı, Tarımsal Üretim ve Geliştirme Genel Müdürlüğü, İzmir
- Basbag, M., Demirel, R., & Avci, M. (2009). Determination of some agronomical and quality properties of wild alfalfa (*Medicago sativa L.*) clones in Turkey. Journal of Food, Agriculture and Environment, 7(2), 357-359.
- Cacan E, Kokten K, Kaplan M (2018). Determination of yield and quality characteristics of some alfalfa (*Medicago sativa L.*) cultivars in the east Anatolia region of Turkey and correlation analysis between these properties. Applied Ecology and Environmental Research, 16(2): 1185-1198 https://doi.org/10.15666/aeer/1602_11851198
- Cacan E, Kokten K, Seydosoglu S (2020). Determining the performance of alfalfa population collected from a narrow agroecological zone of Turkey. Ciencia Rural, 50(11): 1-11 <https://doi.org/10.1590/0103-8478cr20190721>
- Dugalić, G., Gajić, B., Katić, S., & Stevović, V. (2008). Influence of liming on yield and chemical composition of alfalfa on an acid soil. Source: Cereal Research Communications, 36(Supplement (VII. Alps-Adria Scientific Workshop)), 995-998. <https://doi.org/10.2307/90002874>
- Engin B, Mut H (2018). Variation of some nutrient contents with relative feed value according to cutting order in alfalfa (*Medicago sativa L.*) varieties. Journal of Tekirdag Agricultural Faculty, 15(02): 119-127
- Ertuş, M. M., Sabancı, C. O., & Zorer Çelebi, Ş. (2012). Determination of some characteristics of sainfoin (*Onobrychis sativa*) landraces grown in Van province. YYU J AGR. SCI, 22(3), 165-172.
- Ferreira J, Cornacchione M, Liu X, Suarez D (2015). Nutrient composition, forage parameters, and antioxidant capacity of alfalfa (*Medicago sativa, L.*) in response to saline irrigation water. Agriculture, 5(3): 577-597 <https://doi.org/10.3390/agriculture5030577>
- Gjoroska V B, Krstik M, Gudeva LK, Cvetanovska L (2019). Determination of mineral composition in the alfalfa (*Medicago sativa L.*) collected from different regions in the Republic of North Macedonia. Journal of Agriculture and Plant Sciences, 17(1): 57-65
- JMP (2018). Statistical Discovery from SAS, USA
- Juknevičius, S., & Sabienė, N. (2007). The content of mineral elements in some grasses and legumes. Ekologija, 53(1), 44-52.
- Jones J B J (1967). Interpretation of plant analysis for several agronomic crops. In: Soil Testing and Plant Analysis Part II. Plant Analysis. Soil Science Society of America, Inc, Publisher Madison, Wisconsin, USA
- Karayilanli E, Ayhan V (2016). Investigation of feed value of alfalfa (*Medicago sativa L.*) harvested at different maturity stages. Legume Research, 39(2): 237-247 <https://doi.org/10.18805/lr.v0iOF.9292>
- Lakić, Ž., Predić, T., Đurđić, I., & Popović, V. (2020). Recultivation of degraded soil due to mining activity without adding organic layers of soil using alfalfa and mixtures of grass legumes. Agriculture and Forestry, 66(4): 223-237. <https://doi.org/10.17707/AgricultForest.66.4.18>
- Petković, K., Manojlović, M., Čabilovski, R., Krstić, Đ., Lončarić, Z., & Lombnæs, P. (2019).

- Foliar application of selenium, zinc and copper in alfalfa (*Medicago sativa* L.) biofortification. Turkish Journal of Field Crops, 24(1): 81-90. <https://doi.org/10.17557/tjfc.569363>
- Oten, M., & Albayrak, S. (2014). Collection and characterization of alfalfa (*Medicago sativa* L.) in west Mediterranean coastal zone. Derim, 31(2), 79-88. <https://doi.org/10.16882/derim.2014.50249>
- Samoraj, M., Dmytryk, A., Tuhy, Ł., Zdunek, A., Rusek, P., Moustakas, K., & Chojnacka, K. (2023). Applicability of alfalfa and goldenrod residues after supercritical CO₂ extraction to plant micronutrient biosorption and renewable energy production. Energy, 262: 1-17. <https://doi.org/10.1016/j.energy.2022.125437>
- Singh D, Garg A K (2015). Performance of public and private sector developed lucerne (*Medicago sativa* L.) varieties for forage yield and quality. Range Management and Agroforestry, 36(2): 225-228
- Sosnowski, J., Jankowski, K., Wiśniewska-Kadzaj, B., Jankowska, J., & Kolczarek, R. (2014). Effect of the extract from *Ecklonia maxima* on selected micro-and macroelements in aerial biomass of hybrid alfalfa. Journal of Elementology, 19(1): 209-217. <https://doi.org/10.5601/jelem.2014.19.1.608>
- Touil L, Guesmi F, Farès K, Zagrouba C, Ferchichi A (2009). Mineral composition and genetic variability of some Mediterranean populations of the cultivated alfalfa (*Medicago sativa* L.) supported by morphological markers. Asian Journal of Plant Sciences, 8(1): 1-10 <https://doi.org/10.3923/ajps.2009.1.10>
- Turan N, Celen A E, Ozyazici M A (2017). Yield and quality characteristics of some alfalfa (*Medicago sativa* L.) varieties grown in the Eastern Turkey. Turkish Journal of Field Crops, 22(2): 160-165 <https://doi.org/10.17557/tjfc.356236>
- Yildirim N, Eryigit H, Erdal I (2006). Effect of alfalfa mosaic virus (AMV) on the content of some macro and micronutrients in alfalfa. Journal of Culture Collections, 5(1): 90-93.

**A REVIEW ON DETERMINATION OF PHYSICAL AND BIOCHEMICAL
CONTENTS OF SOME ARONIA (*Aronia* spp.) BERRY FRUIT SPECIES**

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Abstract

The Aronia genus (Rosaceae family, Maloideae subfamily) includes two species of native North American shrubs: *Aronia melanocarpa* (Michx.) Ell. (black chokeberry) and *Aronia arbutifolia* (L.) Pers. (red chokeberry). Its shrubs are around 1.8-3 meters, and the crown width is up to 0.9-1.5 meters. Aronia (*Aronia* spp.) species are mostly used as ornamental plants, but their berry fruits can also be consumed as fruit. Their fruits contain very rich tannins. Aronia, a significant berry fruit source of natural anthocyanin antioxidants, has shown a broad spectrum of biomedical functions. These contain cardiovascular disorders, advancing age-induced oxidative stress, inflammatory responses, and diverse degenerative diseases. Moreover, Aronia anthocyanins are demonstrated that improve neuronal and cognitive brain functions and ocular health. However, it is known that the protein content in its fruits is low. The fruits of *Aronia melanocarpa* have been traditionally used as folk medicine by Potawatomi Native Americans to cure many diseases such as colds. In the first half of the 20th century, cultivars of black chokeberry were introduced to the Soviet Union and other European countries, providing fruits used by the food industry. *Aronia* spp. is also used extensively in the production of fruit juice, food colorant, wine in Western Europe, Denmark, Poland, and Russia (especially Siberia). This study aims to give information about the botanical characteristics and distribution of the Aronia plant, its usage areas, and its benefits to human health.

Keywords: Aronia, Rosaceae, biochemical compounds, usage areas, human health

INTRODUCTION

Aronia (*Aronia* spp.) is a multi-stemmed, shrub-shaped and deciduous plant from the Rosaceae family native to Northeast America (Anonymous, 2017a). The fruits of *P. prunifolia* (purple aronia) are small, scarlet, purple-black, and slightly hairy berries. Red aronia bushes range in height from 1.8 to 3 meters, with crown widths ranging from 0.9 to 1.5 meters. These species typically grow upright. Although the majority of Aronia (*Aronia* spp.) species are grown for their decorative value, its berry fruits can also be eaten. Its fruits are high in tannins (Anonymous, 2017c). However, the protein level of the fruits is known to be poor. As a result, birds prefer not to consume its fruits. At the end of summer, the leaves on the branches turn true red, and the lowest sections of the leaves are hairy while the higher parts are vividly colored. The leaves are oval or elliptical in form, with serrated edges. In the New England region of America, they bloom in the first week of May. Its panicles of little white blooms measure 3.8 cm in diameter. It blooms for an extended period of time. In late September and early October, red ripe fruits emerge from its blossoms. Small fruits with a diameter of 0.64 cm are present in clusters. The fruits can keep their hardness, brightness, and attractiveness until December. There are usually two or three well-known species. One of them was grown in Europe. The most common type is *Sorbaronia mitschurinii* (Anonymous, 2017b). This species is related to *Aronia melanocarpa*. In recent years, regarding *Sorbaronia mitschurinii*, eminent pomologist Ivan Vladimirovich in Russia, has been working on crossbreeding. Black aronias are shorter than red aronias and peak economic efficiency at plant heights ranging from 1.2 to 4.8 meters. In terms of climate requirements, the aronia plant prefers sunny conditions. It can also grow in the shade, although the yield is reduced. They may grow in both moist and dry environments. They prefer acidic and neutral soils (pH 5.1-6.5), but can thrive in a variety of soils (pH 5-8.5). It is typically grown from seed. However, seedlings need to rest for 12-13 weeks. In the summer, semi-woody cuttings can be used to propagate it. Bastards can multiply when the plants are dormant at the end of fall and in winter (Anonymous, 2017g). Aronia (*Aronia* spp.) is also widely used in the production of fruit juice and wine and food colorant in Western Europe, Denmark, Poland, and Russia (particularly Siberia). The most common bred varieties are “Nero” and “Viking”. In Western Europe, the average yield per bush on mature plants ranges between 10 and 17 kg. Commercial aronia production first began in Russia in the 1940s. In the 1950s, this product began to be produced mostly in Poland, out of the Western European countries. According to 2010 statistics, Poland's production area expanded to 15,000 decares (90% of global aronia production) (Anonymous, 2017f).

The purpose of this research is to provide information on the botanical characteristics and distribution, usage areas, importance and benefits of cultivation, and benefits to human health of the aronia plant, which is not widely known in our country but has high polyphenol and antioxidant properties in terms of fruit and leaf characteristics.

Studies on the benefits of aronia for human health, usage areas, physical and biochemical components

The aronia plant's fruits and leaves are both beneficial to human health. Anthocyanins, flavonoids, and antioxidants were shown to be 10 times greater in aronia juice than in the same grape (*Vaccinium oxycoccos*) (Anonymous, 2017e). In a study conducted in Ukraine, Korenet et al. (2017) added aronia to wheat flour. The use of aronia in wheat dough products as a source of vitamins, minerals, pectin components, and phenolic compounds has been shown to reduce sugars, organic acids, and some other chemicals. In order to investigate the effect of adding aronia to wheat dough, an algorithm including theoretical analysis and physico-chemical experiments was developed and powdered aronia was added to wheat dough. Aronia additions to wheat flour were found to have amylolytic and proteolytic effects on wheat flour, as well as the ability to generate sugar. The gathered data was statistically evaluated using a computer tool called MS Excel 97 2003. It was determined that the addition of aronia powder to wheat flour prevented the swelling of gluten proteins by reducing the gluten content in wheat flour. They stated that it allowed them to make dough faster and to preserve it for a long period before cooking. They reported that using aronia ingredients in dough technology not only boosted nutritional contents, but also improved dough quality.

Many studies have been conducted on the phenolic components, antioxidant content, and health benefits of aronia. In one study, they investigated the effect of climatic conditions on the phenolic compounds and antioxidant capacity of *Aronia melanocarpa* fruit juice over three years and determined that the total phenolic and total flavonoid content ranges ranged from 8834 to 11093 mg / L and 6993 to 9710 mg / L, respectively. They reported that this alteration was caused by erratic precipitation and temperature fluctuations. In their study, the highest anthocyanin and phenolic content was discovered in fruits gathered in 2012. They stated that favorable weather conditions (temperature and number of hours of direct sunshine) was the possible reason behind this. As stated above, aronia juice, indeed, contains a lot of antioxidants (12.9-14.6 mmol/L; 128-167 mmol/L). Therefore, according to this study, it is concluded that flavonoid and non-flavonoid components formed the antioxidant activity, and aronia juice could be a beneficial dietary source in human nutrition (Toli et al., 2017).

In another study conducted by Tolić et al., (2015), the quality, phenolic compounds and antioxidant contents of different products of the aronia plant (powder, dried fruit, juice, tea and capsule) was investigated. They used the spectroscopic method (Folin-Ciocalteu and different methods in pH) to determine the properties of phenolic compounds, and DPPH and FRAP methods to determine the antioxidant activity of aronia. According to the findings of the study, there are 3002 to 6639 mg of phenolic compounds in each liter of fruit juice and 1494 to 5292 mg in 100 grams of dried fruit.

In the clinical study designed to evaluate the effects of its polyphenols on platelet function, it was aimed to develop a formulation for the use of aronia juice as a placebo. Three formulations with the same nutritional composition as Aronia (*Aronia* spp.) fruit juice were prepared by mixing with various nutrients, artificial colors, flavors and water. Six food panel experts assessed the resemblance of aronia juice and other formulations in terms of taste, color, odor, and texture. The final 4-week placebo study tested for effects on platelet function, biochemical and anthropometric parameters. They found no alterations in platelet functioning or other cardiovascular systems. As a result, they discovered that aronia juice can be used as a food supplement with no adverse effects in people (Kardum et al., 2017).

In addition, an aronia orchard was established in 1997 at the North Willamette Research Center in Aurora, Oregon, using rooted *Aronia melanocarpa* cuttings. As a result of the studies, 'Albigowa', 'Darbrowice', 'Egerta', 'Kutno', 'Nero', and 'Nowa Wies' varieties were bred. All varieties were planted in 1998, however due to damage caused by birds, no fruit was collected the first year. The net was then placed around the area to manage bird damage (1999-2001), and in 1999, 4.4 to 12.4 kg/plant crop per plant was harvested. The highest yield was obtained from the Nero variety with 12.4 kg. In 2001, the highest yield was obtained from Kutno variety with 22.1 kg/plant. Fruit weights ranged between 2.7 g and 2.8 g in 2001, according to measurements. The amount of water-soluble dry matter in all cultivars was found to range between 15.8% and 18.3%. It was mentioned that berry antioxidant concentration ranges between 440 and 574 mg/100 g (Strik et al (2002)).

Likewise, in a study conducted in Poland, Ochmian et al. (2012) studied fruit quality and several physical aspects of Aronia (*Aronia melanocarpa*) cultivars such as Nero, Polish, Galicjanka, Viking, and Hugin. In fruit samples, the lowest fruit weight (32 g) and the least fruit juice (73.6%) were obtained from Hugin variety. However, when compared to other types, it has the maximum amount of water-soluble solids (18.7°Bx), titratable acidity (1.05 g), polyphenols (2340 mg), particularly cyanidin 3-galactoside, as well as nitrate (98.5 mg) and nitrite (1.87

mg). In terms of color features, exterior skin color, and inside color, it has been discovered that the Hugin variety is lighter in color than other fruit types. According to them, the largest fruited variety was Galicjanka (100 fruit weight 111.7 g), whereas individual component content was lowest in fruits of the 'Nero' and 'Viking' cultivars when compared to the other cultivars.

Lee et al. (2014) used liquid chromatography to investigate the distribution ratios of polyphenol compounds and antioxidants in *Aronia melanocarpa* species in a study they conducted in South Korea. In the same study, they used 70% methanol to extract aronia (*Aronia melanocarpa*) leaves that were fresh, mature, and aged. The polyphenols in the leaves were analyzed using liquid chromatography (HPLC-MS/MS) and the results were reported. Among the 12 components in the leaves of Aronia (*Aronia* spp.), polyphenol components such as 5 flavonoids, 3 Apigenin 7, 4'-di-glucoside, 4 quercetin dirhamnosylehexoside, and 10-12 kaempferol coumaroylglycoside were detected. Each polyphenol component was confirmed by comparing it to the same group's reference polyphenol standards. The samples were taken at three different phases of the Aronia (*Aronia* spp.) plant's leaves. According to the antioxidant capacity measurements, it was determined that fresh leaves had the highest antioxidant capacity as compared to mature and old leaves. As a result, they reported that the antioxidant and polyphenol levels in tea produced from fresh aronia leaves will be higher.

In a study conducted in Poland, Borowska and Brzóska (2016) showed that the fruit of *Aronia melanocarpa* contains several compounds that are beneficial to human health. They stated that these substances contain polyphenols, anti-oxidative, anti-inflammatory, antiviral, anti-cancer, antiatherosclerotic, hypotensive, antiplatelet and antidiabetic properties. Thus, they reported that the eating of aronia grapes is critical for the continuation of human health. According to researchers, homemade pharmaceuticals containing harmful compounds for diseases may cause major health problems in the future, even if they leave a very little amount of residue in the human body for therapeutic purposes. Therefore, the fruits of *A. melanocarpa* can play an important role in this regard. So far, scientists, nutritionists and health practitioners have also stated that aronia products play an active role in the prevention and treatment of non-communicable diseases; on the other hand, they have determined that xenobiotic-containing drugs have negative effects on the human body.

Croatian cuisine rarely uses the aronia plant (*Aronia melanocarpa*), although its berry fruits have been shown to possess high levels of polyphenolic chemicals and antioxidant activity. The quality, phenolic content, and antioxidant power of various Aronia products (juices, powders, fruit teas, capsules, and dried fruits) were compared in a study. According to those researchers,

the antioxidant activity and phenolic content of the finished products that are consumed by customers may be affected by the processing method used to produce the product. Spectroscopic techniques (Folin-Ciocalteu and pH different methods) were used in this study to characterize and analyze phenolic chemicals. Utilizing the 2,2-diphenyl-2-picrylhydrazyl (DPPH) and ferric reducing antioxidant power (FRAP) methods, the antioxidant activity of aronia products was evaluated. It has been discovered that aronia products have high phenol contents (3002–6639 mg/L and 1494–5292 mg/100 g of dry matter, respectively), but low anthocyanin contents (150–1228 mg/L and 141–2468 mg/100 g, respectively). It has been reported that high antioxidant capacity can be found in the juices and other chokeberry products under examination (12.09 to 40.19 mmol per L or 58.49 to 191.31 mmol per 100 g of dry matter, respectively). According to reports, consumers choose phenolic- and antioxidant-rich capsules and powders over other aronia products. In conclusion, it was emphasized that the products of the aronia plant have more protective properties than curing some diseases. The results of the experiments showed that *A. melanocarpa*'s leaves and products, in addition to its fruit, may be useful in preventing and treating the toxic impact of some xenobiotics on humans; and added that more thorough research on the topic should be done for more understandable findings (Toli et al. 2015).

In another study carried out in Korea, Thi and Hwang (2014) assessed the bioactive elements and antioxidant properties of aronia leaves by obtaining samples at various stages of maturation (leaves at about 2 months and 4 months, respectively). Researchers have determined that fresh leaves contain more polyphenols and flavonoids than old leaves. HPLC tested three phenolic substances (chlorogenic acid, p-pumaric acid, and rutin). The 2,2-di-phenyl-1-picrylhydrazyl (DPPH), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS), and superoxide anion radical scavenging assays were used to assess antioxidant activity. As a result, it was mentioned that depending on the concentration (0-100 g/mL), aronia leaf extracts had a greater reducing power. In comparison to distilled water extract, the 80% ethanol extract has higher antioxidant activity. They stated that thanks to their high concentration, phenolic chemicals are known to have antioxidant properties. They concluded that fresh aronia leaves have a higher concentration of bioactive substances and polyphenols and may also be better suited for extracting their antioxidant content.

Žlabur, et al., (2017) conducted a study in Croatia to develop a new functional food product. The purpose of this study is to determine the feasibility of using aronia powder as a final product to increase the nutritional value of apple juice. They added aronia powder to apple juice by

ultrasound extraction method and analyzed the content of bioactive compounds, nutritional composition and antioxidant potential of aronia powder. It was discovered that the antioxidant capacity was higher in the juice samples with aronia powder regardless of the extraction technique. At the same time, the researchers reported that the content of all bioactive compounds increased significantly as a result of the analysis of apple juice samples treated with high-intensity ultrasound and containing aronia powder. They also stated that high-intensity ultrasonic applications dramatically shortened extraction time of plant material. In conclusion, they determined that there was a positive correlation between vitamin C concentration, total phenols, flavonoids and anthocyanin content and antioxidant capacity in juice samples with aronia powder applied through high-intensity ultrasound.

CONCLUSION AND RECOMMENDATIONS

The aronia plant's popularity has grown in recent years as a result of increased media coverage and scientific research. The purpose of this study was to provide information about the botanical characteristics and distribution, usage areas, importance and benefits of cultivation, and benefits to human health of the aronia plant, which is not widely known in our country although having high polyphenol and antioxidant properties in terms of fruit and leaf characteristics. The fact that the aronia plant includes a high concentration of phenolic compounds, that its antioxidant activity is high, that fresh aronia leaves have more bioactive components, and that it is rich in polyphenols improve its popularity as a diet fruit among health-conscious customers. Furthermore, growers prefer it as an alternative berry fruit because it is less picky in terms of temperature and soil need than other berry fruits. As a result of this review, we feel that this information concerning aronia will shed light on future investigations.

REFERENCES

- Anonim, (2017a): <http://www.michiganflora.net/genus.aspx?id=Aronia>
- Anonim, (2017b): <http://arnoldia.arboretum.harvard.edu/pdf/articles/2010-67-3-aronia-native-shrubs-with-untapped-potential.pdf>
- Anonim (2017c) : <http://arnoldia.arboretum.harvard.edu/pdf/articles/1938.pdf>
- Anonim, (2017e): <http://www.riverbendorchards.ca/Aronia011.pdf>
- Anonim, (2017f) : <https://www.ag.ndsu.edu/springfever/aronia.pdf>
- Anonim, (2017g): <http://tcpermaculture.blogspot.com.tr/2013/04/permaculture-plants-aronia-or-chokeberry.html>
- Borowska, S., Brzóska, M.M. (2016). Chokeberries (*Aronia melanocarpa*) and Their Products as a Possible Means for the Prevention and Treatment of Noncommunicable Diseases and Unfavorable Health Effects Due to Exposure to Xenobiotics. *Comprehensive Reviews in Food Science and Food Safety* Vol.15 982-1017. <https://doi.org/10.1111/1541-4337.12221>
- Kardum, N., Ristic, A.K., Zec, M., Kojadinovic, M., Petrovic-Oggiano, G., Zekovic, K., Kroon, P.A and Glibetići, M. (2017). Design, formulation and sensory evaluation of a polyphenol-rich food placebo: an example of aronia juice for food intervention studies. *International Journal of Food Sciences and Nutrition* .Volume 68 Issue-6. <https://doi.org/10.1080/09637486.2017.1283682>
- Korenets, Y., Goriainova, I., Nykyforov, R., Nazarenko, I., Simakova O. (2017). The Study Of Influence Of Aronia Additives On Functional-Technological Properties Of Wheat Flour. *Eureka: Life Sciences*, Number 1, Food Science and Technology. 27-34 pp. <https://doi.org/10.21303/2504-5695.2017.00299>
- Lee, J.E., Kim, G.S., Park, S., Yun-Hi Kim, Y.H., Kim, M.B., Lee, W.S., Jeong, S.W., So Jung Lee, S.J., Jin, J.S., Shin, S.C. (2014). Determination of chokeberry (*Aronia melanocarpa*) polyphenol components using liquid chromatography–tandem mass spectrometry: Overall contribution to antioxidant activity. *Food Chemistry* 146: 1–5. <https://doi.org/10.1016/j.foodchem.2013.09.029>
- Ochmian, I., Józef Gr ajkowski, J., Smólik, M. (2012). Comparison of Some Morphological Features, Quality and Chemical Content of Four Cultivars of Chokeberry Fruits (*Aronia melanocarpa*) *Not Bot Horti Agrobo*, 40(1):253-260. <https://doi.org/10.15835/nbha4017181>
- Thi, N.D. and Hwang, E.S.(2014). Bioactive Compound Contents and Antioxidant Activity in *Aronia (Aronia melanocarpa)* Leaves Collected at Different Growth Stages. *Prev. Nutr. Food Sci.* 19(3):204-212. <https://doi.org/10.3746/pnf.2014.19.3.204>
- Tolić, M.T., Krbavčić, I.P., Vujević, P., Milinović, B., Jurčević I.L. , Vahčić N. (2017). Effects of Weather Conditions on Phenolic Content and Antioxidant Capacity in Juice of Chokeberries (*Aronia melanocarpa* L.) .*Pol. J. Food Nutr. Sci.*, Vol. 67, No. 1, pp. 67–74. <https://doi.org/10.1515/pjfn-2016-0009>
- Tolić, M.T., Jurčević I.L., Krbavčić, I.P., Marković, K. and Nada Vahčić, N. (2015). Phenolic Content, Antioxidant Capacity and Quality of Chokeberry (*Aronia melanocarpa*) Products. *Antioxidant Properties of Chokeberry Products*, *Food Technol. Biotechnol.* 53 (2) 171–179. <https://doi.org/10.17113/ftb.53.02.15.3833>

- Strik, B., Finn, C., & Wrolstad, R. (2002). Performance of chokeberry (*Aronia melanocarpa*) in Oregon, USA. In XXVI International Horticultural Congress: Berry Crop Breeding, Production and Utilization for a New Century 626 (pp. 439-443).
<https://doi.org/10.17660/ActaHortic.2003.626.61>
- Žlabur, J.S., Dobričević, N., Pliestić, S., Galić, A., Bilić, D.P. and Sandra Voćca, S. (2017). Antioxidant Potential of Fruit Juice with Added Chokeberry Powder (*Aronia melanocarpa*)
Molecules 2017, 22, 2158; <https://doi.org/10.3390/molecules 22122158>

**A STUDY ON THE BIOCHEMICAL CONTENTS AND HUMAN HEALTH
BENEFITS OF RASPBERRY (*Rubus idaeus* L.) FRUITS**

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ABSTRACT

Rubus idaeus L. (raspberry) is a plant belonging to the genus *Rubus* from the Rosoideae subfamily of the Rosaceae (Rosaceae) family. Raspberry (*Rubus idaeus* L.) has been cultivated in many parts of the world for hundreds of years. Turkey has an extremely suitable location and ecology for raspberry cultivation, as it is the homeland of raspberries. Raspberry production increases the importance of raspberry production due to its wide consumption range and easy cultivation. Raspberry seedlings are easy to produce and cost-effective. There are many varieties with different growing requirements and fruiting periods (summer and autumn raspberries). Raspberries, which are in the group of berry fruits, have a very special place in the food industry as well as fresh consumption with their unique appealing color, taste and aroma, structure and smell. Raspberries are evaluated both as fresh consumption and economically in the food industry. It is one of the most popular fruits of the fruit juice and beverage industry. It is consumed intensely in canning, deep-freezing, pastry and confectionery areas, jam, marmalade and ice cream, etc. In addition, raspberry is a dietary fruit and is very beneficial for human health due to the pigments, phenols, flavones, flavonoids, vitamins and fibers it contains. The aim of this study is to give information about the botanical characteristics and distribution of the raspberry plant, its usage areas and its benefits to human health.

Keywords: Raspberry, biochemical compounds, utilization, human health

INTRODUCTION

Turkey has a significant potential for raspberry production thanks to its status as the raspberry's homeland as well as its ecological superiority. In Turkey, berry has recently become one of the fruit species that are continually in demand in domestic and foreign trade and can find consumers at high prices. Furthermore, raspberry cultivation is gaining popularity among both producers and consumers due to the health benefits of berry fruits. As a result, small family companies or intermediate farmers generate significant economic benefit by producing raspberries. Raspberries have a significant role since they regularly bear fruit year after year and are easy to grow; they can be used as an industrial product such as jam, marmalade, beverage, ice cream, frozen food, pastry, and canned food production; and they can be sold fresh in small garden enterprises (Pehlivan ve Güleriyüz, 2004). The raspberry (*Rubus idaeus* L.) belongs to the Rosaceae family's Rubus genus. The genus Rubus is divided into two subgenera: Idaeobatus and Eubatus, and it contains a large number of highly diverse species. Raspberry is extensively grown around the world, particularly in Turkey, where the Black Sea region is located inside the limits of the raspberry's motherland. It grows naturally in the north of Turkey, along a belt running west to east, at altitudes of 1000 m or higher, in areas with high relative humidity (Jennings 1988; Polat ve Göçmen 2008). It is a berry plant that produces red, tasty fruits in the summer and autumn. It is also high in phenols, flavones, flavonoids, vitamins, and antioxidants (Kähkönen ve ark., 1999; Halvorsen ve ark., 2001, Pehlivan ve Güleriyüz, 2004; Onur, 2006; Eydurhan ve ark., 2006). Due to its superior qualities, such as being simple to produce, affordable, requiring little expertise in rootstock and other technical matters, easy pruning and finishing, beginning to bear fruit soon after planting, and fruiting consistently every year; raspberries are preferred by producers. Its roots are fringe-rooted, numerous, and tight and thin. Under ideal soil root conditions, it can reach a depth of 1-1.5 m. Although its roots are perennial, its stems are only two years old and renew every year. This feature distinguishes it from other fruits. On the other hand, annual shoots are those that have survived one winter (Ağaoğlu ve Gerçekçioğlu, 2013). Being in the form of a bush facilitates the harvesting process. Since the harvest takes 4-6 weeks, labor requirements are lower than for other berry fruits. In general, it is successfully grown in places with plenty of sun, sheltered from the wind and sufficient soil moisture (Atila 2002, Göktaş 2011, Çalışkan 2019, Akkurt 2021). The cultivation of raspberries has spread throughout Turkey. Despite the fact that the Marmara Region has advanced to a significant level of cultivation, "covered raspberry orchards" can still be found across the region. The Marmara Region, particularly Bursa Province, is the leading producer of raspberries, accounting for 98% of total production. The country's output rises in parallel with

the rise in the Bursa. Increased production in suitable regions is required to meet domestic and foreign market demand, particularly in Bursa province. The purpose of this research is to provide information by thoroughly researching the herbal qualities, biochemical contents, and human health advantages of raspberry, one of the berry fruits with high medical value and increasing market value.

RASPBERRY PRODUCTION AND POTENTIAL IN TURKEY

Raspberry varieties are classified based on their fruit color and annual output. Raspberries are classified into three types. These are; a) *R. idaeus var. vulgatus* and *var. strigosus*; red and yellow colored type, b) *R. occidentalis*; black colored type, c) *R. neglectus*; purple colored type. Red raspberries are the most produced species among blackberries and other raspberries (Crandall, 1995). Sucker shoots are typically used to propagate raspberry. Because of its steep development, it is kept growing after three or four years as long as it is supported by a thick stake. Black colored raspberries are not preferred for production because they are sensitive to diseases, especially anthracnose. Since black raspberries cannot be reproduced with sucker shoots, they can be propagated by tip or simple dipping methods. The shoots of black raspberries are not very steep and a wire training system is needed. Purple raspberries are the result of a mix between red and black raspberries. Purple raspberries ripen later in the summer than red raspberries. Purple raspberries grow strong and have large fruits. Purple raspberries are between red and black raspberries in terms of development and are generally grown with a wire training system. Yellow-fruited raspberries are not preferred by consumers. However, it is used in research and breeding of new varieties.

Table 1 shows raspberry output in Turkey over the last three years. When we look at raspberry production in Turkey during the previous three years, we can see that there has been no major rise in planting area or production amount. However, an increase of 1038 decares was observed in the planting area. On the other hand, while 784 kg/da of raspberry was produced in 2020, the growth in 2022 was only 49 kg/da. The annual production volume increased by 1213 tons between 2020 and 2022. As can be observed, there has been no discernible growth in raspberry output in Turkey.

Table 1. Turkey raspberry production amount, production area, yield per decare and annual production

Years	Areas (da)	Yield (kg/da)	Production quantity (Tonnes)
2020	6.943	784	5.445
2021	7.095	718	5.093
2022	7.981	833	6.652

Source: TÜİK, 2022

In Table 2, the world raspberry production and the amount of raspberry planted area, yield per decare and annual production amounts of the countries that produce the most raspberries are given. According to Table 2, the global raspberry planted area is 110.567.00 hectares. The raspberry yield per hectare in the world is 80.181.00 hg/ha and the yield in 2021 is 48.830.00 tons. Russian Federation leads the globe in raspberry planted area, yield per hectare, and yearly output amount, with 23.809.00 ha, 83.035.00 hg/ha, and 97.700.00 tons, respectively (Table 2). Serbia is second and Poland is third (Table 2).

Table 2. Raspberry production amount in the world in 2021

Countries	Areas (ha)	Yield (hg/ha)	Production quantity (Tonnes)
Russian Federation	23.809.00	83.035.00	197.700.00
Mexico	8.520.00	194.449.00	165.676.62
Serbia	20.807.00	53.150.00	110.589.00
Poland	19.800.00	52.475.00	103.900.00
United States of America	6.758.00	120.080.00	81.150.00
Spain	2.420.00	201.777.00	48.830.00
Ukraine	5.400.00	67.204.00	36.290.00
Bosnia and Herzegovina	2.686.00	62.669.00	16.833.00
Chile	3.824.00	41.664.00	15.934.27
Azerbaijan	2.636.00	45.014.00	11.866.05
World	110.567.00	80.181.00	886.538.58

Source: FAO, 2022

Table 3 shows the annual raspberry production amount, production area, and yield per decare in Turkey by provinces. Isparta has the largest raspberry planted area in Turkey, with 50 decares. The yield per decare at Isparta is 760 kg/da, with an annual production of 38 tons. The production area in Adana, on the other hand, is 24 decares, the yield per decare is 2000 kg/da, and the annual output amount is 48 tons. According to TUIK data for 2022, Adana has the

greatest raspberry production in Turkey. This is followed by the provinces of Isparta, Konya and Kahramanmaraş.

Table 3. Raspberry production amount, production area and yield in Turkey by provinces

Provinces	Areas (da)	Yield (kg/da)	Production quantity (Tonnes)
Adana	24	2.000	48
Konya	10	1.500	15
Kahramanmaraş	10	1.400	14
Samsun	1	1.000	1
Bursa	8	833	6
Yalova	14	929	13
Isparta	50	760	38

Source: TÜİK, 2022

In general, it is known that phenol and flavonoid compounds containing gallic acid, rutin, isoquercitin and ellagic acid are high in berries. The most important one is ellagic acid, which has antitumor properties. The highest total amount of ellagic acid was detected in black raspberries (Häkkinen, et al., 2000; Kähkönen et al, 2001) Ellagic acid has significant anticarcinogenic/antimutagenic properties. It has also been reported to have antibacterial and antiviral effects (Akiyama et al., 2001, Šmerák, et al., 2002). Among all fruits and vegetables, the highest amount of ellagic acid is found in red (*Rubus ideaus*) and black (*Rubus occidentalis*) raspberries. As stated above, it is reported that its anticarcinogenic activity prevents the formation of cancer by inactivating the chemical components that cause cancer in the body (Stoner, and Mukhtar, 1995). In addition to these benefits, ellagic acid has anti-aging properties (7,14,17). Furthermore, there is evidence that ellagic acid prevents or reduces the majority of oxidative damage in DNA. It has been found that raspberry extracts, particularly myricetin, have a high antibacterial action and limit the growth of several bacteria that are detrimental to human health (Kresty et al., 2001; Peiffer, et al., 2014). It is known that raspberries are higher in antioxidant compounds than other berry fruits.

Table 4 shows that 100 g of fresh raspberry fruit contains thiamine (0.032 mg), riboflavin (0.038 mg), niacin (0.598 mg), vitamin B6 (0.055 mg), A (2 µg), C (26.2 mg) in terms of vitamins; and it contains Calcium (25 mg), Iron (0.69 mg), Magnesium (22 mg), Phosphorus (29 mg), Potassium (151 mg), Sodium (1 mg) and Zinc (0.42 mg) in terms of minerals (USDA, 2022).

Table 4. Nutritional contents of raspberry fruit (per 100 g of edible fresh fruit)

Food component	Amount
Water	85.8 g
Energy	52 kcal
Protein	1.2 g
Total lipid (fat)	0.65 g
Carbohydrate, by difference	11.9 g
Minerals	
Calcium, Ca	25 mg
Iron, Fe	0.69 mg
Magnesium, Mg	22 mg
Phosphorus, P	29 mg
Potassium, K	151 mg
Sodium, Na	1 mg
Zinc, Zn	0.42 mg
Vitamins	
Thiamin	0.032 mg
Riboflavin	0.038 mg
Niacin	0.598 mg
Vitamin B ₆	0.055 mg
Vitamin A	2 µg
Vitamin C	26.2 mg

Source: USDA, 2022

CONCLUSION

In conclusion, it has been discovered that raspberries (*Rubus ideaus L.*) are particularly beneficial fruits for humans due to their high content of phenol and flavonoid flavonoids, both of which are essential for health, as well as their anticarcinogenic and antioxidant properties. It has also been discovered that raspberry, being a diet fruit, reduces the risk of Alzheimer's, cardiovascular disease, diabetes mellitus, obesity, and many metabolic disorders that are common today. Furthermore, bioactive compounds found in raspberry fruits have been shown to slow the progression of disease factors in the body. It has been discovered that red raspberry (*Rubus idaeus L.*) in particular is a fruit high in nutritional content and bioactive components. They contain critical minerals, dietary fibre, and polyphenolic compounds. As a result, scientists have discovered that raspberry fruits, due to their metabolic qualities in the human body, render them inactive by lowering the risk of pathophysiology, which includes illness components. Raspberry fruit has been determined to be both a nutritious fruit and extremely advantageous to human health. This study, we feel, will give light on more extensive investigations on the impact of raspberry on human health.

REFERENCES

- Ağaoğlu, S., Gerçekçioğlu, R., (2013). Üzümsü Meyveler. Tomurcukbağ Ltd. Şti. Eğitim Yayınları No:1.
- Akiyama, H., Fujii, K., Yamasaki, O., Oono, T., and Iwatsuki, K. (2001). Antibacterial action of several tannins against *Staphylococcus aureus*. *Journal of antimicrobial chemotherapy*, 48(4), 487-491.
- Akkurt, M. (2021) Ahududu. Ankara Üniversitesi Açık Erişim Sistemi. https://acikders.ankara.edu.tr/pluginfile.php/112121/mod_resource/content/0/AHUDUDU%201.pdf (Access of date: 23.04.2023).
- Atila, S. P. (2002). Bazı Ahududu ve Böğürtlen Çeşitlerinde Ayaş (Ankara) Koşullarında Adaptasyon Üzerine Ön Değerlendirme (Doctoral dissertation, Yüksek Lisans Tezi, Ankara Üniversitesi Fen Bilimleri Enstitüsü, Ankara, 90).
- Crandall, P. C. (1995). Bramble Production. The Management and Marketing of Raspberry and Blackberries, 213 p. Howorth Press Inc,
- Çalışkan, S. Türkiyede ahududu (*Rubus idaeus* L.) ve böğürtlen (*Rubus fruticosus* L.) yetiştirilen bazı bahçelerde bitki paraziti nematod türleri üzerinde faunistik ve sistematik araştırmalar.
- Eyduran, S. P., Ağaoğlu, Y. S., and Çelik, M. (2006). Bazı Ahududu Çeşitlerinin Ayaş (Ankara) Koşullarına Adaptasyonu Üzerine Araştırmalar. II. Ulusal Üzümsü Meyveler Sempozyumu, 14(16), 224-230.
- FAO, (2022). Food and Agriculture Organization (FAO), (<https://www.fao.org/faostat/en/>), (Access of date:23.04.2023).
- Häkkinen, S. H., Kärenlampi, S. O., Mykkänen, H. M., and Törrönen, A. R. (2000). Influence of domestic processing and storage on flavonol contents in berries. *Journal of Agricultural and Food Chemistry*, 48(7), 2960-2965.
- Halvorsen, B. L., Holte, K., Myhrstad, M. C., Barikmo, I., Hvattum, E., Remberg, S. F., and Blomhoff, R. (2002). A systematic screening of total antioxidants in dietary plants. *The Journal of nutrition*, 132(3), 461-471.
- Jennings, D. L. (1988). Raspberries and blackberries: their breeding, diseases and growth. Academic press.
- Göktaş, A. (2011). Ahududu ve Böğürtlen Yetiştiriciliği. Meyvecilik Araştırma Enstitüsü Müdürlüğü Yayın No: 38.
<https://arastirma.tarimorman.gov.tr/marem/Belgeler/Yetiştiricilik%20Bilgileri/Ahududu-Böğürtlen%20Yetiştiriciliği.pdf> (Erişim Tarihi: 14.12.2021)
- Kähkönen, M. P., Hopia, A. I., Vuorela, H. J., Rauha, J. P., Pihlaja, K., Kujala, T. S., and Heinonen, M. (1999). Antioxidant activity of plant extracts containing phenolic compounds. *Journal of agricultural and food chemistry*, 47(10), 3954-3962.
- Kähkönen, M. P., Hopia, A. I., and Heinonen, M. (2001). Berry phenolics and their antioxidant activity. *Journal of agricultural and food chemistry*, 49(8), 4076-4082.
- Kresty, L. A., Morse, M. A., Morgan, C., Carlton, P. S., Lu, J., Gupta, A., and Stoner, G. D. (2001). Chemoprevention of esophageal tumorigenesis by dietary administration of lyophilized black raspberries. *Cancer Research*, 61(16), 6112-6119.
- Onur C (2006)., Ahududu Yetiştiriciliği. Damla Ofset, Antalya, 100s.
- Peiffer, D. S., Zimmerman, N. P., Wang, L. S., Ransom, B. W., Carmella, S. G., Kuo, C. T., ... and Stoner, G. D. (2014). Chemoprevention of Esophageal Cancer with Black Raspberries, Their Component Anthocyanins, and a Major Anthocyanin Metabolite, Protocatechuic Acid Chemoprevention of Esophagus Cancer with Berry Constituents. *Cancer prevention research*, 7(6), 574-584.
- Pehlivan, M., and Güler yüz, M. (2004). Ahududu ve böğürtlenlerin insan sağlığı açısından önemi. *Bahçe*, 33(1).

- Polat, İ., and Göçmen, M. (2008). Karadeniz Bölgesinden seçilen bazı kırmızı ahududu (*Rubus ideaus* L.) tiplerinin genetik farklılığının RAPD tekniği ile belirlenmesi. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 21(2), 185-191.
- Šmerák, P. E. T. R., Šestáková, H. E. L. E. N. A., Polívková, Z. D. E. Ń. K. A., Bárta, I., Turek, B. O. H. U. M. I. L., Bártová, J. I. Ř. I. N. A., and Anděl, M. (2002). Antimutagenic effect of ellagic acid and its effect on the immune response in mice. Czech J. Food Sci, 5, 181-191.
- Stoner, G. D., and Mukhtar, H. (1995). Polyphenols as cancer chemopreventive agents. Journal of Cellular Biochemistry, 59(S22), 169-180.
- USDA, (2022).U.S. Department of Agriculture, FoodData Central Search Results. (<https://fdc.nal.usda.gov/fdc-app.html#/food-details/2344775/nutrients>), (Access of date :23.04.2023).
- TÜİK, (2022). Turkish Istatistical Institute. (<https://www.turkiye.gov.tr/turkiye-istatistik-kurumu-baskanligi-tuik>), (Access of date :01.04.2023).

**EARLY SEASON GROWN OF MULBERRY (*Morus spp.*) CULTIVATION IN THE
MEDITERRANEAN REGION**

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ABSTRACT

In the Mediterranean region, the most early-season mulberry production is carried out in Mersin province and Anamur, Silifke districts. Today, mulberry production in Turkey continues with 1 964 724 mulberry trees. As of 2022, 72 89 tons of mulberry are produced annually in an area of 16 334 decares in Turkey. There are 30 380 mulberry trees that bear fruit in Mersin, and mulberry production has been carried out on a total area of 765 decares. However, 1000 decares of this production consist of greenhouse mulberry production. For the remaining 15 334 decares of land, mulberry cultivation has been carried out in the open. However, the amount of mulberry production in Mersin is 1 120 tons. *Morus laevigata* Wall. *Morus alba* var. It is a type of *laevigata* (mulberry with long fruit) and is known by names such as finger mulberry and black mulberry. Finger mulberry berries have a dark red colour. It has a high antioxidant capacity thanks to the high amount of anthocyanin, phenolic substances and ascorbic acid it contains. With this feature, finger mulberry is a type of mulberry that is consumed by consumers with highly attractive, long, large, red-black fruits, and its production has become widespread especially in the Mediterranean Region in recent years. Harvest begins in the open and in the greenhouse in February and ends in June. If hard pruning is aimed in the open and single harvest in the greenhouse, normal pruning is done if there is a second harvest target. In addition, the

second harvest in the greenhouse is carried out in December, January and February. There are buyers at high prices in the market as fresh fruit rather than dried finger mulberry. As is known since the Mediterranean region is the region where many products, especially strawberries, citrus fruits, bananas and tomatoes, are grown thanks to its warm and mild climate, farmers prefer the first-year mulberry, which can produce both in the open and the greenhouse, provides earliness and can find buyers at high prices, as an alternative product. This study has been carried out to evaluate the current situation, production techniques, profitability and production potential of early mulberry cultivation in the Mediterranean region.

Keywords: Mulberry, Mediterranean, Greenhouse, Earliness

INTRODUCTION

Morus laevigata Wall is a commercially important mulberry species belonging to the Moraceae family. (Jain and Kumar 1989; Vijayan et al. 2011). *M. laevigata* Wall species global range extends from the Indus to Assam, Arunachal Pradesh, Bangladesh to Myanmar, and the tropical and subtropical Himalayas. (Brandis, 1906; Kanjilal et al. 1940; Tikader and Dandin, 2005; Tikader, 2011). The fruits of *Morus alba* var *laevigata* are elongated and dark red in color. Its fruits are often eaten fresh. Like with other mulberry species, the flowers of *M. laevigata* wall species are in clusters; male flowers are 5-12 cm long, while female flowers are 5-6 cm long. Male flowers hang loosely from the branch; and after the flowers wilt, the male flowers dry and fall off. Male flowers have four stamens and four perianth lobes. Male flowers can also be present in flower buds as curled fibers. Female flowers are typically shorter and more compact than male blooms, with four persistent perianth lobes. The stigma is bipartite and the ovary is unicellular. These eggs have a pendulous shape. Its pollination is an anemophile process. Because *M. laevigata* has a long flowering period, the fruit harvest season is likewise longer than in other mulberry species. As a result, a product can be derived from *M. laevigata* for an extended period of time. The fruits of *M. laevigata* Wall species are large, rich in anthocyanins, and their fruits vary from sweet to sour. (Vijayan, et al.2011). Tikader and Kamble (2008) showed in a study they conducted in India that several cultivars of *M. laevigata* Wall mulberry are salt tolerant. As it can be understood from here, they reported that mulberry production can be made in saline barren soils. *M. laevigata* is a suitable raw material for the paper industry as well as for silkworm breeding; the powder obtained from the stem and stem is a good nutrient medium for mushroom production. In addition, its shade-dried leaves are an excellent feed for poultry. At the same time, it has been stated that when the leaves are used as feed for chickens, it has positive effects on the formation of the desired yellow color in the eggs, egg vitality and egg quality (Narayana ve Setty 1977). With this feature, *M. laevigata* (finger mulberry) is a mulberry species that is liked by consumers due to its high attractive, long, large, red-black fruits, and its production has increased in greenhouse and open areas in the Mediterranean region in recent years (Sally, 2006; Polat, 2013). It is extensively produced in the Mediterranean regions of Mersin, Anamur, and Silifke. Locals have given it names such as Finger Mulberry and Black Mulberry. The fruit weighs about 15 g and is quite huge. It is consumed as fresh fruit rather than dried mulberry and commands high market prices. The purpose of this study was to evaluate the profitability of early mulberry cultivation in greenhouse and open field, production techniques, and marketing in the Mediterranean Region to other fruit species.

GREENHOUSE AND OUTDOOR PRODUCTION TECHNIQUE

M. laevigata (finger mulberry) mulberry is collected in the Mediterranean region in February when cultivated in greenhouses, and in late March and early April when grown outdoors.

Mersin has 102,000 decares of greenhouse space, which produces 47,000 decares of bananas, 10,000 decares of strawberries, and 1,000 decares of mulberry, according to data from the Provincial Directorate of Agriculture and Forestry. Harvesting begins in April and continues until June. Furthermore, harvesting in the greenhouse occurs in December, January, and February. In recent years, Mersin's Anamur and Silifke districts have seen a surge in greenhouse mulberry production.

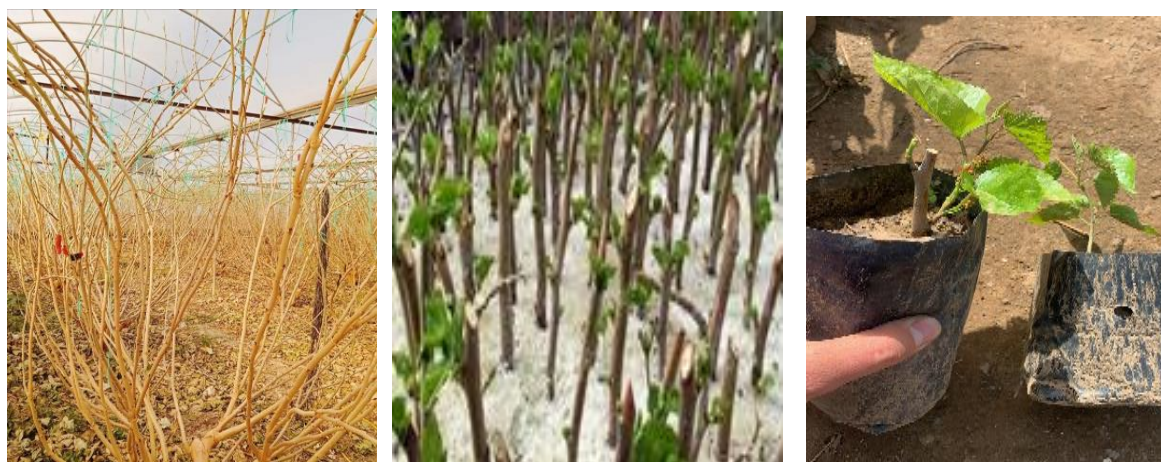


Figure 1. Reproduction with steel (Mersin Mezitli)

Steel is commonly used for reproduction in mulberry production in the region. Cuttings are taken from healthy and somewhat vigorous yearly shoots. Cuttings should be taken from branches with nodes that are not too far apart or from shoots that are not too short. *Morus leaviata* cuttings are harvested in November and December, after the shoots have gone dormant. As shown in Figure 1; the steel thickness is 1-1.5 cm on average, the length is 15-25 cm, the lower part is cut straight from just below the bottom node, and the top section is tilted 1-1,5 cm above it. If you want to use green cuttings, take leafy summer cuttings from slightly lignified branches. In July, green cuttings are taken from one-year branches by cutting 15-20 cm in length. Because these cuttings are leafy, they must be rooted in humid circumstances to create water balance. The possibilities of multiplication of the mulberry plant by cuttings have been examined by numerous researchers and different auxin derivatives, which are natural plant hormones, are used in these investigations. IBA (Indole-3-butyric acid) and NAA are the most widely used (1-Naphthene acetic acid). In addition, new products with different trade names containing these hormones have been employed in cuttings rooting in recent years. (Yıldız et al., 2009; Ekizoğlu, 2010; Erdem, 2015).



Figure 2. Pruning and finishing (Mersin Mezitli)

As seen in Figure 2., rooted tuberous mulberry seedlings are planted in greenhouses in September and October, and outdoors in February, after the planting areas are prepared. The saplings are planted in such a way that 5 m row spacing is 3.5 m above the row. The fruits are taken from annual fresh shoots. In greenhouse mulberry production, an average of 60-70 saplings are planted per decare. According to the preference of the manufacturers, open planting is also planted at the same intervals, however it might be planted more frequently or sparsely at times. After planting, depending on the development status of the seedlings, a hard pruning is done 20 cm above the main body. Pruning in the greenhouse is done in May. In open production, pruning is done in July. As a pruning technique, cutting is made on the main trunk in the form of an inverted umbrella, leaving 3 or 4 main branches, and the trees are left to develop. Later, 4-5 branches develop on annual shoots and bear fruit on them. In order for the developing branches not to hang down, wire grids with a height of approximately 2.5 m formed within the greenhouse roof are created with 4 wires in each row. These wires are used so that the branches do not sag. The wires must be thick enough to carry the branches (Figure 2). In early mulberry production, both in the open and in the greenhouse, producers do not use as many chemical pesticides, fertilizers and fertilizers as in other plant production. Spraying is done only to combat spider mites (*Tetranychus urticae*) and mealybug (*Planococcus citri*). When there is no fruit on the mulberry plants, this spraying is not done once a year. In addition, as a result of pruning, 1% burgundy slurry is given before the bud burst. For this reason, the products produced are cultivated in accordance with natural conditions. Therefore, the market value of the mulberry products produced is quite high.



Figure 3. Mulberry production in greenhouse (Mersin Mezitli)

The first harvest in greenhouse mulberry production begins in January. Harvest continues from January to the end of March. Because the first products are fresh, they find buyers at very high prices in the market. Thus, producers get high profits. In open field production, the first harvest starts in the first week of April and continues until the end of June. In greenhouse mulberry farming, one decare can yield 3 tons of mulberry in one season. Harvesting is typically done by hand by women. Thus, it also contributes to the women's employment. In general, mulberry producers in the greenhouse used to produce vegetables (Tomato, pepper, eggplant) in the greenhouse. Due to the high expenses of both maintenance and disease and pest control methods in greenhouse vegetable growing, the producers could not earn enough money, and the market condition was not stable and lucrative. Producers, on the other hand, shifted to greenhouse mulberry cultivation. Mulberry production is simpler than vegetable production, therefore input costs are lower, and fresh mulberry fruits command high market prices. As a result, producers choose to grow mulberries in ancient vegetable greenhouses.

ECONOMIC EVALUATION OF MULTI PRODUCTION IN GREENHOUSE

When we compare mulberry agriculture in the Mediterranean region to strawberries and bananas, which are also abundantly produced in the region, we can find that the input cost of mulberry cultivation is cheaper. There are fewer diseases and pests in mulberry farming than in strawberries and bananas. As a result, insecticides and fertilizers are inexpensive in mulberry production. Mulberry cultivation is more advantageous due to the fact that they begin producing in the first year, are easier to care for, and use less water than strawberry and banana plants. The downsides are high harvest labor, short fruit shelf life, and high input expenses such as greenhouse iron frame, irrigation system, plastic cover, and labor in a one-decare mulberry greenhouse setup. Strawberry has advantages such as being able to be grown without soil,

requiring less harvesting effort than mulberry, having a longer shelf life of its fruits, and not requiring a heating system in greenhouse cultivation. The strawberry plant, on the other hand, is more susceptible to illnesses and pests than the mulberry plant, so the cost of pesticides, fertilizers, and watering is more; it requires new seedlings virtually every year; and the cost of a strawberry greenhouse is higher per decare (greenhouse iron skeleton, plastic cover, irrigation system, , plastic cover, workmanship, etc.). On the other hand, when comparing greenhouse banana production to mulberry cultivation, banana has advantages such as inexpensive maintenance and labor expenses, as well as high product yield per unit area. However, because the banana plant is susceptible to certain illnesses and pests (such as worms, red spiders, and fusarium), chemical pesticides, fertilizers, and greenhouse expenditures (greenhouse iron skeleton, plastic cover, irrigation system, plastic cover, labor, etc.) There are other drawbacks, such as becoming more dependent and susceptible to cold. The most crucial thing to consider in these comparisons is that the manufacturing model with the best profit at the lowest cost should be preferred. Yet, given the value of the produced product in foreign trade and the supply and demand condition in the domestic market, strawberry and banana production has a significant impact on the Turkish economy. The term "independent" refers to a person who does not work for a company.

CONCLUSION AND RECOMMENDATIONS

In terms of mulberry production in the greenhouse, the Mediterranean region, which is Turkey's fruit and vegetable paradise due to its ecological superiority, should be viewed as a variety and an alternative production method among other greenhouse fruit producing types. Furthermore, because of the low input costs compared to other greenhouse fruits and the excellent profitability of the farmers, mulberry production in the greenhouse is becoming more popular. Due to the stunted nature of the mulberry plant, which is also called as the Australian Mulberry, producers are turning old vegetable greenhouses into mulberry greenhouses. Thus, producers both reduce greenhouse costs and gain higher profits from vegetables. In addition, since mulberry production in the greenhouse does not require more fertilizers, pesticides and maintenance costs like vegetables, it offers producers an easy-to-care and high-income production model. However, planned production is one of the most important issues. Manufacturers must be informed about this. In addition, it is suggested that it would not be right to choose a production pattern that will compete with the economically and strategically important products of the region, and that these productions should be made in planned, small enterprises and local places.

REFERENCES

- Brandis, D. (1906). Indian Trees. Constable and Company Ltd, London, UK p. 612-613.
- Erdem, S. (2015). Bulancak karası dutunun bazı meyve özelliklerinin belirlenmesi ve çelikle çoğaltılması üzerine bir araştırma (Master's thesis, Fen Bilimleri Enstitüsü).
- Ekizoğlu, C. (2010). Beyazdut (*Morus alba* L.) ve Karadutun (*Morus nigra* L.) çelikle çoğaltılması üzerine bir araştırma (Master's thesis, Fen Bilimleri Enstitüsü).
- Jain A.K., Kumar R. (1989). Mulberry species and their distribution in North Eastern India. In: Sengupta K, Dandin, S.B. (Eds.). Genetic resources of mulberry and utilization. Central Sericultural Research and Training Institute, Mysore. pp.37-42.
- Kanjilal, U.N., Kanjilal, P.C., Das, A., De, R.N., Bor, N.L. (1940). Nyctaginaceae to Cycadaceae. Flora of Assam, Vol 4. Government Press, Shillong, Meghalaya, India. p. 274-275.
- Narayana, H., and Setty, S. V. S. (1977). Studies on the incorporation of mulberry leaves (*Morus indica*) in layers mash. Indian Vet. J, 56(9), 778-787.
- Tikader, A, Dandin, S.B, (2005). Biodiversity, geographical distribution, utilization and conservation of wild mulberry *Morus serrata* Roxb. Caspian Journal of Environmental Sciences. 3:177-184.
- Tikader, A., and Kamble, C. K. (2008). Mulberry wild species in India and their use in crop improvement a review. Aust J Crop Sci, 2(2), 64-72.
- Tikader, A. (2011). Distribution, diversity, utilization and conservation of mulberry (*Morus* spp.) in North West of India. Asian and Australasian Journal of Plant Science and Biotechnology, 5(1), 67-72.
- Vijayan, K., Tikader, A., Weiguo, Z., Nair, C. V., Ercisli, S., and Tsou, C. H. (2011). *Morus*. Wild crop relatives: genomic and breeding resources: tropical and subtropical fruits, 75-95.
- Yıldız, K., Çekiç, Ç., Güneş, M., Özgen, M., Özkan, Y., Yaşar, A. K. Ç. A., and Gerçekcioğlu, R. (2009). Farklı Dönemlerde alınan Kara Dut (*Morus nigra* L) Çelik Tiplerinde Köklenme Başarısının Belirlenmesi. Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi, (1), 1-5.

SANATTA ELEŞTİREL VE ANALİTİK YAKLAŞIMLAR

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Özet

Eleştiri, bilginin temellerini ve doğruluk durumunu inceleme, sınama, yargılama anlamına gelmektedir. Eleştirel düşünme kavramı ise, herhangi bir durumun olumlu veya olumsuz özelliklerini tarafsız şekilde değerlendirme, yargılama ve sonuca varma sürecidir. Tarafsız düşünme biçimi olan eleştirel düşünmenin; beceri, tutum ve alışkanlıklar bütünü olduğu söylenebilir. Bir tür akıl yürütme sayılan eleştirel düşünme, analiz ve değerlendirme gibi zihinsel süreçlerden oluşan bir düşünme biçimidir. Çağlar boyunca tüm alanlarda kullanılan eleştirel düşünme yaklaşımları, ilerleme ve gelişim adımlarının atılmasını hızlandıran bir unsur olmuştur. Sanatsal üretici düşünme biçimi, düşünme ile uygulama-deneme arasındaki etkileşimi ve karşılıklı ilişkiyi içeren bir kavramdır. Sanatsal alanlarda da etkinlik bağlamında üretici düşünce, sanat etkinliği süreçlerini olumlu etkilemiştir. Sanatsal anlamda eleştirel düşünce, doğru iletişim kurabilme yöntemleri arasında yer almaktadır. Bu çalışmada, insanın çevreyi tanımasının, sanat eseriyle ilgili bilimsel sonuçlara varabilmenin eleştirel ve analitik düşünme yoluyla olabileceğinin vurgulanması amaçlanmıştır. Bu özelliklerin ve alışkanlıkların bireylere, eğitimin ilk aşamalarından itibaren verilmesinin önemi vurgulanmaktadır.

Anahtar kelimeler: Sanat, eleştiri, analitik, düşünme, yaklaşım.

CRITICAL AND ANALYTICAL APPROACHES TO ART

Abstract

Criticism means examining, testing, and judging the foundations of knowledge and its accuracy. The concept of critical thinking, on the other hand, is the process of objectively evaluating, judging, and reaching conclusions about the positive or negative aspects of any situation. Critical thinking, which is an impartial way of thinking; can be said that it is the whole of skills, attitudes, and habits. Critical thinking, which is considered a type of reasoning, is a way of thinking that consists of mental processes such as analysis and evaluation. Critical thinking approaches, which have been used in all fields throughout the ages, have been an element that accelerated the progress and development steps. Artistic productive thinking is a concept that includes the interaction and reciprocal relationship between thinking and practice-experiment. In the context of activity in artistic fields, productive thinking has positively affected the processes of art activity. In the artistic sense, critical thinking is among the methods of establishing correct communication. This study, it is aimed to emphasize that people can get to know the environment and reach scientific conclusions about the work of art through critical and analytical thinking. The importance of giving these characteristics and habits to individuals from the first stages of education is emphasized.

Keywords: Art, criticism, analytical, thinking, approach.

Giriş

Tarihsel sürece bakıldığında, iki yüz bin yıl önce ortaya çıkan eleştirel düşünme kavramı tarihte bilinen zihinsel düşünmeye sahip Homo Sapiens canlı türü ile ortaya çıkmıştır. Her yaşamsal amaçlı adımın, eleştirel bir düşünme sonucunda atıldığına inanılmaktadır. İlk tarih çağlarındaki mağara duvarlarına yapılmış resimler, eser üretim süreci, eleştirel ve analitik algının başladığını kanıtlamaktadır. İnsanoğlunun antik çağdan itibaren temellerini attığı bu kavram, mantıksal bir yaklaşımla günümüze dek uzanmıştır. Genel açıdan bakıldığında, bilimsel olarak ilk eleştirel düşünme M.Ö. 600 yılında Sokrates'in geliştirdiği bir beceri ve sanat alanıdır (Şenşekerci ve Bilgin, 2008, 21). İlerleyen zamanlarda ise, özellikle Rönesans döneminde bilimsel çalışmalara öncülük etmiştir. “Descartes, Machiavelli, Erasmus, Moore, ve Newton” gibi öncü isimler eleştirel düşünme yaklaşımlarını günümüzün gelişmiş düzeyine ulaştırmıştır (Akarsu, 2018, 3). Eleştiri kelimesinin, genellikle olumsuzluk içeren bir algıya sahip olduğu söylenebilir. Aksine eleştiri sözcüğünün nesnel anlamı, bir durumu iyi ve kötü yanlarıyla değerlendirmek olarak tanımlanmaktadır (Karabulut ve ark. 2008: 240). Sanat eleştirisi ise bir sanat eserini öncelikle eser ve sanatçı olmak üzere farklı bilgi ve belgelerden yola çıkarak, o eser hakkında olabildiğince doğru bir yargıya ulaşma çabası olarak tanımlanabilir. Eleştirel düşünme; analiz, sentez, problemi ortaya koyma ve çözme, çıkarım ile değerlendirme gibi üst düzey becerileri içermektedir. Tıpkı sanat eseri üretim sürecinde karşılaşılan aşamalar gibi. Eleştirel düşünme ve analitik yaklaşımlar, bilimsel yollarla eser üretmeyi ve üretilen eserler hakkında tarafsız yorum yapabilmeyi gerekli kılmaktadır.

Sanata Eleştirel ve Analitik Bakış

Özellikle günümüz teknoloji çağında eleştirel düşünme sosyal bir varlık gösterebilmek adına son derece önemlidir. Yeni fikir ve düşünceler üretmek, sosyolojik açıdan insanlara rehberlik edebilecek bir yaklaşımdır. Üretilen yeni fikirlerin, her alanda olduğu gibi sanat alanında ve günlük yaşamın içinde yer aldığı görülmektedir. Sanat alanında bir tür keşif kabul edilen bu yenilikçi fikirlerin; gözlem, merak, nesnellik, çıkarım, açık fikirlilik, yaratıcı düşünce ve farkındalığa dayandığını söylemek doğru olacaktır. Yaratıcı, sosyal, bütüncül ve yansıtıcı düşünme biçimleriyle fikirlerin çözüme dönüştüğü de ifade edilebilir. Sanat eleştirisi, bazı yaklaşımlara dayalı sanat eserini tarafsız olarak inceleyip en nesnel sonuçlara ulaşmayı amaçlamaktadır (Ülger, 2021, 33). Ayrıca eleştirel düşünme ve analitik yaklaşım sanatta; yaratıcı, yenilikçi ve sürdürülebilir bir tavır gerektirmektedir. Eleştirel düşünme yönteminin göz ardı edilmesi, toplumları; sosyolojik, bilimsel ve sanatsal açılardan olumsuz yönde etkilemektedir. Sanat açısından değerlendirildiğinde, araştırmacı, inceleyici; sorgulayıcı eleştirel bir anlayışın geliştirilebilmesi için, öncelikle bu alanda yenilikçi bir anlayışın benimsenmesi

gerekmektedir. Özellikle günümüzün 21.yy. ileri beceri düzeyinde; kritik düşünme, iletişim kurabilme, işbirlikçilik, paylaşımcılık ve yaratıcılık gibi unsurların önemi vurgulanmaktadır (Akarsu, 2018, 9). Kişisel gelişimde; öncelikle kendini eleştirebilmenin, eleştirilere açık ve anlayışlı olmanın etkin olduğu söylenebilir. Ayrıca sanatsal temelli eleştirel düşünce biçimi; eseri oluşturan sanatçılar ile tamamlayıcı rolde olan izleyiciler arasında bir etkileşim ve iletişim anlamı taşımaktadır. Sanatta yaratıcı ve sağlıklı ilişkilerin biçimlendirilmesinde önemli bir etken olduğu gibi, sanat eserlerinde estetik bir algılayış ortaya koyacak mantıksal beceriye sahip olmak gerekmektedir.

Tarihsel perspektiften bakıldığında; önceleri çağlarla ifade edilen sanat; daha sonraları dönemlerle, modernizm boyunca akımlarla, post modern süreçte ise, anlayış, kavram ve düşüncelerle açıklanmaya ve betimlenmeye doğru evrilmiştir. Tüm bu süreçler boyunca, sanatla olan temas her zaman irdelenmiştir. Sanatçı eser ve izleyici profilleri ile devamında sanat eserinin algılanması, çözümlenmesi, yorumlanması ve çıkarım yapılması gibi süreçleri içinde eleştirinin varlığı ve analitik çözümlenmeler kesinleşmiştir. Daha da öteye gidildiğinde eleştiri, sanatsal bir eylemin ya da kurgunun kimliği olmuştur. Eleştirel bakış açısıyla birlikte analitik düşünme, hem sanat eseri oluşumunda hem de eleştiri süreçlerinde oldukça önemli bir rol taşımaktadır. Genel olarak analitik düşünme; bir bütündeki her bir parçanın analiz edilmesi, parçaların bütünlükle ilişkisinin incelenmesi ve bir sentez yapılarak çözüme varılması anlamı taşımaktadır

(<https://mail.baskent.edu.tr/~21293301/%C3%B6%C4%9Frenmeyi-%C3%B6%C4%9Frenme.html>.) Bu bağli olarak, bir durumu, olayı veya kavramı parçalara ayırarak anlamlandırmak şeklinde ifade edilmektedir. Böyle bir sistemin sanatta yansımaları da eleştirel ve çözümleneci bir yaklaşım olarak görülmektedir.

Sanat; hem bireyler hem de toplumlar için bir kimlik ortaya koyma ve varlık gösterme yöntemi olması nedeniyle, zamanlar arası bir üretim sürecidir. Bu kavrama hizmet eden eleştiri, bireyi ve toplumu kişisel sanat olaylarını veya eserlerini onaylamaya ve anlamaya doğru yönlendirir. Sanat eseri karşısında kendini bir yön belirleme konusunda zorunlu hisseden insan; eseri bazı bireysel tecrübeler ya da akademik ilkeler kullanarak anlama ve çözme çabasına girmektedir. Sanat eseri eleştirisinde, sadece duygusal değil, teknik ve bilimsel olarak da anlamlandırmaya yönelmek gerekir. Sanat eserlerine yapılan eleştiriler, genellikle kesin doğrular bulmayı amaçlamaz. Öncelikle eleştiri yapacak kişi; eleştiri boyunca algılarını tüm unsurlara karşı açık tutmalıdır. Esere yönelik doğru ipuçlarıyla, bilimsellik taşıyan, sistematik ve nesnel bir eleştiri yapabilmelidir.

Sanat eseri eleştirisinde, kullanılacak sanat diline hakim olmak, konuyla ilgili tecrübe ve bilgiye sahip olmak önemli faktörlerdir. Ayrıca sanat eleştirisinde, mitoloji ve ikonografik inceleme,

estetik ve eleştiri bilgisinin yanı sıra; bilimsel sanat eleştirisi ve analitik düşünme becerisi gibi bazı teorik bilgilerden yararlanmak akademik bir sanat eleştirisi yapabilmek için gereklidir. Mevcut bilgilere dayanarak, sanat eserinin bağlı olduğu akımlar, dönem özellikleri ve bilimsel gelişmeler ışığında incelenmesi, eseri anlamada daha bütüncül bir algıyı içerebileceği söylenebilir (Ülger, 2021, 34).

Sanatı oluşturan temel unsurlar arasında; sanatçı, sanat eseri, sanat izleyicisi, eserin ortaya çıktığı zaman veya dönem, sanatın içinde bulunduğu doğal ve toplumsal çevre etkinlik göstermektedir. Sanat eseri eleştirisinin amacı; bir eserin, görüşün veya tutumun değeri ile ilgili durum belirtmek ve eserden hareketle çıkarım, çözümleme ve değerlendirme yapmaktır. Böylece, eleştirel yaklaşım esere sanatsal bir çizgi belirlerken, aynı zamanda sanatçıya da eleştirici gözüyle yeni bir kimlik kazandırmaktadır. Bireylerin; müze ve sanat galerileri gibi farklı mekanlarda, eserle doğrudan karşılaşabileceği, sanat eleştirisi yapabileceği imkanların yaratılması bu kimlik oluşum sürecinde etkilidir (Mercim ve Alakuş, 2005, 45).

Sonuç

Yapılan araştırmalarda; sanat ve insan iç içe olduğu sanatsal eleştiri ve analitik çözümleme sisteminin; gelişen bir yapıya sahip olduğu, sürekli evrildiği, şekil değiştirdiği, yeni anlayış ve değerlere sahip olduğu görülmüştür. Bu nedenle, eleştiri sonucunda sanat eserinin insan üzerinde oluşturduğu durumun temelinde, insanların eser karşısındaki duyguları, algı ve izlenimleri, tepkileri ve yargıları aslında eserin alt anlamları olarak görülmektedir. Bilgiye dayalı yorum, bilim ve sezgiler bütünlük içerisinde olduğunda sanat eseri hakkında doğru karar verilebilir. Böylece eleştiri de amacına yönelik bir tutum sergilemiş olur.

Sanatın toplumsal bir değer ve kültürel bir unsur olduğu düşünüldüğünde, sanatsal yaklaşımların alışkanlık, tecrübe ve kimlik kazanmış olması sanat kültürünün doğmasına neden olmaktadır. Sanat kültürünün gelişmesi için eleştirmenlerin yanı sıra, sanatın kültür merkezli olarak gelişmesi, sanatın ve sanatçının tanımı, estetik, temel sanat eğitimi tasarım ilke ve öğelerinin bilinmesi ve uygulanması, ayrıca bunların sanat eseri üzerinden incelenerek açıklanması büyük önem taşımaktadır. Ayrıca bireylerin; müze ve galeriler gibi farklı mekanlarda sanat eleştirisini ve güncel sanat değerlendirmelerinin yapılabileceği ortamlarda daha fazla bulunmasının, sanat faaliyetlerinin hayatın içinde yer almasının, sanat, eser yorumlaması, eleştirisi ve analitik bakabilmeye ilgili bilgilerin temel eğitim düzeyinden itibaren verilmesindeki önemin anlaşılmasının bilincine varılmalıdır.

Kaynakça

- Akarsu, B. (2018). Eleştirel düşünme sanatı. *İstanbul: Cinius Yayınları*.
- Karabulut, N., Karakuzu, M., & Konca, Y. (2008). Sanat eğitiminde pedagojik eleştiri yöntemleri. *Güzel Sanatlar Enstitüsü Dergisi*, (21), 87-111.
- Mercin, L., & Alakuş, A. O. (2005). Sanat eleştirisi ve pedagojik eleştiri yönteminin incelenmesi. *DÜ Ziya Gökalp Eğitim Fakültesi Dergisi*, 5, 36-46.
- Şenşekerci, E., & Bilgin, A. (2008). Eleştirel düşünme ve öğretimi. *Uludağ Üniversitesi Fen-Edebiyat Fakültesi Sosyal Bilimler Dergisi*, 9(14), 15-43.
- Ülger, K. (2021). Sanat eleştirisi dersinin işlenmesine eleştirel bir yaklaşım. *Sanat Dergisi*, (38), 33-51.

İnternet kaynakları

<https://mail.baskent.edu.tr/~21293301/%C3%B6%C4%9Frenmeyi%C3%B6%C4%9Frenme.html>.

SERAMİK SANATINDA ALTERNATİF ŞEKİLLENDİRME YÖNTEMLERİ

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Özet

İnsanoğlu, varoluşuyla birlikte seramik malzemeyle oluşturduğu nesnelere, günlük ihtiyaçlarını karşılamak için hız kesmeden üretmiştir. Tarihin başlangıcından itibaren doğal bir malzeme olan seramik; yaşamın her alanında kullanılmış, kullanıldıkça da gelişmeye ihtiyaç duymuştur. Her türlü günlük kullanım eşyası, dini ritüel objeleri, mimari ve dekoratif unsurlar, kil tabletler olarak adlandırılan yazılı belgeler şeklinde günümüze dek ulaşmıştır. Seramik malzemelerle üretilen ürünlerin işlevi, sanatsal değeri ve kültürel özellikleri dikkate alınarak çeşitli şekillendirme yöntemleri tercih edilmiştir. Seramik ürünler sanatsal açıdan ele alındığında; çeşitli şekillendirme, dekor ve pişirim yöntemleri kullanılarak önem kazanmaktadır. Astar ve sır kullanımıyla su geçirmez özellik kazanan ilk kaplar, seramik sanatı tarihi adına önemli bir dönüm noktası olmuştur. Şekillendirme ve dekorlama özellikleri ile üretildikleri çağın sanat anlayışı ve teknolojisini yansıtan bu seramik ürünler; insanlık adına değerli izler taşımakta ve o döneme ışık tutmaktadır. Bu çalışmada, seramik sanatında kullanılan çeşitli yöntemlerin kullanımını ve gelişimi incelenmiştir. Bunlardan, şekillendirme yöntemlerinin tarihsel süreçte ortaya çıkan, gelişim gösteren ve yaygın olanların yanı sıra, günümüzde alternatif olarak kullanılan yöntemler de ortaya konulmuştur. Alternatif bir şekillendirme yöntemi olan akitma ile şekillendirmenin aynı zamanda da bir dekor yöntemi olduğu da belirtilmiştir.

Anahtar kelimeler: Seramik, sanat, dekor, şekillendirme, alternatif.

ALTERNATIVE FORMING METHODS IN CERAMIC ART

Abstract

With its existence, mankind has produced ceramic material without slowing down to meet its daily needs. Ceramic, which has been a natural material since the beginning of history; has been used in all areas of life, and it needs improvement as it is used. All kinds of daily use items, religious ritual objects, architectural and decorative elements, and written documents called clay tablets have survived to the present day. Various shaping methods have been preferred considering the function, artistic value, and cultural characteristics of the products produced with ceramic materials. When ceramic products are considered artistically; It gains importance by using various shaping, decoration, and firing methods. The first vessels that gained waterproof features with the use of lining and glaze became an important turning point in the history of ceramic art. These ceramic products reflect the artistic understanding and technology of the era in which they were produced, with their shaping and decoration features; It carries valuable traces on behalf of humanity and shed light on that period. In this study, the use and development of various methods used in ceramic art were examined. Among these, in addition to the shaping methods that emerged, developed, and common in the historical process, methods used as alternatives today have also been revealed. It has also been stated that shaping by pouring, which is an alternative shaping method, is also a decoration method.

Keywords: Ceramics, art, decor, shaping, alternative.

Giriş

İnsanoğlu; kendi tarihi kadar eski olan toprağı şekillendirerek, kullanılabilir hale getirmeyi başarmıştır. Zamanla bu toprak objeleri pişirmeyi keşfetmiştir. İlk başlarda bu toprak ürünleri elleri ve parmaklarıyla şekillendirmiş, doğal yollarla renklendirip boyamayı öğrenmiştir. Sonrasında, şekillendirme ve dekorlama tekniklerini geliştirerek birbirinden farklı pek çok seramik ürüne özgün görünüm kazandırmıştır. Yüzyıllar boyunca süregelen bu gelişmeler seramik yolculuğunu başlamasını sağlamıştır. Varoluşu süresince çevreyi, kendini, günlük kullanım eşyalarını veya barınmak amacıyla yaptıkları mekânları çeşitli malzemelerle süsleme çabasına girmişlerdir. Kullandıkları malzemeler, genellikle doğal ve kolay ulaşılabilen türde olmuştur.

İşlevselliğin yanı sıra estetik bir algı oluşturmak amacıyla da zamanla çeşitli şekillendirme ve dekorlama teknikleri üretmişlerdir. Tarihin ilk dönemlerinden bugüne dek hem şekillendirme hem de dekorlama tekniklerinde pek çok malzeme kullandıkları gibi, seramik malzeme ile de bunu denemişlerdir. Seramik malzemeyle kullanılarak farklı yöntemlerle yapılan şekillendirmeler sonucu oluşan ürünlere çeşitli dekorlama teknikleri uygulanabilmektedir.

Teknolojik gelişmelerle seramik alanında da çağın gerektirdiği ilerlemeler yaşanmış, 19. yüzyılın sonlarında özellikle de 20. yüzyılın başlarında endüstriyel gelişmelerle birlikte Modernizmin doğmuştur. Bu andan itibaren şekillendirme ve dekorlama tekniklerindeki yaklaşımlarda değişimler görülmüştür. Bu değişimler sanatın diğer alanlarında olduğu gibi seramik alanında da daha kavramsal anlamlar kazanmasını sağlamıştır. Artık güzel olanı üretmenin sanat olduğu anlayışının yerine, üretilen sanat nesnelерinin güzeli temsil ettiği anlayışı gelişmiştir. Bu açıdan bakıldığında sanatsal üretim sürecindeki şekillendirme, dekor ve çeşitli üretim tekniklerinde de kavramsal ifadelerin ön plana çıktığı gözlenmektedir.

Seramik Sanatında Uygulanan Teknikler

Farklı ihtiyaçlar doğrultusunda şekil alan seramik ürünlerin kullanımı ve üretimi, günümüzde teknik ve teknolojik gelişmeler ışığında hız kazanmıştır. Seramik üretim sürecinde genel anlamıyla; şekillendirme, dekorlama ve pişirim teknikleri olmak üzere 3 ana başlık bulunmaktadır. Bu durum, kullanılan çamurun türüne, üretilecek miktara, ürünün işlevselliğine bağlı olarak çeşitli sınıflara ayrılmaktadır. Bunlar geleneksel, artistik, endüstriyel ve ileri teknoloji seramikler şeklinde nitelendirilmektedir. Ayrıca ürün türüne göre de; çimdikleme, plaka, sucuk, kalıp içi ve kalıp dışı sıvama, torna, döküm, presleme, şablon gibi genel kullanılan tekniklerin yanı sıra, akıtma, daldırma ve kurinuki gibi alternatif şekillendirme teknikleri de bulunmaktadır.

İlk bakışta en ilkel teknik gibi görünen çimdikleme yöntemi, hiçbir alet olmadan sadece el ile yapılmasından dolayı tercih edilir bir yöntemdir. Aslında oldukça fazla bir hassasiyet gerektiren bu yöntem, bir formun içini ve dışını aynı anda şekillendirebilmeyi ve dokunsal deneyimi öğretmektedir. Plaka ve sucuk teknikleri plastik seramik çamuru ile yapılabilecek en yaygın şekillendirme yöntemleri arasında yer alırken, kalıp içi ve kalıp dışı sıvama teknikleri de anı kıvamda uygulanabilecek farklı tekniklerdir. İster iç yüzey, ister dış yüzey dekorları olsun her ikisinde de kesin sonuçlar elde edilebilmektedir.

Seramik üretiminin genellikle şekillendirme, bazen de düzeltme ve rötuş aşamalarında kullanılan tornalar ise; alçı tornası, şablon tornası ve çömlekçi tornası olarak üç farklı şekilde görülmektedir (Canbolat, 2014, 4). Sıvı döküm çamurunun alçı kalıpların içine dökülmesi prensibiyle şekillendirilen döküm yönteminin yanı sıra, pres ve şablon gibi yöntemler ise genel olarak endüstriyel şekillendirme yöntemleri arasında yer almaktadır.

Seramik üretiminde alışılmışın biraz daha dışında farklı şekillendirme teknikleri de kullanılmaktadır. Kimi hassas, ince ve kırılğan; kimi ise daha detaylı olması nedeniyle daha az tercih edilmektedir. Seramik üretim sürecinde bazen şekillendirme ve dekor ayrı ayrı tekniklerle yapılıyor olsa da, bazı şekillendirme türleri aynı zamanda ürüne dekor özelliği de kazandırmaktadır. Dünyanın çeşitli coğrafyalarında, farklı kültürlerde ve farklı işlevlerde çeşitli tekniklerle dekorlu pek çok seramik ürün bulunmaktadır. Dönemlere ve toplumlara göre farklılıklar gösteren bu ürünler, kullanılan kültürel ve sanatsal öğeler ile yansıttıkları konular açısından farklılıklar taşımaktadır. Her dönemin kendisine ait bir bakış açısı ve her toplumun da kendisine ait bir kimliği bulunmaktadır. Tüm bu unsurlar, sanat eserlerinin karakteristik özelliklerini yansıtmaktadır. Kullanılan geometrik, bitkisel desenlerden ya da stilize insan, hayvan motiflerinden, dekorların hangi döneme ve uygarlığa ait olduğu anlaşılabilir. Çeşitli sahneler, tarihsel olaylar veya dini inanışlar gibi toplumların yaşayış biçimleri ile ilgili her şey seramik ürünlerin dekorlarında ifade edilmeye çalışılmıştır. Astar kazıma, çamur akıtma, ajur, kesme, oyma, rölyef, mayolika, sıraltı ve sır üstü dekorlama transfer tekniklerinin yanı sıra; raku, sagar ve obvara gibi artistik pişirim yöntemleri ile de dekorlama uygulamaları gerçekleştirilebilmektedir. Her ne kadar hepsi ayrı ayrı kendine has farklı malzeme kullanımı, dikkat ve üslup gerektirse de, çamur akıtma, ajur, kesme, parça çıkartma gibi delikli şekillendirme türlerinin diğerlerine oranla çok daha kırılğan ve hassas olduğu ifade edilebilir.

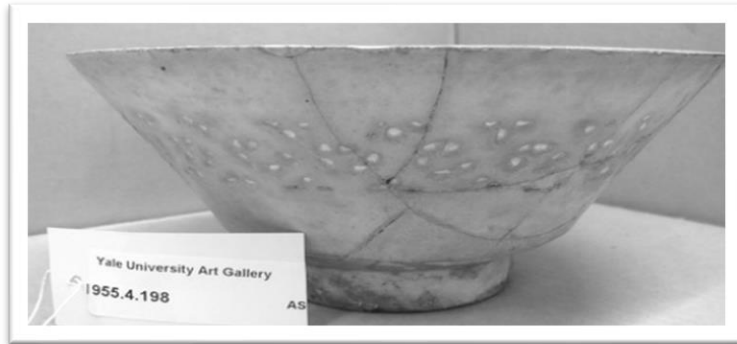
Seramik Şekillendirmede Alternatif Teknikler

Alternatif seramik şekillendirme olarak tanımlanan tekniklerden akıtmayla şekillendirmede ajurlu, delikli ve boşluklu özellikler; daldırma olarak tanımlanan teknik ile ürün üzerine çeşitli rastlantısal doku özellikleri kazandırılmaktadır. Kurinuki tekniği ise, kütleli şekillendirme

prensibine dayalı bir yöntem olup, bütünden detaya doğru bir şekillendirme yolu izlenmektedir. Uzakdoğu seramik şekillendirme tekniği olan kurinuki, geleneksel seramik şekillendirme tekniklerine göre daha az uygulanmaktadır. Kütleli seramik çamurunun öncelikle dıştan kazıma tekniği, sonrasında da iç boşluğun elde edilebilmesi suretiyle ürün oluşturulmaktadır (Karakurt, 2021, 90).

Çalışma kapsamında ele alınacak olan alternatif seramik şekillendirme tekniği olan akıtma ile şekillendirme, bazı kaynaklarda bir tür ajur tekniği olarak ifade edilmektedir. Ajur kelimesi, terminolojik açıdan ele alındığında ise, delikli, örgü, gözenek şeklinde tanımlanmaktadır (TDK, 1994: 20). Ajur; ahşap, mermer, taş gibi malzemelerde kafes biçimli oyuk bezeme; seramik, çini, porselen gibi ürünlerin üzerinde görülen desenli delikleri bezeme tanımlaması yapılmaktadır.

Her toplum yaşadığı çağın teknik, teknolojik ve malzeme imkânlarıyla ürettikleri ürünlerde ve dekor çalışmalarında kendilerini ifade etmiştir. Bu dekorlardan ajur tekniği de pek çok medeniyette farklı teknik ve yöntemlerle ortaya çıkmaktadır. Örneğin; bu teknik, bazı Selçuklu seramiklerinde etkileyici beyazlığından dolayı araştırmacılar tarafından “Selçuklu Beyazları” olarak adlandırılan özel bir kategoride ele alınmaktadır (Görsel 1). Bu eserler genellikle boyasız ve beyaz, bazen de kobalt mavisi veya mangan moru boya akıtmalı olarak üretilmiştir. Bazı örneklerde ise, sadece bu ürünlere has “pirinç delikleri” şeklinde tanımlanan delikli dekorlar görülmektedir. Ajurlu delikli seramik yüzeyler, şeffaf sırla kaplanmakta, bu delikler gövdenin su geçirmemesini önlemekte ve ışığın süzülmesini sağlayarak, gövdenin porselene benzer, saydam ve zarif yüzey özelliğini vurgulamaktadır (Avşar, 2015, 102). Bu dönemde üretilen seramik kapların yüzeylerinde, çeşitli desenlerde önceki örneklerde kabartmalar sonrasında ise, küçük delikler açılarak üretilmiştir. Seramik yüzeylerde ışığın geçmesi sağlanmıştır (Poyraz, 2019, 78).



Görsel 1. Selçuklu beyazı pirinç delikli kase, 12.yy.

<http://artgallery.yale.edu/collections/objects/bowl-seljuk-white-ware>

Boşluklu veya ajurlu olarak adlandırılan dekorlarda iki farklı yöntem kullanılmaktadır. İlki; kesme, oyma veya delme yöntemiyle diğeri ise; akıtma ile şekillendirme yöntemidir. Geleneksel açıdan el alındığında yaygın olan delikli, boşluklu veya ajur görünümü keserek oluşturulmaktadır. Plastik kıvamda şekillendirilen seramik ürünler deri sertliğine yakın bir kıvamda iken, üzerine çizilen desenler kesilerek parçalar çıkartılır. Seramik yüzey üzerinde kesilen boşluklar; her ne kadar risk teşkil etse de, hem işlevsellik hem de dekoratif açıdan farklı dönemlerde, uygarlıklarda ve kültürlerde uygulandığı görülmektedir. Kesilerek oluşturulan ajur tekniği seramikte; şekillendirilme işlemi bitmiş forma geçirilen desenlerin, form yaş iken yüzeyden kesilerek çıkarılması ya da delinmesiyle oluşturulan bir dekor yöntemidir. Ajur tekniği ile yapılan dekorlara “kesme” veya “delik işi” de denilmektedir. Bu dekor uygulamalarında tekrar eden motifler, yan yana gelen birimler, örüntü ve ritmiklerle delikli süslemeler oluşturulmaktadır. Seramik yüzeylere ince ve sivri uçlu aletlerle uygulanan ajur dekor tekniği, estetik özelliklerin yanı sıra, ürüne farklı işlevsel özellikler de kazandırmaktadır. Boşluklu veya delikli izlenimini veren bir teknik olan ajur tekniği öncelikli olarak Yunanistan sonrasında ise, Uzak Doğu, Anadolu Selçuklu ve İran' da yayılımını sürdürmüştür. Uygulanması oldukça güç ve zahmetli bir yöntem olduğu için bu teknik şeytan işi olarak tanımlanmıştır (Aktaş, 2015, 1). Teknik; Çin'den İran'a, oradan da Avrupa'ya taşınarak İngiltere, Almanya, İtalya seramik fabrikalarında fonksiyonel ürünler yapılmıştır.

Seramik şekillendirmede doluluk ve boşluk algısını ortaya koyan, yüzeylerde açılan delikler şeklinde oluşturulan boşluklar, ajur yönteminin pek çok kültürde karakteristik örnekleri görülmektedir. Ajurlu dekorlar uygulaması zor ve riskli olması nedeniyle, genel olarak deri sertliğinde olan formlarda uygulanmaktadır (Gökçe, 2011, 44). Bu tür uygulamaların seramik sanatında en çok risk taşıyan yöntem olduğu söylenebilir. Yinede, seramik yüzeylerde bırakılan boşluklar veya delikler başta ışığı geçirmesiyle dikkat çekici bir özellik taşımaktadır. Ayrıca ince ve narin bir görünüme sahip olmasıyla da estetik bir değer taşımaktadır.

Yüzeyde delikler açmak suretiyle sağlanan boşluklar şeklinde tanımlanabilen, geçmişte pek çok örneği görülebilen ajur tekniği, 18.yy. da yapılmış pek çok seramik ürünlerde kullanılmıştır. Victoria and Albert Müzesi' nde bulunan ajur süslemeli tabaklar yiyecek koymaya yarayan, derin olmayan kaplardır (Görsel 2). Müzede yer alan ajur dekorlu tabakların genelde kenar kısımları bordür şeklinde ajur (delik) dekorlarıyla süslenmiştir. Müzede bulunan koleksiyonda ajur dekorlu tabakların genellikle İngiltere ve Fransa'da üretildiği belirtilmektedir (Gökçe, 2011, 50).



Görsel 2.

Yüksek Derece Pişirilmiş Seramik Çamuru Tabak, Victoria and Albert Müzesi, 18. Yy.

Gelişimini kesintisiz şekilde sürdüren bu dekor tekniği, günümüz sanatçılarının seramik üretimlerinde tercih ettiği alternatif şekillendirme ve dekor uygulaması olarak varlığını devam ettirmektedir.

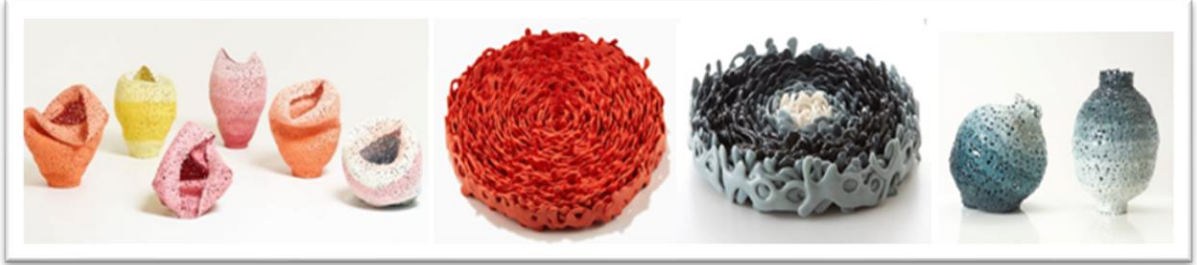
Türkiye'de çeşitli üniversite ve ünvanlarda akademisyen olarak görev yapan sanatçı, Olgu Sümengen Berker, Türkiye ve Almanya'da 11 kişisel sergisi açmıştır. Sanatçı, dünya çapında 70'in üzerinde ulusal ve uluslararası karma ve yarışma sergisine katılmıştır. 4 ödülü ve uluslararası süreli yayınlarda yayınlanmış makaleleri bulunan Berker'in eserleri çeşitli özel veya müze koleksiyonlarında yer almaktadır. 2017'de Almanya'ya yerleşen sanatçı, stüdyosunda bağımsız olarak çalışmaktadır. Ayrıca Hollanda'daki NATO Müşterek Kuvvet Karargahı Brunssum, Sanat ve El Sanatları Merkezi'nde sanat üzerine dersler vermektedir (<https://www.olguarts.com/about/>). Alternatif seramik şekillendirme yöntemlerini kullanan sanatçının eserlerinde kendisine özgü yaklaşımlar dikkat çekmektedir.



Görsel 3. Olgu Sümengen Berker eserlerinden örnekler.

http://turkishpaintings.com/index.php?p=34&l=1&modPainters_artistDetailID=1740&t=true

Aslen Koreli olan Mimi Joung, Kraliyet Sanat Koleji'nden Seramik ve Sanat eğitimi almıştır. Bazen sıradan, yün, ipek iplik, iğne kutusu gibi buluntu malzemeleri, bazen de, doğal malzemeleri bir araya getirip kili, hikâyelere dönüştürerek yeni düşünceler oluşturduğu belirtilmektedir. Çalışmalarını, insan durumlarına ve deneyimlerine atıfta bulunmak için yapığını, köken ve yerinden edilme gibi konularına odaklandığını da ifade etmektedir (Görsel). Evinden ve oradaki önemli izlerden çok uzakta, kendi kökleri ve değişim döngüsünü vurgulayan bir yorumcu, gözlemci ve tarihçi kimliğiyle eserlerini üretmektedir. Mimi Joung için elleri içgüdüsel olarak kendi hayatını ve okuduklarını yansıtmaktadır. Sanatçı diğer insanlardan ve durumlardan öğrendiklerini yansıtarak eğlenceli bir yaklaşım sergileyerek fikirleri çözmeye çalıştığını söylemektedir. Malzeme ve tekniklerdeki rahatlığının, seramik malzemelerin, formların ve renklerin tarihsel bağlamında daha derin bir anlam aramasına olanak tanıdığı eserlerindeki dilden anlaşılmalıdır (<https://cavalierofinn.com/artists/39-mimi-joung>). Malzemelerin en önemli kısmının, eserlerindeki kırılmanın en son noktasında olduğunu ifade eden sanatçı, buna izin vermenin, çalışmanın fiziksel gücünü gerçeğe dönüştüren bir özgürlük olduğu tanımlamasını yapmaktadır.



Görsel 4. Mimi Joung, eserlerinden örnekler

<https://mimijoung.com/about>

Seramik üretiminde farklı şekillendirme yöntemlerinde değişik kimyasal ve fiziksel yapılarla sahip seramik çamurları kullanılmaktadır. Endüstriyel veya seri üretim olarak bilinen, alçı kalıba döküm yönteminde kullanılan döküm çamuru, alternatif bir şekillendirme yöntemi olan akıtma suretiyle yapılmaktadır. Akıtma ile şekillendirme olarak tanımlanabilen bu yolla, yine döküm çamuru ve alçı yüzey kullanılmaktadır. Bütünü oluşturacak parçalar tek tek ve birbirlerinden bağımsız olarak şekillendirilmektedir. Yüzeyden kalkabilecek kıvama geldiğinde ise parçalar birbiri ile yapıştırılarak bütün oluşturulmaktadır. Şekillendirme süresince parçaların

kıvamın korumak ve dayanımını sağlamak gerekmektedir. Oldukça kırılan ve hassas bir et kalınlığına sahip olmaları nedeniyle her bir parça özenle kullanılmalıdır.

Kişisel uygulama aşamalarında, akıtma ile şekillendirme yönteminde, boşluk ve doluluk algısı sorgulanırken, denge ve bütünlük unsurlarına da vurgu yapılmaktadır. Parçaların oluşturulmasından yapıştırılmasına, ürünün şekillendirilmesinden kurutulup pişirilmesine kadar her aşamasında büyük bir özen ve tecrübe gerekmektedir. Herhangi bir aşamada oluşabilecek hata veya dikkatsizlik geri dönüşü olmayan sonuçlar doğurabilmektedir. Her ne kadar risk teşkil eden bir üretim yöntemi olsa da, herhangi farklı bir dekora gerek kalmadan ürünler tamamlanmaktadır. Aslında dekoru, şekillendirme yönteminin kendisidir denilebilir. Akıtma ile şekillendirilmiş ürünler kuruduktan sonra 1100 °C de pişirilmektedir. Çalışmalar isteğe bağlı sırlı veya sırsız olarak sergilenebilme özelliğine sahiptir.



Görsel 5. Akıtma ile şekillendirilmiş özgün parça örnekleri.

Seda Dilay kişisel eser arşivinden



Görsel 6. Akıtma ile şekillendirilmiş özgün çalışma örnekleri.

Seda Dilay kişisel eser arşivinden.

Sonuç

Sanat eserlerinin güncel değer kazanabilmesi adına atılan adımlarda yenilikçi yöntemlerin kullanılması gerekliliği görülmektedir. Seramik malzemenin, tarihsel, kültürel, sanatsal ve teknolojik özellikler taşıması nedeniyle gelişime oldukça imkân veren bir seçenek olduğu söylenebilir. Seramik ürünlerin değerinin artırılması için, zaman zaman farklı şekillendirme, dekor ve pişirim yöntemleri kullanılmaktadır. Tarihi süreçte işlevselliğin estetik algıyla birlikte değerlendirilmiş olması, seramik ürünlerde yenilikçi ve sürdürülebilir bir yaklaşım olarak görülmektedir. Günümüzde seramik sanatında, en yaygın kullanılan şekillendirme tekniklerinin yanı sıra alternatif yöntemlerinde tercih ediliyor olması da bu nedenlerden kaynaklanmaktadır.

Farklı kıvamlarda farklı şekillendirme ve dekorlama teknikleri

Sonuç olarak; seramik şekillendirmede kullanılan alternatif üretim yöntemleri, plastik sanatlarda daima güncel ve sürdürülebilir bir tutum oluşturmaktadır. Yenilikçi şekillendirme yöntemleri ile yapılan çalışmalara bakıldığında, alışılmış seramik şekillendirme yöntemlerine göre farkındalık oluşturduğu ve özgün bir kimlik taşıdığı gözlenmektedir. Şekillendirme sonucunda ortaya çıkan estetik ya da kavramsal etkilerin de diğer sanatçılara ve sanat disiplinlerine olumlu etkiler sağlayabileceği öngörülmektedir.

Kaynakça

- Aktaş, M. (2015). Seramik Yüzey Değerlendirilmesinde Ajur Yöntemi (Doctoral dissertation, Anadolu University (Turkey).
- Avşar, L, Avşar, M (2015). Seramik Sanatı Eğitiminde Selçuklu Seramiğinin Yeri kalemisi, Cilt3, Sayı5, Volume3, Issue5.
- Canbolat, A. (2014). Seramik şekillendirme yöntemlerinde tornanın kullanımı ve seramik tornalar (Doctoral dissertation, Anadolu University (Turkey).
- Gökçe, E. (2011). Londra Victoria ve Albert Müzesi'nde bulunan farklı formlarda görülen bazı ajurlu (delikli) seramikler (Doctoral dissertation, DEÜ Güzel Sanatlar Enstitüsü).
- Karakurt, H. A. (2021). Kütlesel form yöntemi ile şekillendirme.
- Poyraz, Mine (2019). "Rice Grain Method" And Historical Development in Ceramic Art. İnönü Üniversitesi Kültür ve Sanat Dergisi, 5(2), s. 75-84
- İnternet kaynakları
- <https://cavalierofinn.com/artists/39-mimi-joung>
- <https://mimijoung.com/about>
- http://turkishpaintings.com/index.php?p=34&l=1&modPainters_artistDetailID=1740&t=true
- <https://www.olguarts.com/about/>
- <http://artgallery.yale.edu/collections/objects/bowl-seljuk-white-ware>

**STRENGTH ANALYSIS OF LEVELING SHOVEL BY FINITE ELEMENT
METHOD**

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Abstract

The task of the soil for agricultural production is to grow plants selected and planted according to the needs and wishes of people. For this, it starts by appropriately cultivating the soil. Applying agricultural techniques reveals the necessity of using various tools according to the type of soil and plant. In this sense, one of the soil tillage tools is the leveling shovel. Leveling shovels are used in agricultural enterprises for works such as leveling, paving, shoveling, channel opening, and channel closing. The leveling shovel is used for cleaning the land, breaking down the stones and plant residues on the surface of the land, and allowing the residues on the surface of the land to mix with the soil, while the amount of organic matter in the soil becomes fertile for the soil. Machine manufacturers, thinking that the products they produce after the sale will be operated under difficult conditions in the field, use thicker materials than they should be without performing strength analysis. While this increases the cost of the machine, it also increases the energy consumption of the machines used to drive the machine. Choosing the ideal material with a strength analysis using finite element methods before production will reduce costs and ensure the sustainability of agriculture. In this study, a leveling shovel used in soil tillage was solid modeled with Solidworks software. Then, the stress distributions occurring on the leveling shovel were simulated with the finite element package software Ansys Workbench in different load and working environments. As a result of the study, the maximum stress value was found to be 103.79 MPa, and the maximum total displacement value was found to be 406.23 mm.

Keywords: Leveling shovel, finite element method, Ansys Workbench.

Introduction

The task of the soil for agricultural production is to grow plants that are selected and planted according to the needs and wishes of people. For this, it starts by appropriately cultivating the soil. By applying agricultural techniques, it is necessary to use various tools according to the type of soil and plant. The available land sometimes creates a limited situation for adequate production. New agricultural lands are needed to increase the amount and yield of agricultural products [1]. In this sense, one of the tillage tools is the leveling shovel. Leveling shovels are designed for works such as leveling, paving, shoveling, channel opening, and channel closing. The leveling shovel increases the amount of organic matter in the soil while cleaning the land, breaking down the stones and plant residues on the surface of the land, and mixing the residual materials on the land surface into the soil [1-5]. Therefore, it also improves the soil structure.

Many benefits are obtained with the operations performed with the leveling shovel. These are;

- Erosion control
- Ensuring that the water the plant will receive reaches it evenly
- Create the required planting method and planting depth
- Eliminating the drainage problem by making the pits on the land uniform
- By preparing a smooth seedbed, it is possible to ensure smooth movement areas for other production machinery [6-8].

Since leveling shovels work on hard ground and in difficult conditions, the surfaces in contact with the soil are extremely abraded. The blades of leveling shovels need to be made of high-strength, high-strength materials such as steel to prevent easy abrasion.

Materials and Methods

The material of the research was the leveling shovel produced by the manufacturer. The 30MNB5 steel used in the shovel part of the leveling shovel and the manufacturing steel used in the body of the leveling shovel are widely used in the market, some technical specifications of the materials are given in Table 1 and the technical dimensions of the leveling shovel are given in Figure 1.

Table 1. Leveling shovel material properties

Shovel (30MNB5)	
Modulus of Elasticity	210 GPa
Yield Strength	510 MPa
Poisson's ratio is	0,3
Density	7860 kg/m ³

Body (Manufacturing Steel St50)	
Modulus of Elasticity	211 GPa
Tensile Strength	470 MPa
Yield Strength	295 MPa
Poisson's ratio	0,3

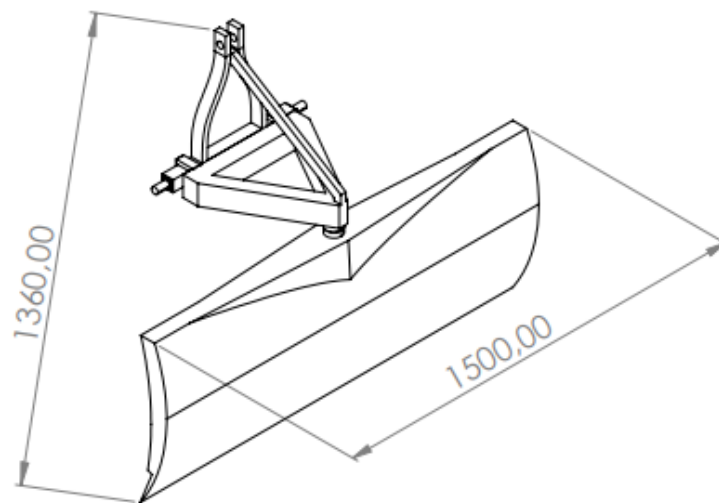


Figure 1. 3D solid model of leveling shovel

The leveling shovel was solidly modeled with Solidworks software (Fig.2). Then, the stress distributions occurring on the leveling shovel were simulated with the finite element package software Ansys Workbench in different load and working environments. The analyzes were carried out as three-dimensional linear static. The stress analysis results obtained are given as outputs of Ansys Workbench package software. The operation of the leveling shovel was evaluated and simulated for the application conditions. The forces on the leveling shovel were

$$\text{calculated by equation (1) [8]. } R_c = a \cdot b \cdot n \cdot k_o \cdot \sqrt{v} \quad (1)$$

Inequality;

R_{ϕ} : Towing Force (daN)

a: Work depth (dm)

b: Working width of a body (dm)

n: Number of bodies (Pieces)

k_o : Specific soil resistance (kp/dm^2) (40 kp/dm^2 was taken in the study)

v: Advance speed (km/h) (Advance speed was taken as 5.4 km/h).

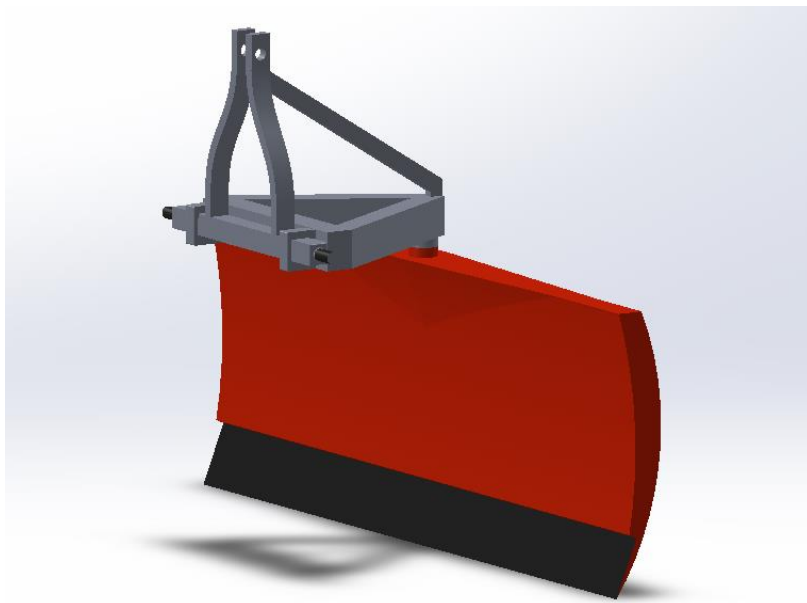
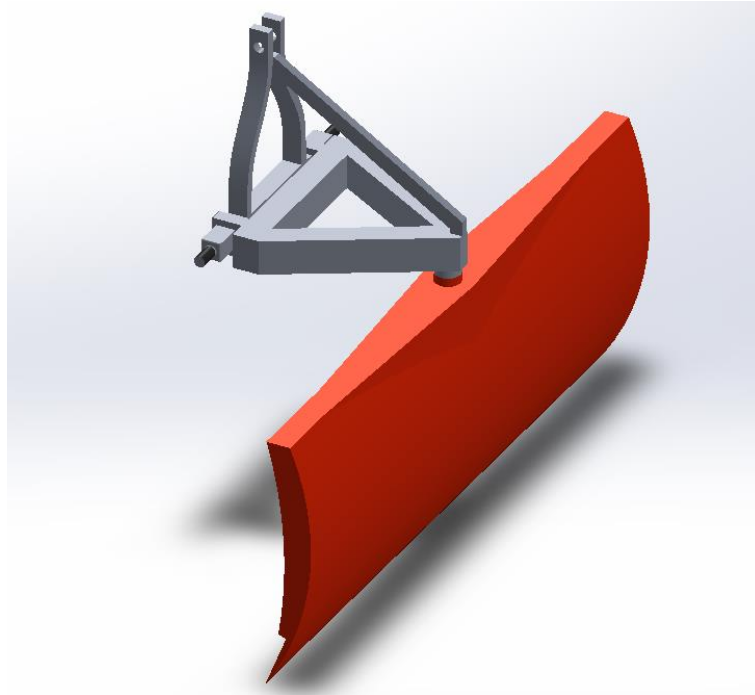


Figure 2. Solid model drawings of the leveling shovel

In the first step of the analysis process performed in the simulation environment with the finite element method, the meshing of the leveling shovel model, in other words, the separation of the model into the most appropriate small parts, was performed (Fig.3). The "meshing" functions of Ansys Workbench software were utilized to create the finite element structure of the leveling shovel. A total number of 786.908 elements and 1.182.837 total nodes were obtained for the leveling shovel.

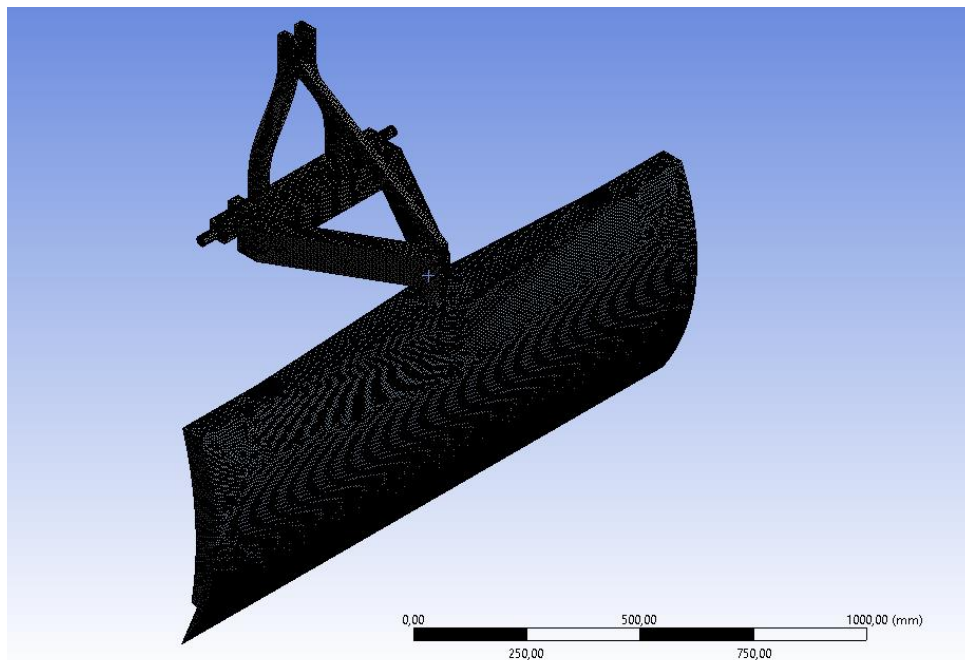


Figure 3. Finite element structure of the leveling shovel model

Towing force is a horizontal force consisting of the soil-vegetation resistance required to pull an agricultural machine and the rolling resistance required to overcome the weight of the tractor and agricultural machine [9]. Although the forces in the vertical direction are smaller than the forces in the horizontal direction, they were used in the analysis. During tillage, the soil is pushed by the leveling shovel in the opposite direction to the vertical component of soil resistance in an attempt to go deeper. Forces of 1350 N (Fig.4) and 100 N (Fig.5) were applied at certain points in the opposite direction to the direction of advance of the leveling shovel (Fig.4).

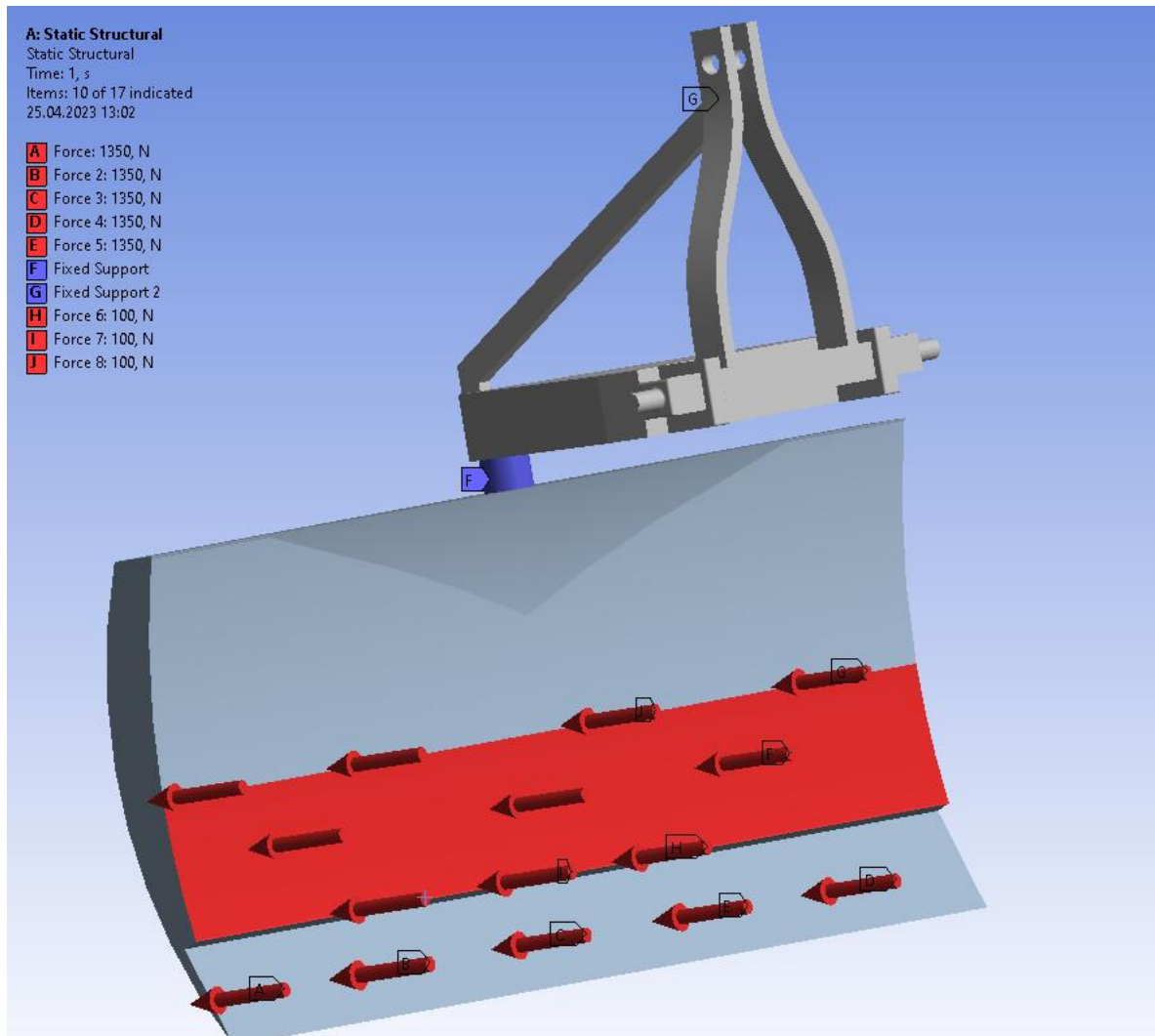


Figure 4. Defining boundary conditions and loads

Research Findings and Discussion

After the stress analysis solution process, the stress distributions occurring on the leveling shovel are given in Figure 5. When the structure of the leveling shovel is examined, it is seen that the maximum equivalent stress is at the connection part of the leveling shovel with the body. The maximum stress value is 103.79 MPa. When this value is evaluated in terms of shovel material, it is below the yield strength of the shovel. When the stresses on the body were examined (Fig.6), it was determined that the stress distribution under the applied loads remained within the yield strength limits of the material. The maximum equivalent stress and the safety coefficients obtained according to the yield strength of the material for Figures 5-7 are given in Table 2. When the equivalent stress values of all structural elements are analyzed, it is seen that the leveling shovel works safely without damage under the application conditions.

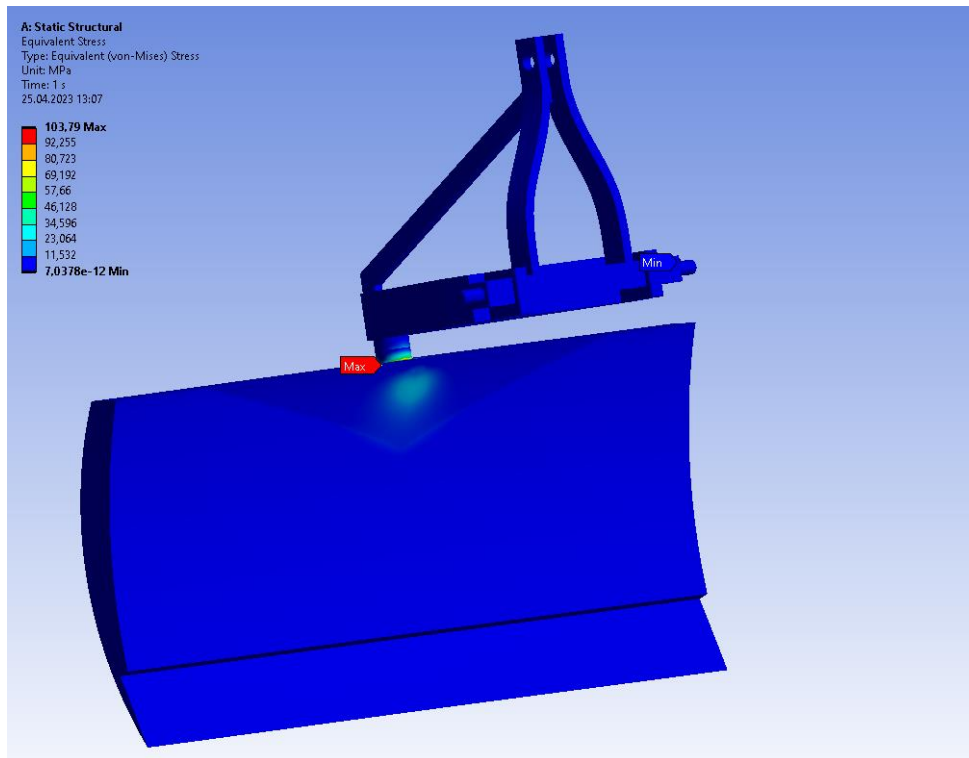


Figure 5. Distribution of equivalent stresses for the whole structure

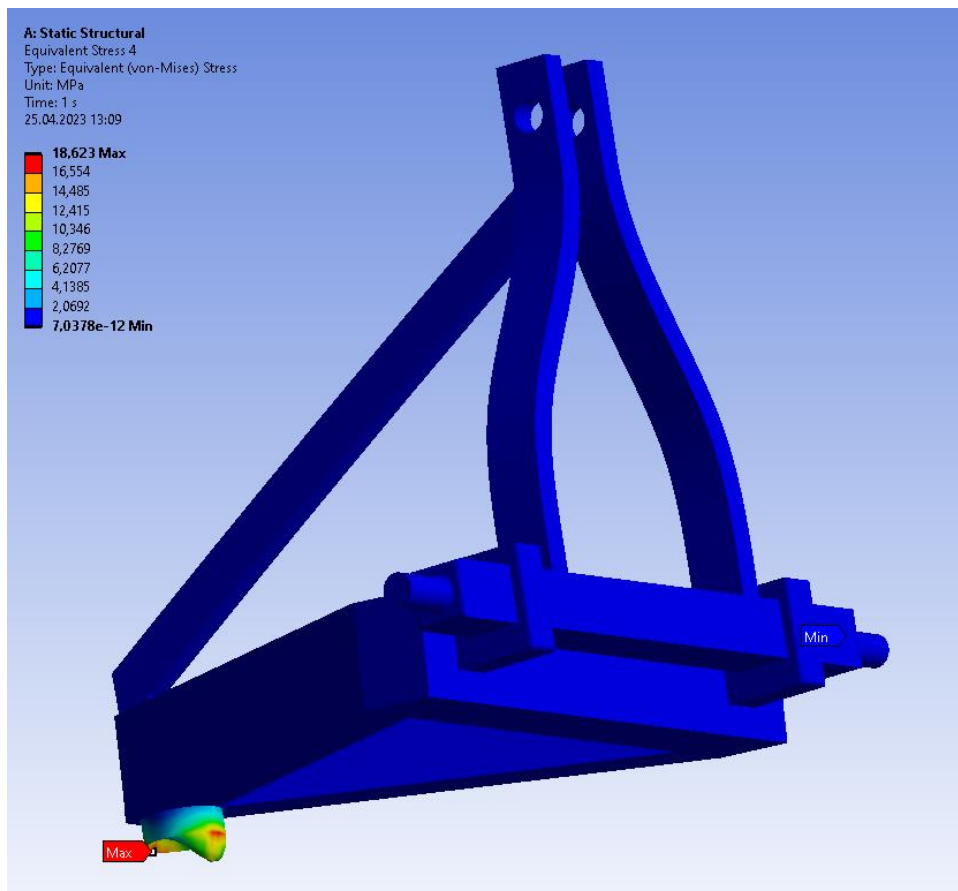


Figure 6. Equivalent stress distributions for the body

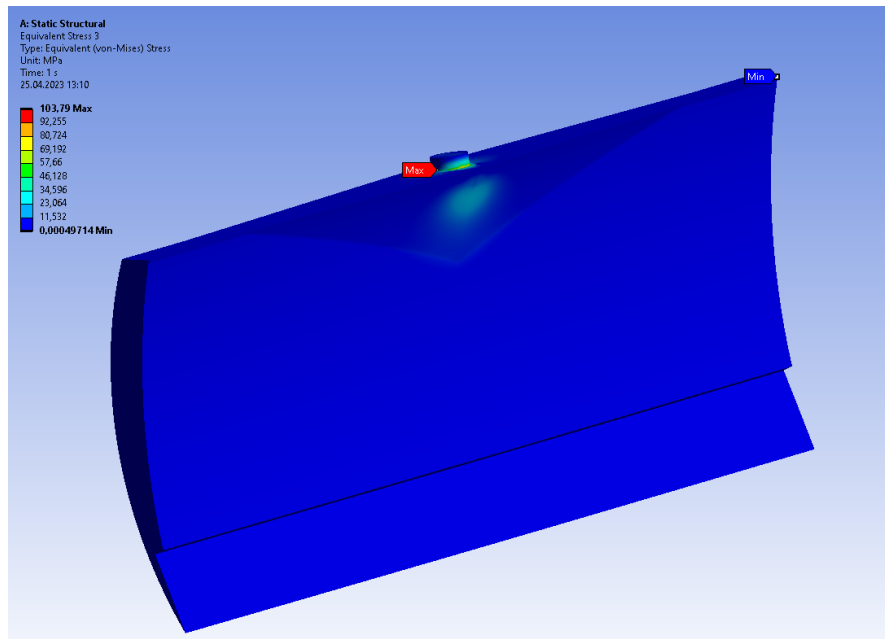


Figure 7. Equivalent stress distributions for the paddle element

Table 2. Working safety coefficients calculated for leveling shovel

Leveling Shovel Elements	Material Yield Strength [σ_{yield}] [mpa]	Max. Equivalent Stress [σ_{es}] [mpa]	Safety Coefficient [k_{em}]=[$\sigma_{yield} / \sigma_{es}$]
Shovel	510	103,79	4,914
Body	295	18,623	15,84

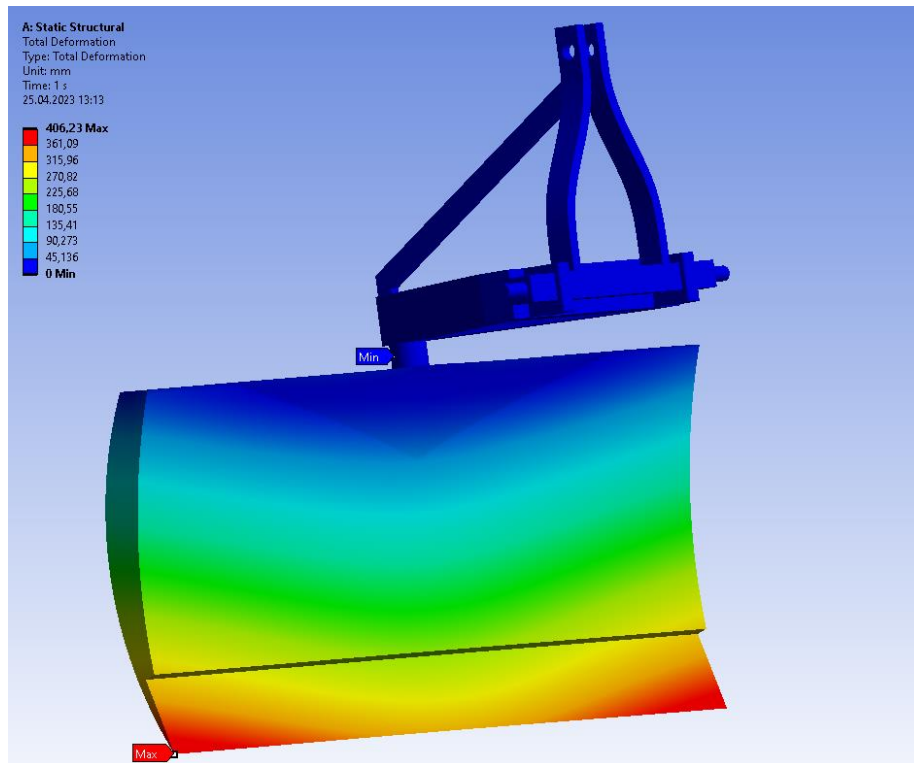


Figure 8. Maximum total displacement distribution of the leveling shovel

In the research, displacement analysis was performed under the loads applied to the leveling shovel. As a result of the analysis, the maximum total displacement value was found to be 406.23 mm (Fig.8).

Conclusion

In this study, three-dimensional solid modeling of the leveling shovel obtained from the market was made and the stress analysis of the modeled leveling shovel under normal field conditions was simulated. The results obtained as a result of the analysis are given below.

- a. For the whole leveling shovel construction, the maximum equivalent stress value is 103.79 MPa at the connection part of the leveling shovel with the body.
- b. The maximum equivalent stress value is 103.79 MPa at the connection of the leveling shovel with the body.
- c. The maximum equivalent stress value was determined as 18.623 MPa on the body.
- d. The maximum total displacement for the leveling shovel was found to be 406.23 mm.
- e. In the simulation, no damage was found in the construction of the leveling shovel. It was determined that the leveling shovel and its body carried the forces applied at different points within the elastic deformation limits of the materials used.

It is necessary to carry out material tests of agricultural tools and machines designed by personnel and produced from different materials and shapes. Since the trials carried out in real

field conditions are time-consuming and costly, the strength analysis of the products to be designed with 3D solid modeling techniques and finite element method will minimize unnecessary time loss [10]. In this context, the data obtained in the virtual environment should be interpreted very well before manufacturing, and experimental studies should be directed when necessary.

References

1. Gökçebay, B., (1986). Agricultural Machinery I. Ankara University Faculty of Agriculture Yay: 979 Textbook: 289, Ankara.
2. Arslan, S. (2006). Toprak Sıkışmasının Azaltılması İçin Alternatif Bir Yöntem: Kontrollü Tarla Trafiği. Kahramanmaraş Sütçü İmam Üniversitesi Fen ve Mühendislik Dergisi, 9(1), 135-141.
3. Chaudhary M R, Garji P R, Prihar S S & Khera R (1985). Effect of Deep Tillage on Soil Physical Properties and Maize Yields on Coarse Textured Soils. Soil and Tillage Research 6(1): 31-44.
4. Kirişci V (1999). Pulluk Tabanı ve Dipekazan Kullanımı. Cine Tarım Dergisi 17.
5. Kok H, Taylor R K, Lamond R E & Kessen S(1996). Soil Compaction Problems and Solutions. www.oznet.ksu.edu/library/CRPSL2/AF115.pdf
6. Korucu, T., Kirişci, V., Selvi, K.Ç. (2003). Toprak Sıkışmasını Azaltmaya Yönelik Traktör ve Makina Kullanım İlkeleri, Tarımsal Mekanizasyon 21. Ulusal Kongresi, 3-5 Eylül 2003, 172-178, Konya.
7. Upadhyaya S K, Williams T H, Kemble L J & Collins N E (1984). Energy Requirements for Chiseling in Coastal Plain Soils. American Society of Agricultural and Engineers 27(6): 1643-1649
8. Acar, A.İ., Öztürk, R., Güner, M. (2011). Tarım Alet ve Makineleri, Anadolu Üniversitesi Yayınları, Yay. No: 2354, Eskişehir.
9. Akıncı İ (1994). Traktör-Tarım Makinası Enerji İlişkilerinin Saptanması İçin Bilgisayar Destekli Ölçme Sisteminin Geliştirilmesi ve Mekanizasyon Planlamasında Temel İşletmecilik Verilerinin Belirlenmesi Üzerinde Bir Araştırma. Doktora Tezi, Çukurova Üniversitesi Fen Bilimleri Enstitüsü (Basılmamış), Adana, Türkiye
10. Yalçın, H., Çakır, E. (2005). Tillage Effects And Energy Efficiencies of Subsoiling and Direct Seeding in Light Soil on Yield On Second Crop Corn for Silage in Western Turkey.

**ERGONOMIC ANALYSIS OF WORKING POSTURES OF WORKERS IN
MACHINE SHOP**

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Abstract

Despite the transition to automation systems in many areas with technological innovations, most enterprises still need a physical labor force. Especially in jobs that require intensive labor, inappropriate working postures of employees cause musculoskeletal system disorders and cause a decrease in production efficiency. The main goal of ergonomics is to achieve the best performance with the least manpower. It is known that inappropriate postures during work cause permanent musculoskeletal disorders in employees in the long term. Various methods are used to detect and analyze this situation. In this study, the work of the employees in the machine shop on various benches was recorded, the data obtained were processed and the working postures were analyzed with the REBA (Rapid Entire Body Assessment) Method. As a result of the evaluations, the REBA score of the employees was calculated as 4. This value indicates that a medium-risk work stoppage has occurred and measures should be taken. As a precautionary measure, it is recommended to make the necessary ergonomic arrangements to improve the working postures of the employees.

Keywords: Working postures, REBA Method, workshop.

Introduction

Despite the transition to automation systems as a result of technological innovations in many sectors, many industrial enterprises still need physical labor. In jobs requiring intensive labor, employees' inappropriate working postures cause musculoskeletal system disorders and cause a decrease in production efficiency. With the idea that the main goal of ergonomics is to achieve the best performance with the least manpower, the examination of working postures, which is an important issue for both businesses and employees, has an important place in the science of ergonomics.

In the most general sense, posture is defined as the alignment of the body, head, torso, arms, and legs in space. According to this definition, working posture can be defined as the alignment of the body parts according to the work performed or the characteristics of the work [1]. Inappropriate working postures are defined as the deviation of one or more body parts from normal posture [2]. It is known that various musculoskeletal disorders often occur in sedentary or low-mobility workers and even cause serious disorders in the long term [3]. If the posture during work is not correct, this causes stress, fatigue, and pain in the worker. In this case, it would be the best decision to wait for the active muscles of the worker to regenerate themselves. The factors that make improper working postures important in machine shops can be analyzed in two groups: disorders in the body and inefficiencies in production.

Musculoskeletal disorders are caused by ordinary body movements such as bending, straightening, holding, grasping, twisting, and reaching, while production inefficiencies occur due to these disorders. These movements may not be harmful in normal life, but their repetition, forceful behaviors, and fast movements in work make them harmful to the body. These disorders are not instantaneous. They are long-term and slowly developing disorders [4]. It can be said that the most common musculoskeletal disorders in machine shop workers are low back and back pain.

A study conducted in the USA reported that the total direct and indirect costs of musculoskeletal diseases to the industry in 1997 were \$13-\$14 billion. Musculoskeletal disorders accounted for 42% of occupational diseases [5]. It can be said that these disorders are caused by fixed postures, continuous and repetitive movements, duration and frequency of work, strains caused by inappropriate postures in certain parts of the body, and work that does not allow appropriate movement and vibrations.

REBA Method

The REBA method is an observation-based posture analysis method that analyses the posture of the employee during static or dynamic whole-body activities, enabling the detection of the working style that may cause occupational musculoskeletal disorders and taking precautions. REBA was developed by two researchers, Hignett and McAtamney, in 1995 and published in 2000, utilizing RULA (Rapid Upper Limb Assessment) methods based on the OWAS (Ovako Working Posture Analysis System) method used in the metal industry [6]. The REBA method evaluates the whole-body posture. To apply the method and to analyze posture, it is recommended to analyze the study with photographs or videos. From the images obtained, posture analysis is performed by selecting frequently repeated movements that require more physical force, strain the employee more, and take time. In the REBA method, the risk score is determined by giving points to the postures by taking into account the instantaneous posture of the neck, torso, legs, upper arm, and lower arm during the posture to be analyzed [7]. In this study, the working postures of the employees in the machine shop were examined and the REBA method was used in the risk analysis with the data obtained.

Materials and Methods

Material

For the ergonomic evaluation of the employees working in the machine shop, the employees working in Karamanoğlu Mehmetbey University Vocational School of Technical Sciences Machining Workshop were selected as the research material. In the workshop, there are machines such as universal lathe, milling machine, drill machine, and grinding machine, which are actively used in production. The data were collected without interrupting the work of the employees. To determine the physical loads and postural disorders of the workers in the machine shop, the data in the study were taken in real-time from 5 people randomly selected from 10 employees who volunteered and allowed the data to be taken. During the recording of the measurements with the camera, the employees continued their normal work. The images obtained were analyzed in a computer environment.

Method

In each process group monitored within the scope of the study, randomly selected employees were filmed with a camera. Camera recordings were used to make timeliness calculations and the images were analyzed and analyzed during the work of the workers in the machine shop. Physical load scores of employees can be determined using REBA methods [7,8].

The REBA method is a practical method that allows all parts of the body to be analyzed. It numerically expresses the risk caused by a working posture or movement to be analyzed. In the REBA method, a score ranging from 1 to 15 is determined depending on the flexions and extensions that occur in the torso, neck, legs, upper arms, lower arms, and wrists during a working posture and the loads that the employee is exposed to during these postures. When determining the REBA score of a working posture according to the REBA method, the body parts are first divided into two Group A and Group B. Group A includes the torso, neck, and legs, while Group B includes the upper arms, lower arms, and wrists [7].

The scores of the trunk, neck, and legs are determined separately and a score consisting of the combination of these scores is determined with the help of Table A. A score is obtained by adding the Load/Strength score to this score. The scores of the upper arm, lower arm, and wrists are also determined separately and a score consisting of a combination of these scores is determined with the help of Table B. The grip score is added to this score to obtain a score of B [9,10]. Then, using Table C, a score C is obtained, which is a combination of scores A and B. The REBA score is obtained by adding the activity score to the C score (Figure 1).

REBA Method

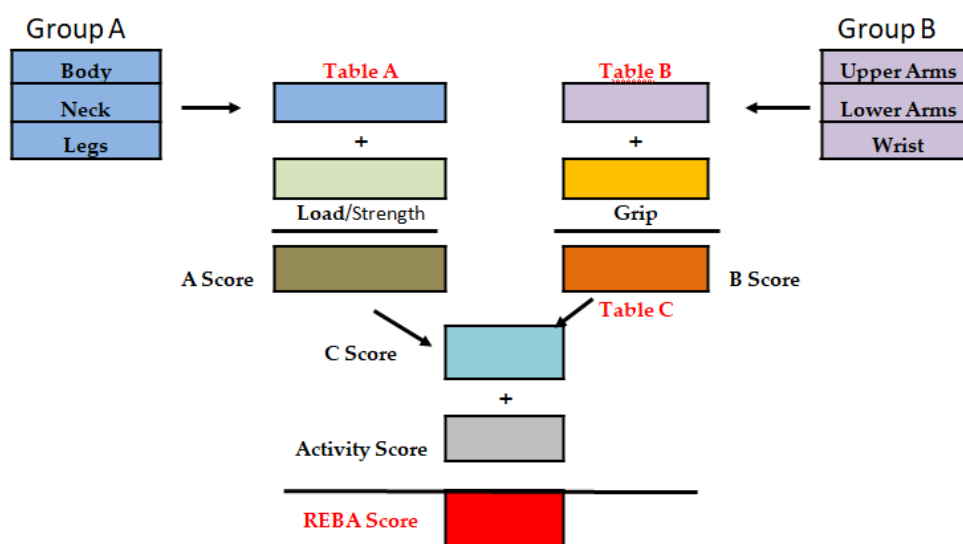
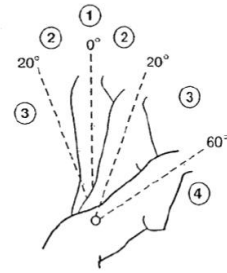


Figure 1. REBA Method flow diagram [9].

According to the posture position of the workers; separate scores of the trunk, neck, and legs are determined (Fig. 2). With the help of Table A shown in Table 1, the posture angles are converted into a numerical value with a score consisting of a combination of these scores.

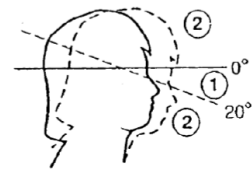
Body:

Movement	Score	Score Change
Upright	1	
0° – 20° Stretching	2	
0° – 20° Reach		If there is sideways flexion or rotation +1
20° – 60° Stretching	3	
> 20° Reach		
> 60° Stretching	4	



Neck:

Movement	Score	Score Change
0° – 20° Stretching	1	If there is sideways flexion or rotation +1
> 20° Stretching or Reach	2	



Legs:

Movement	Score	Score Change
Bilateral weight bearing, walking or sitting	1	Knee flexion between 30°-60° +1
Unilateral weight bearing or unstable posture	2	

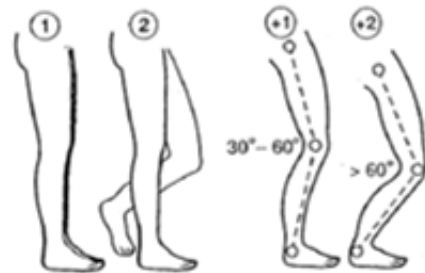


Figure 2. Group A score determinat

Table 1. REBA Method Table A

		Neck											
		1				2				3			
		Legs				Legs				Legs			
Body	1	1	2	3	4	1	2	3	4	1	2	3	4
	2	2	3	4	5	3	4	5	6	4	5	6	7
	3	2	4	5	6	4	5	6	7	5	6	7	8
	4	3	5	6	7	5	6	7	8	6	7	8	9
	5	4	6	7	8	6	7	8	9	7	8	9	9

After obtaining the numerical data for group A, Score A is obtained by adding the Load/Strength score (Table 2).

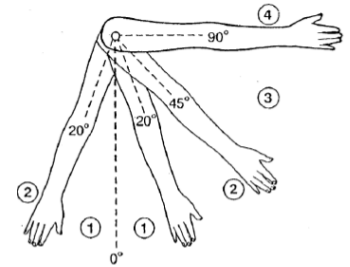
Table 2. Load/Strength Score Table

Load/Strength	Score
< 5 kg	0
5 – 10 kg	1
> 10 kg	2
The sudden or rapid increase in force	+1

After the numerical values of group A are obtained, the parts in group B are evaluated. As shown in Fig.3, separate scores for the upper arm, lower arm, and wrists are determined according to the posture position.

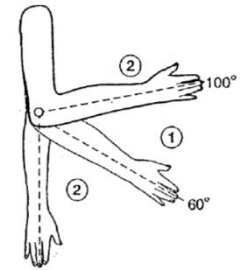
Upper Arms:

Movement	Score	Score Change
20° Stretching 20° Reach	1	+1 if there is arm rotation
20° – 45° Stretching > 20° Reach	2	+1 if the shoulder is raised
45° – 90° Stretching	3	If gravity support is effective in arm posture -1
> 90° Stretching	4	



Lower Arms:

Movement	Score
60° – 100° Stretching	1
< 60° Stretching or > 100° Reach	2



Wrist:

Movement	Score	Score Change
0° – 15° Stretching or Reach	1	If there is side flexion or rotation of the wrists +1
> 15° Stretching or Reach	2	

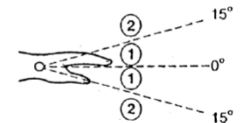


Figure 3. Group B score determination template

After the scores of the posture angle of the employees are obtained with the help of the template given in Fig.3, they are analyzed in Table B using Table 3. The first stage of the B group score value is realized by combining the determined arm and wrist angle score values in Table B.

Table 3. REBA Method Table B

		Lower Arm					
		1			2		
		Wrist			Wrist		
		1	2	3	1	2	3
Upper Arm	1	1	2	2	1	2	3
	2	1	2	3	2	3	4
	3	3	4	5	4	5	5
	4	4	5	5	5	6	7
	5	6	7	8	7	8	8
	6	7	8	8	8	9	9

In the second stage, the Group B score is determined by adding the grip score value given in Table 4 to the value in Table B.

Table 4. Grip Score Value

Degree	Description	Score
Good	Grip handle and medium grip strength	0
Good	A suitable Hand grip is suitable but not ideal or a grip with another part of the body is suitable	1
Poor	Hand grip possible although not suitable	2
Not Suitable	Difficult and unsafe grip, and no handle. Using another part of the body, the grip is not suitable	3

According to the REBA flowchart given in Figure 1, the A and B score values obtained are combined in the C table shown in Table 5. Thus, the C score is obtained.

Table 5. REBA Method Table C

		B Score											
		1	2	3	4	5	6	7	8	9	10	11	12
A Score	1	1	1	1	2	3	3	4	5	6	7	7	7
	2	1	2	2	3	4	4	5	6	6	7	7	8
	3	2	3	3	3	4	5	6	7	7	8	8	8
	4	3	4	4	4	5	6	7	8	8	9	9	9
	5	4	4	4	5	6	7	8	8	9	9	9	9
	6	6	6	6	6	8	8	9	9	10	10	10	10
	7	7	7	7	7	9	9	9	10	10	11	11	11
	8	8	8	8	8	10	10	10	10	10	11	11	11
	9	9	9	9	9	10	10	11	11	11	12	12	12
	10	10	10	10	10	11	11	11	12	12	12	12	12
	11	11	11	11	11	12	12	12	12	12	12	12	12
	12	12	12	12	12	12	12	12	12	12	12	12	12

The angles of the body parts, load/force ratios, and grip conditions for the work performed were examined in detail for the workers. It is seen that the work is mobile. The activity score is added to the obtained C score according to the activity status of the employees (Table 6).

Table 6. Activity Score Schedule

Activity	Score
Holding one or more body parts still (e.g., holding for longer than 1 minute)	+1
Repetitive work at short intervals (e.g. more than four repetitive tasks in 1 minute)	+1
If the work causes rapid and large changes in posture or works on unstable ground	+1

The REBA score is obtained by adding the activity score to the C score. The score is evaluated using the REBA risk rating chart shown in Table 7. The REBA risk rating consists of 5 grades from 0 to 4. The grades are separated by numerical values 1-15. With the REBA score obtained, an ergonomic risk assessment of working conditions is performed.

Table 7. REBA Risk Assessment Schedule

Grade	REBA Score	Risk Level	Measure
0	1	Negligible	Not Required
1	2 - 3	Low	May be necessary
2	4 - 7	Medium	Required
3	8 - 10	High	In a short time Required
4	11 - 15	Very High	Immediately Required

Research Results and Discussion

A and B group values were determined according to the REBA method. The neck, trunk, and legs in group A were scored according to flexion and rotation values. Firstly, data were taken for the trunk as shown in Figure 4. When Figure 4 is analyzed, it is seen that the body of the employee flexes approximately 20°-60°. The score 3 corresponding to this angular value was converted into numerical values using the REBA A score determination template in Fig.4. Thus, the body score will be 3 since there is a 20°-60° flexion.

Body

Movement	Score	Score Change
Upright	1	If there is sideways flexion or rotation +1
0° – 20° Stretching 0° – 20° Reach	2	
20° – 60° Stretching > 20° Reach	3	
> 60° Stretching	4	



Figure 4. Body posture angles during operation

As seen in Figure 5, it was observed that the length was flexed approximately 0°-20°. These angular values were converted into numerical values using the REBA A score determination template in Fig.2. Thus, the neck score will be 1 because it stretches from 0°-20°.

Neck

Movement	Score	Score Change
0° – 20° Stretching	1	If there is sideways flexion or rotation +1
> 20° Stretching or Reach	2	



Figure 5. Neck posture angles during operation

For the legs, which is the last component in group A, it is seen that there is unilateral weight bearing or unstable posture and 30°-60° flexion in the knees as seen in Fig.6. Therefore, the numerical value of the neck score was taken as 1+1=2.

Legs:

Movement	Score	Score Change
Bilateral weight bearing, walking or sitting	1	Knee flexion between 30°-60° +1
Unilateral weight bearing or unstable posture	2	Knee flexion >60° +2

Figure 6. Leg stance angles during the study



Load/Strength	Score
< 5 kg	0
5 – 10 kg	1
> 10 kg	2
The sudden or rapid increase in force	+1

Figure 7. Load/Strength Score



In determining the force/load score in the machine shop, material weight, and pulling force were taken into consideration. The weight score was determined as 0 with the assumption that the applied force was less than 5 kg. Thus, the force/load score was 0 (Fig.7). Table A value was obtained as 5 by using Table A in Table 8 with these data obtained.

Table 8. REBA Method Table A

		Neck											
		1				2				3			
		Legs				Legs				Legs			
		1	2	3	4	1	2	3	4	1	2	3	4
Body	1	1	2	3	4	1	2	3	4	3	3	5	6
	2	2	3	4	5	3	4	5	6	4	5	6	7
	3	2	4	5	6	4	5	6	7	5	6	7	8
	4	3	5	6	7	5	6	7	8	6	7	8	9
	5	4	6	7	8	6	7	8	9	7	8	9	9

When finding the Table B score, the upper arm, lower, arm, and wrist posture position should be analyzed. during work, the worker's upper arm holds the machine parts at an angle of 20° (Fig.8). The upper arm 20° posture position is determined as 1 point.

Upper Arms:

Movement	Score	Score Change
20° Stretching 20° Reach	1	+1 if there is arm rotation
20° – 45° Stretching > 20° Reach	2	
45° – 90° Stretching	3	+1 if the shoulder is raised If gravity support is effective in arm posture - 1
> 90° Stretching	4	



Figure 8. Upper arm posture angles during operation

During the machine shop, it is seen that the worker's lower arm grasps the machine parts at an angle between 60° and 100° (Fig.9). In this case, 1 point was assigned for the lower arm 60° and 100° reaching position.

Lower Arms:

Movement	Score
60° – 100° Stretching	1
< 60° Stretching or > 100° Reach	2



Figure 9. Lower arm posture angles during the operation

During the work in the machine shop, it was determined that the wrists of the worker had extension or flexion between 0° and 15°. No lateral flexion or rotation of the wrists was observed (Fig.10). In this case, the score for the wrists was determined as 1 point.

Wrist:

Movement	Score	Score Change
0° – 15° Stretching or Reach	1	If there is side flexion or rotation of the wrists +1
> 15° Stretching or Reach	2	



Figure 10. Posture angles of the wrists during the operation

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The grip score was assumed to be 0, assuming a good grip in the processes studied in machine shops (Table 9).

Table 9. Grip Score Value

Degree	Description	Score
Good	Grip handle and medium grip strength	0
Good	A suitable Hand grip is suitable but not ideal or a grip with another part of the body is suitable	1
Poor	Hand grip possible although not suitable	2
Not Suitable	Difficult and unsafe grip, and no handle. Using another part of the body, the grip is not suitable	3

Table B value was obtained as 1 by using Table B in Table 10 with these data.

Table 10. REBA Method Table B

		Lower Arm					
		1			2		
		Wrist			Wrist		
		1	2	3	1	2	3
Upper Arm	1	1	2	2	1	2	3
	2	1	2	3	2	3	4
	3	3	4	5	4	5	5
	4	4	5	5	5	6	7
	5	6	7	8	7	8	8
	6	7	8	8	8	9	9

With the help of Score, A and Score B, Score C value was found as 3 with the help of Table 11.

Table 11. REBA Method Table C

		B Score											
		1	2	3	4	5	6	7	8	9	10	11	12
A Score	1	1	1	1	2	3	3	4	5	6	7	7	7
	2	1	2	2	3	4	4	5	6	6	7	7	8
	3	2	3	3	3	4	5	6	7	7	8	8	8
	4	3	4	4	4	5	6	7	8	8	9	9	9
	5	4	4	4	5	6	7	8	8	9	9	9	9
	6	6	6	6	6	8	8	9	9	10	10	10	10
	7	7	7	7	7	9	9	9	10	10	11	11	11
	8	8	8	8	8	10	10	10	10	10	11	11	11
	9	9	9	9	9	10	10	11	11	11	12	12	12
	10	10	10	10	10	11	11	11	12	12	12	12	12
	11	11	11	11	11	12	12	12	12	12	12	12	12
	12	12	12	12	12	12	12	12	12	12	12	12	12

Since the work performed was repetitive with short intervals, the Activity Score was taken as +1 (Table 12).

Table 12. Activity Score Schedule

Activity	Score
Holding one or more body parts still (e.g., holding for longer than 1 minute)	+1
Repetitive work at short intervals (e.g. more than four repetitive tasks in 1 minute)	+1
If the work causes rapid and large changes in posture or works on unstable ground	+1

When the values obtained from the A score, B Score, C Score, and Activity scores are placed on the REBA Flow Diagram in Figure 1, the REBA Score used in ergonomic and risk assessment during work in the machine shop was found to be 4. As can be seen from Table 7, this value is in the 2-degree risk zone. Precautions need to be taken.

Employees working in the machine shop should be given breaks at short time intervals. Öz and Çakmak (2017) state that a safety culture should be developed for employees [8].

References

1. Haslegrave, C.M., “What do we mean by a working posture?”, *Ergonomics*, 37(4), 781-799, 1994.
2. Westgaard, R.H., Aaras, A., “Postural muscle strain as a causal factor in the development of muscle-skeletal illness”, *Applied Ergonomics*, 15(3), 162-174, 1984.
3. Akay, D., Dağdeviren, M., & Kurt, M. (2003). “Çalışma duruşlarının ergonomik analizi” *Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi*, 18(3).
4. Cohen, A.L., Gjessing, C.C., Fine, L.J., Bernard, B.P., McGlothlin, J.D., **Elements of Ergonomics** (A Primer Based on Workplace Evaluations of Musculoskeletal Disorders), NIOSH, March 1997, USA.
5. NIOSH, **Musculoskeletal disorders and workplace factors: A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity and low back pain**, Cincinnati, OH: U.S: Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS, NIOSH Publication, No. 97-141, 1997.
6. Baş, H., Sönmez, H.A., Öztürk, H. ve Yapıcı, F. 2018. Çalışma Duruşunun Kas-İskelet Sistemi Rahatsızlıklarına Etkileri ve Örnek Uygulama. *Ergonomi Dergisi*, 1(2), 103-107. DOI: <https://doi.org/10.33439/ergonomi.481341>.
7. Hignett, S. and McAtamney L., 2000. Rapid Entire Body Assessment (REBA). *Applied Ergonomics*. 31:201- 205. DOI: [https://doi.org/10.1016/S0003-6870\(99\)00039-3](https://doi.org/10.1016/S0003-6870(99)00039-3).
8. Öz, E., & Çakmak, B. (2017). Tarım Makineleri Üreten Bir İşletmede İş Akışının Ergonomi ve İş Güvenliği Yönünden Değerlendirilmesi. *Mühendislik Bilimleri ve Tasarım Dergisi*, 5(Ergonomi 2016), 275-282.
9. Kara, Y., Atasagun, Y., & Peker, A. (2014). Montaj hatlarında çalışma duruşlarının REBA yöntemi ile analizi ve ergonomik risk değerlendirmesi, *7. Uluslararası İş Sağlığı ve Güvenliği Konferansı, İstanbul-Türkiye*, 5(7).
10. Atıcı, H., Gönen, D., & Ali, O. (2015). Çalışanlarda Zorlanmaya Neden Olan Duruşların REBA Yöntemi ile Ergonomik Analizi. *Mühendislik Bilimleri ve Tasarım Dergisi*, 3(3), 239-244.

TEXTILE WASTEWATER TREATMENT BY TiO₂ BASED PHOTOCATALYSTS

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Abstract

TiO₂ photocatalysis faces significant challenges for its practical and commercial exploitation due to its low visible light photoconversion efficiency, low quantum yield, and high recombination rate. Therefore, in order to decrease recombination, it is crucial to increase TiO₂'s capacity for light utilization and photogenerated electron-hole pair separation. Modifying the surface of TiO₂ with graphene, silver, iron is frequently used methods because it offers a simple method for increasing its photoactivity. The main goal of this work has consisted of a comparison study of TiO₂, AgNO₃ and Fe(NO₃)₂ nanocomposites in photocatalysis of textile wastewater at lab scale photoreactor. The effect of type of oxidant agent (H₂O₂, PMS) was analyzed to determine the synthesized hybrid photocatalysts reach the best performance. It has been observed that the iron-based titanium form is more efficient with the result of 59.12% and 100% COD and color removal efficiency respectively.

Keywords: TiO₂, AOPs, Heterogeneous photocatalyst.

Introduction

Advanced Oxidation Processes (AOPs) are recent developments in wastewater treatment, effectiveness of processes is determined by their capacity to generate the second-strongest oxidant after fluorine. Utilizing oxidizing agents such as homogeneous or heterogeneous photocatalysts, ozone (O_3), hydrogen peroxide (H_2O_2), or UV radiation to reduce free hydroxyl radicals (OH^\bullet). It is very likely that these OH^\bullet will attack organic matter in an aggressive and non-selective manner, producing only water and carbon dioxide as byproducts at a total mineralization level or species with molecular weights below an intermediate level. Heterogeneous photocatalysis, an advanced oxidation technology, is a useful technique for reducing and mineralizing persistent organic pollutants in water [1, 2].

Titanium dioxide (TiO_2) is a widely accepted candidate among the many semiconductor heterogeneous photocatalysts because of its photostability, inherent electronic and surface properties, non-toxicity, cost-effectiveness, and environmental friendliness. To apply semiconductor photocatalysts for water treatment, the following needs to be fulfilled; the operation needs to be performed at room temperature or pressure, complete mineralization without secondary pollution, repetitive cycles and low costs for operations. TiO_2 photocatalysis is a photo-induced charge separation phenomenon that occurs on the TiO_2 surface, and very high reactive oxygen species can cause microbial inactivation and organic mineralization without secondary pollution [3-5].

The majority of common photocatalysts are semiconductors and are extensively investigated in the past decades. TiO_2 is having high photocatalytic efficiency, typical morphology, photostability, and chemical and biological stability. The high bandgap energy (3.2 eV) of TiO_2 is responsible for excitation itself by ultraviolet (UV) radiation to cause separation of the charges within the particles. TiO_2 can produce reactive oxygen species (ROS) after UV irradiation that can completely degrade pollutants within a very short time. Modifying the surface of TiO_2 with graphene, silver, iron is frequently used methods because it offers a simple method for increasing its photoactivity. [4, 6].

The main goal of this work has consisted of a comparison study of TiO_2 , $AgNO_3$ and $Fe(NO_3)_2$ doped TiO_2 for photocatalysis of textile wastewater in lab scale photoreactor. The effect of type of oxidant agent (H_2O_2 , PMS) was analyzed to determine the synthesized hybrid photocatalysts reach the best performance.

Methods

The photocatalytic oxidation experiments were done under artificial solar radiation in a closed reactor. The degradations were monitored by measuring chemical oxygen demand (COD) and color. Experiment were carried out in a glass vessel batch on an aluminum plate to reflect light. In all cases, the pH of wastewater was initially adjusted to 3, 100 mL of wastewater sample and 0.02 g of catalyst were added the vessel, then 1 hour degradation was initiated by adding the 5 mM oxidant and turning the lamp on simultaneously. At the end of the reaction, the treated wastewater samples were centrifuged at 9000 rpm for 10 min. to separate the catalyst. The COD and color measurements of the treated wastewater were made after filtering through the glass fiber filter, 0.45 μ m syringe filters respectively. For COD analyses closed reflux colorimetric method was used. After were digestion at 148 °C for 2 hours in a thermoreactor, the absorbance of samples were measured by using a Hach Lange DR 6000 model spectrophotometer at 420 nm, also color measurements were performed with the same spectrophotometer.

Results

The results of heterogeneous oxidation experiments are given in Table 1.

Table 1. Experimental results of heterogeneous photocatalysts.

	Oxidant	Color (Pt-Co)	COD (mg/L)	COD %	Color %
Textile Wastewater	—	160	70.13	0	0
TiO₂	—	30	41.58	40.70	81.25
TiO₂	H₂O₂	21	48.25	31.19	86.88
TiO₂	PMS	4	37.18	46.98	97.50
Ag-TiO₂	—	30	60.96	13.07	81.25
Ag-TiO₂	H₂O₂	10	46.58	33.57	93.75
Ag-TiO₂	PMS	0	56.99	18.73	100.00
Fe-TiO₂	—	72	53.88	23.17	55.00
Fe-TiO₂	H₂O₂	0	28.67	59.12	100.00
Fe-TiO₂	PMS	9	45.74	34.77	94.38

According to the obtained data, the maximum COD removal efficiency was observed in heterogeneous photocatalysts oxidation performed using H₂O₂ oxidant with Fe-TiO₂ catalyst with 59.12%. At the same conditions color removal efficiency was 100%. The results obtained by using other photocatalysts are shown in detail in Table 1.

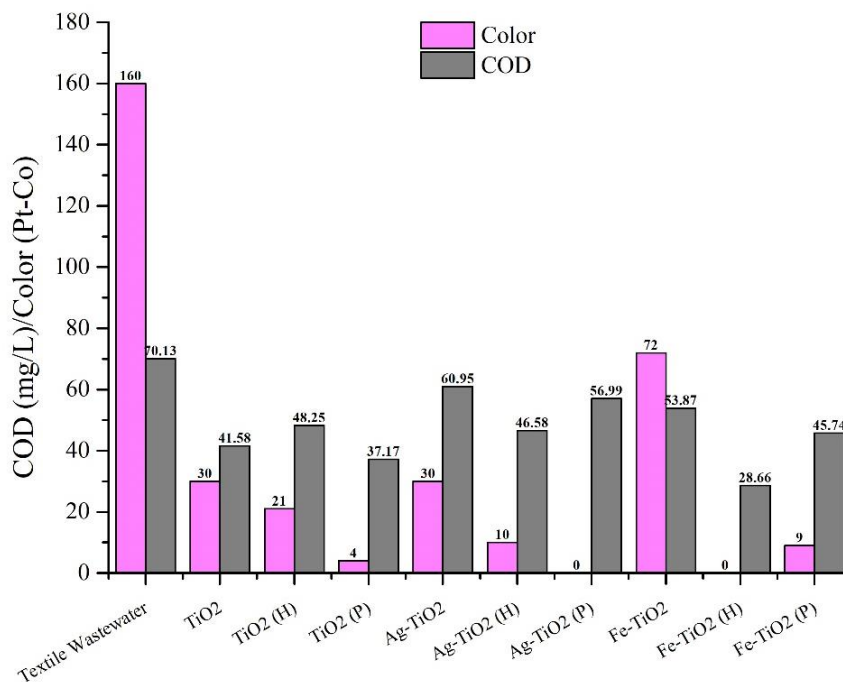


Fig. 1. Color and COD concentrations of textile wastewater after oxidation with heterogeneous photocatalysts.

As can be understood from Fig. 1, the color concentration value has generally been halved for all heterogeneous photocatalysts. The highest color concentration value of 72 Pt-Co was observed in the heterogeneous oxidation of iron-based titanium dioxide (Fe-TiO₂) without oxidant. In heterogeneous oxidations of iron-based titanium dioxide (Fe-TiO₂) in the presence of hydrogen peroxide (H₂O₂), silver-based titanium dioxide (Ag-TiO₂) in the presence of peroxymonosulfate (PMS), the color was completely eliminated.

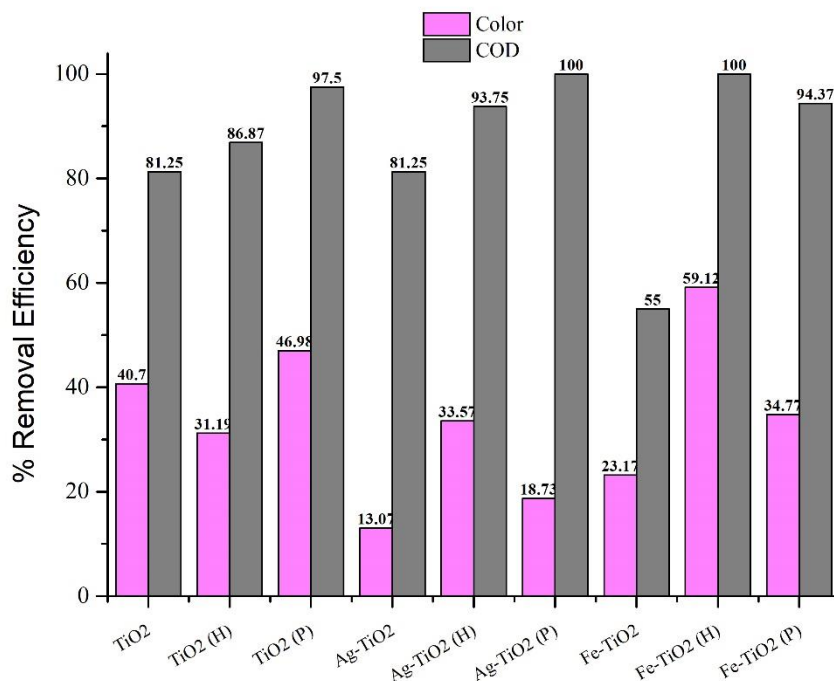


Fig. 2. Color and COD removal efficiency of heterogeneous photocatalysts.

COD removal efficiency usually remains below 50% as it shown Fig.2. The highest efficiency was achieved using H₂O₂ oxidant with Fe-TiO₂ catalyst as 59.12%. The minimum COD removal efficiency was observed in heterogeneous photocatalytic oxidation performed without oxidant with Ag-TiO₂ catalyst as 13.07%. This value is also lower than the efficiency obtained by using titanium dioxide alone. It is expected that the photocatalytic activity of titanium dioxide will increase with the modification of its surface [6, 7]. However, this did not apply to all photocatalysts used. The COD removal efficiency for modified photocatalysts is higher in cases where H₂O₂ is used as an oxidant. According to the results obtained from the heterogeneous catalysts used, the use of titanium alone and modified versions were compared. It has been understood that the iron-based titanium form is more efficient. By taking advantage of this superiority, it is thought that the efficiency of titanium-based iron heterogeneous catalyst can be increased by testing different fractions and investigating the optimal conditions.

References

1. Bethi, B., et al., *Nanomaterials-based advanced oxidation processes for wastewater treatment: A review*. Chemical Engineering and Processing-Process Intensification, 2016. **109**: p. 178-189.
2. Chan, S.H.S., et al., *Recent developments of metal oxide semiconductors as photocatalysts in advanced oxidation processes (AOPs) for treatment of dye wastewater*. Journal of Chemical Technology & Biotechnology, 2011. **86**(9): p. 1130-1158.
3. Yu, J.-G., et al., *The Effect of Calcination Temperature on the Surface Microstructure and Photocatalytic Activity of TiO₂ Thin Films Prepared by Liquid Phase Deposition*. The Journal of Physical Chemistry B, 2003. **107**(50): p. 13871-13879.
4. Lee, S.-Y. and S.-J. Park, *TiO₂ photocatalyst for water treatment applications*. Journal of Industrial and Engineering Chemistry, 2013. **19**(6): p. 1761-1769.
5. Qu, X., P.J.J. Alvarez, and Q. Li, *Applications of nanotechnology in water and wastewater treatment*. Water Research, 2013. **47**(12): p. 3931-3946.
6. Al-Mamun, M.R., et al., *Photocatalytic activity improvement and application of UV-TiO₂ photocatalysis in textile wastewater treatment: A review*. Journal of Environmental Chemical Engineering, 2019. **7**(5): p. 103248.
7. Mohadesi, M., M. Sanavi Fard, and A. Shokri, *The application of modified nano-TiO₂ photocatalyst for wastewater treatment: A review*. International Journal of Environmental Analytical Chemistry, 2022: p. 1-22.

**PESTICIDE REMOVAL FROM WASTEWATER BY ELECTRO-FENTON
METHOD**

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ABSTRACT

The world population has increased rapidly since the industrial revolution which has led to an increase in demand for food. To meet this demand, various agricultural control tools have been used including pesticides which are very effective in protecting crops from harmful organisms and increasing agricultural productivity. However, pesticides are hazardous and can pollute water resources when used excessively. It is important to treat pesticides properly to avoid negative effects on human health and environmental life. The biodegradability of pesticides is very difficult and it has been observed that sufficient pesticide removal cannot be achieved in studies using biological treatment methods. Today, alternative treatment methods are being developed for pesticides whose removal is quite low with conventional wastewater treatment methods. The Electro-Fenton process, which is one of the electrochemical treatment methods, shows very successful results in pesticide removal. In this study, treatability studies of pesticide industry wastewater were carried out using the Electro-Fenton Process. Within the scope of the study, process optimization will be made to determine the optimum conditions of the operational parameters (pH, current density, H₂O₂ concentration and reaction time) in the process. For this purpose, COD analysis will be performed in wastewater before and after the Electro-Fenton application. In this way, the advantages of the treatment method on pesticide removal will be determined.

Keywords: Electro-fenton, iron electrode, optimization, operating parameters

INTRODUCTION

The industrial revolution caused a fast increase within the world population. This situation has led to a tremendous increase in the demand for food, which is one of the basic needs. In response to current increasing demand, the inadequacy to achieve the desired increase in the amount of food production has brought along supply and access drawbacks. To solve this problem in food supply, it was planned to get more products per unit area. To that end, various agricultural control tools have been used. One of the most prevalent methods used in agricultural control is undoubtedly chemical control using pesticides (Kaur et al., 1998). Pesticides are extremely effective, provide fast results and might additionally shield the merchandise from harmful organisms (De Ward et al., 1993). These benefits are the foremost vital reasons why pesticides still be a necessary methodology in plant protection today.

The utilization of pesticides causes a rise in agricultural productivity, however because of their hazardous nature, pesticides are highly harmful and constitute a pollutant class for water resources. Excessive use of those product ends up in accumulations within the soil and water, and these accumulations are mixed with surface waters through rainwater (Arias-Estevéz et al., 2008). Although the main source of pesticides in surface waters is agricultural spraying, high-concentration wastewater from agrochemical industries that manufacture pesticides is also discharged into these surface waters without being sufficiently treated (Burçak and Kaya, 2000). Treatment of pesticides is incredibly vital because of the negative effects they have on human health and environmental life.

Pesticides are compounds that are very tough to biodegrade. Within the literature, it has been determined that adequate pesticide removal could not be achieved in studies using the biological treatment method (Katsayiannis A. and Constantini S., 2005, Bernard M. et al., 2006). Today, alternative treatment ways are being developed for pesticides whose removal is kind of low with conventional wastewater treatment methods. Electro-Fenton process, which is one of the electrochemical treatment methods, shows very successful results in pesticide removal (Nidheesh et al., 2012).

In the Electro-Fenton method, the Fenton process and electrocoagulation are used together to increase the degradability of organic compounds found in high-strength wastewater (Pushpalatha and Krishna, 2017). The increased production of hydroxyl radicals within the presence of electricity provides a remarkable improvement in the removal of pollutants. There are two different configurations of the Electro-Fenton process. The first of these is the system in which Fenton reagents are added to the system from the outside and inert electrodes with high catalytic activity are used as the anode material, and the second is the system in which

H_2O_2 is added from the outside and Fe^{+2} is produced from sacrificial iron anodes. The widely accepted mechanism of the Electro-Fenton process involves the formation of H_2O_2 at the cathode and Fe^{+2} production at the anode. Within the Electro-Fenton process, the source of hydroxyl radicals is not simply Fenton oxidation. In this method, OH^\cdot radicals can also be formed by the hydrolysis of water on the anode surface.

In this study, treatability studies of pesticide industry wastewater were carried out using the Electro-Fenton Process. Within the scope of the study, process optimization will be made to determine the optimum conditions of the operational parameters (pH, current density) in the process. As a result of the experimental studies, the operational conditions that provide the highest Chemical Oxygen Demand (COD) removal will be determined. For this purpose, COD analysis will be performed in wastewater before and after the Electro-Fenton application. In this way, the advantages of the treatment method on pesticide removal will be determined.

MATERIAL AND METHOD

Experimental Set up

A synthetic wastewater sample containing an average of 3000 – 4000 mg/L of Malathion pesticide, prepared to represent the pesticide industry wastewater, was provided. The Electro-Fenton reactor has an effective operating volume of 0.5 L and also acts as a cathode. The iron anode electrode has an effective surface area of 91.5 cm^2 .

Current and voltage control is provided by GW Instek SPD-3606 (0-30 V & 0-6 A) brand digitally controlled direct current power supply. WTW pH 330i brand pH meter was used to adjust the initial pH value of the wastewater and to see the pH change as a result of the reaction. During the reaction, mixing was done with a Heidolph RZR 2102 Control mechanical stirrer. Experimental studies were carried out in the batch reactor setup whose schematic illustration is given in Figure 1.



Figure 1. Schematic illustration of the experimental setup

Experimental Plan

Process optimization will be made to determine the optimum conditions of the operational parameters (pH, current density) in the process. During these studies, the initial H_2O_2 concentration was kept constant at 2000mg/L and the reaction time was 45 minutes. In optimization studies, pH (A), current density (B) parameters are considered as factors directly affecting removal efficiency. Process factors and levels are shown in Table 1.

Table 1. Process factors and levels used for optimization work

Factors	Unit	Levels		
		-1	0	1
pH (A)	-	2	3	4
Current Density (B)	mA/cm ²	20	30	40

Table 2. Experimental Plan

pH	Current Density (mA/cm²)	H₂O₂ Concentration (mg/L)	Reaction Time (min)
2	20	2000	45
	30	2000	45
	40	2000	45
3	20	2000	45
	30	2000	45
	40	2000	45
4	20	2000	45
	30	2000	45
	40	2000	45

Electrochemical Treatment and Chemical Analysis

After the provision of synthetic wastewater, the parameters that are thought to influence the performance of Electro-Fenton (pH, current density) are modified and COD removals in wastewater will be examined. The main purpose here is to work out the optimum conditions for the Electro-Fenton process and to treat the wastewater underneath these conditions. For optimization of variables, 0.4 L wastewater was put into the reactor and pH adjusted. Then the electrodes were connected to the power supply and reaction was initiated by adjusting the required current density. The wastewater was stirred at a speed of a 75 rpm. At the end of the treatment, treated water was centrifuged before parameter analysis. Then, COD analysis was performed on samples taken from the upper part (supernatant). Determination of Chemical Oxygen Demand was performed according to Standard Methods: 5220C - Closed Reflux Titrimetric Method (APHA 2005).

RESULTS

The results of COD removal optimization experiments obtained using Fe electrodes are given in Table 3. All experimental studies were carried out under the same conditions (H₂O₂ concentration = 2000 mg/L, Reaction time = 45 min, NaSO₄ = 0.05M and Stirring speed = 75 rpm). In the experimental studies carried out at the operating parameters (pH, current density) determined according to the lower and upper limit values, the COD removal efficiency (R) ranged from 42.86 % to 72.29%.

Table 3. Results of COD removal for the Electro-Fenton process

Initial pH	Current Density (mA/cm ²)	H ₂ O ₂ Con. (mg/L)	Time (min.)	Initial COD Conc. (mg/L)	Final COD Conc. (mg/L)	COD Removal (%)	Final pH
2	20	2000	45	3360	1920	42,86	3,59
3	20			3445	1365	60,38	6,70
4	20			3344	1083	67,61	7,57
2	30	2000	45	3216	1600	50,25	5,82
3	30			3616	1248	65,49	8,40
4	30			3185	896	71,87	9,17
2	40	2000	45	3264	1568	51,96	4,65
3	40			3000	1008	66,40	8,20
4	40			3696	1024	72,29	9,30

Effect of pH and Current density

In this optimization study, the effect of pH and Current density on COD removal efficiency was investigated using pH=2–3–4 and Current density=20–30–40 mA/cm². During these experiments, the H₂O₂ concentration was kept constant at 2000 mg/L and the reaction time was 45 minutes. As can be seen from the Figure 2, COD Removal increased with increasing pH despite the application of different current densities.

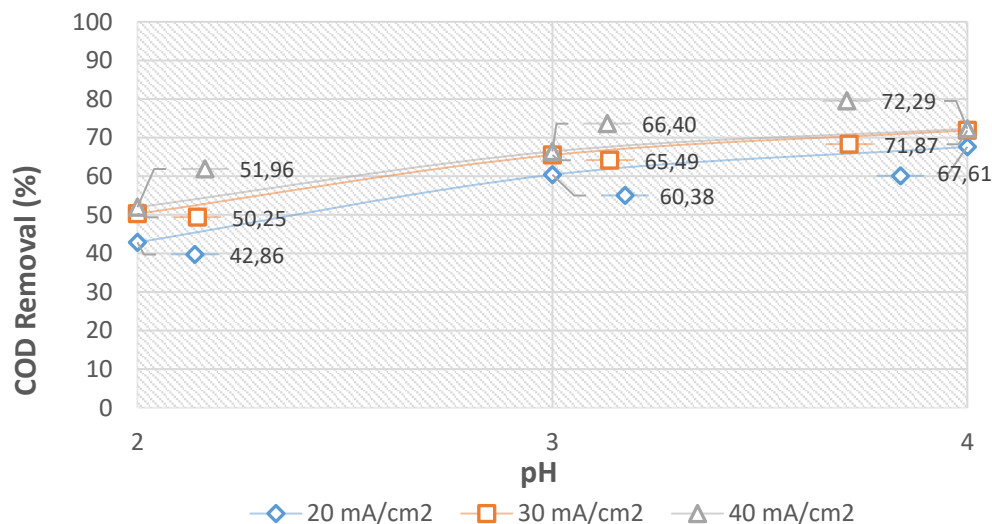


Figure 2. Effect of pH and Current density on COD Removal efficiency

For example, at 20 mA/cm² current density, while the initial pH value was 2, the removal was 42.86%, and when the initial pH value was increased to 3, this removal value increased to

60.38%. When pH increased from 3 to pH 4, the increase in removal efficiency continued, albeit small, and increased from 60.38% to 67.61%.

When the literature is examined, Lin and Lo (1997) and Kang and Hwang (2000) stated that the initial pH is a very effective parameter in the degradation of pollutants in the Fenton process. In electrofenton processes, the highest removal/degradation efficiency was reported by Atmaca and Panizza and Cerisola (2009), mostly in the pH 2-4 range.

COD removal efficiency was examined according to the current density and it was found that when 20 mA/cm² current density was applied at pH 4, the COD removal efficiency was 67.61%. When the current density was increased to 30 mA/cm², the removal value increased significantly to 71.87%. However, when the current density was applied as 40 mA/cm², the increase in removal efficiency was very small. It was 72.29%, an increase of only 0.42%. It has been observed that the applied excess current only causes an increase in energy consumption and does not affect the removal efficiency.

Current density is another important operational parameter in the Electro-Fenton method. As the current applied to the electrodes increases, the production of Fe⁺² required for fenton oxidation also increases. In this case, it increases H₂O₂ dissociation to produce OH[•] radicals (Atmaca 2009, Wang et al, 2019). Insufficient Fe⁺² production leads to a decrease in oxidation efficiency. However, excessive production of Fe⁺² at the anode both causes a decrease in reaction efficiency by making a radical scavenging effect and increases the formation of sewage sludge (Şahinkaya, 2017). While the efficiency obtained does not change significantly even when high current is applied, the energy consumption of the system increases considerably. Therefore, it is important to determine the current density to be used (Atmaca, 2009).

CONCLUSION

As the experimental output, the optimum operational parameters (pH, Current density, H₂O₂ concentration and Reaction time) at which COD is maximally removed were determined as pH 4, 30 mA/cm² current density, 2000 mg/L H₂O₂ concentration and 45 minutes reaction time, respectively. In this optimum condition, a removal efficiency of 71.87% can be achieved.

In line with the results obtained; It has been determined that the Electro-Fenton process is effective in the treatment of wastewater with high COD concentration. It is thought that it can be an alternative to convectional processes in removing COD from wastewater.

By storing the H₂ gas formed in the system or combining it with fuel cell technology, some of the energy need in the system can be met, thus minimizing the energy cost. Thus, a sustainable and environmentally friendly treatment system is provided.

In the experimental studies, a yellow-brown color was formed in the wastewater after treatment. According to Water Pollution Control Regulation, additional color removal should be done in these wastewaters in order to ensure the color parameter of the effluent.

REFERENCES

- APHA, 2005. Standard Methods for the Examination of Water and Wastewater. 21st ed. Washington, DC, USA .
- Arias-Estevez, M., Lopez-Periago, E., Martinez-Carballo, E., Simal-Gandara, J., Mejuto, J.C. ve GarciaRio, L., 2008. The mobility and degradation of pesticides in soils and the pollution of groundwater resources, *Agr., Ecosys. and Env.*, 123, 247-260.
- Atmaca, E., 2009. Treatment of landfill leachate by using electro-Fenton method, *Journal of Hazardous Materials*, 163 (1): 109–114.
- De Waard, M. A., S. G. Georgopoulos, D. W. Hollomon, H. Ishii, P. Leroux, N. N. Ragsdale, and F. J. Schwinn. 1993. Chemical control of plant diseases: problems and prospects. *Ann. Rev. Phytopathol.* 31: 403-421.
- Kang Y. W., Hwang K., 2000. Effect of Reaction Conditions on the Oxidation Efficiency in the Fenton Process, *Water Research*, 10, 2786-2790.
- Katsayiannis, A., Constantini, S., 2005. Persistent Organic Pollutants (POPS) in the Conventional Activated Sludge Treatment Process: Fate and Mass Balance, *Environmental Research*, 97, 245-257.
- Kaur, I., Mathur, R. P., Tandon, S. N., Dureja, P., 1998. Persistence of endosulfan (technical) in water and soil, *Environmental Technology*, 19, 115-119.
- Nidheesh P.V, Gandhimathi R., 2012. Trends in electroFenton process for water and wastewater treatment: An overview, *Desalination*, 299, 1–15.
- Panizza, M., Cerisola, G., 2009. Electro-Fenton degradation of synthetic dyes, *Water Research*, 43 (2): 339–344.
- Pushpalatha, M., Krishna, B. M., 2017. Electro-Fenton Process for Wastewater Treatment–A Review. *International Journal of Advanced Research, Ideas and Innovations in Technology*, 3(1).
- Şahinkaya, S., 2017. Treatment of plastic recycling plant wastewater with Fenton and Electro-Fenton processes, *Journal of Engineering Dicle University Faculty of Engineering*, 8 (3): 631-639.
- Wang, Z., Li, J., Tan, W., Wu, X., Lin, H. and Zhang, H. 2019. Removal of COD from landfill leachate by advanced Fenton process combined with electrolysis, *Separation and Purification Technology*, 208:3–11.

**ROBOTİK SALATALIK HASADI İÇİN DERİN ÖĞRENME İLE SALATALIĞIN
FİDE ÜZERİNDE KONUMUN BELİRLENMESİ**

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Özet

Salatalık (*Cucumis sativus*) hasadı, olgunlaştıktan itibaren iki-üç günde bir, tam verimlilik döneminde ise her gün yapılmaktadır. Hasat zamanı gün içinde sabah erken veya akşam saatlerinde yapılmalıdır. Hasat yaparken yardımcı olarak bıçak kullanılmalıdır. Hasat vakti gelmiş meyveler vaktinde toplanmalıdır aksi taktirde üstte meyve tutumu engellenmektedir. Yaprak rengi ile meyve rengi aynı olduğundan seçici hasat açısından tanımlanması zordur. Bu çalışma ile yetiştirildiği tarım alanında renginden dolayı seçilmesi ve toplanması vakit alabilen bir meyve olan salatalık meyvesinin hasadüzerine bir makine öğrenimi çalışması gerçekleştirilmiştir. Derin öğrenme özellikle robotik sistemlerin çalışmasını kontrol etmek için günümüzde yaygın bir şekilde kullanılmaya başlanmıştır. Bu metod için hergün yeni öğrenme algoritmaları geliştirilmektedir. Bu çalışmada derin öğrenme algoritmalarından YOLOv5 (nano) modeli kullanılmıştır. Oluşturulan modelin tüm metrik değerleri incelenmiştir. En başarılı model YOLOv5n algoritmasıyla, 640x640 boyutundaki görsellerin 10 Batch, 150 Epoch ile eğitilmiş model olduğu görülmüştür. Model değerleri sonuçları “metrics/precision”, “metrics/recall”, “metrics/mAP_0.5” ve “metrics/mAP_0.5:0.95” olarak incelenmiştir. Bunlar, bir modelin tespit başarısını ölçen anahtar metriklerdir ve ilgili modelin doğrulama veri kümesinde gösterdiği performansını belirtmektedir. “YOLOv5 nano” modelinin metrik verilerinin, diğer modellerle kıyaslandığında daha yüksek olduğu tespit edilmiştir. Ölçülen değer Model1: Size: 640, Batch: 10, Epoch: 150, Algorithm: YOLOv5n ‘dur. Buradan “Model 1”in robotik salatalık hasadında salatalığın dal ile ayrılmasında kullanılacak en iyi tespit modeli olduğu anlaşılmıştır.

Anahtar Kelimeler: Derin Öğrenme, salatalık, konum, hasat

**DETERMINING THE POSITION OF THE CUCUMBER ON THE SEEDLING
WITH DEEP LEARNING FOR ROBOTIC CUCUMBER HARVESTING**

Abstract

Cucumber (*Cucumis sativus*) is harvested every two to three days after ripening and every day during full productivity. Harvesting should be done in the early morning or evening hours during the day. A knife should be used as an assistant while harvesting. Harvested fruits should be collected on time, otherwise fruit retention on the top is prevented. Since the leaf color and fruit color are the same, it is difficult to identify in terms of selective harvesting. In this study, a machine learning study was carried out on the harvesting of cucumber fruit, which is a fruit that can take time to select and collect due to its color in the agricultural field where it is grown. Deep learning has been widely used today, especially for controlling the operation of robotic systems. New learning algorithms are being developed every day for this method. In this study, YOLOv5 (nano) model from deep learning algorithms was used. All metric values of the model were analyzed. It was seen that the most successful model was the model trained with the YOLOv5n algorithm with 10 Batches and 150 Epochs for 640x640 images. The results of the model values were analyzed as "metrics/precision", "metrics/recall", "metrics/mAP_0.5" and "metrics/mAP_0.5:0.95". These are key metrics that measure the detection success of a model and indicate the performance of that model on the validation dataset. The metric data of the "YOLOv5 nano" model was found to be higher compared to the other models. The measured value is Model 1: Size: 640, Batch: 10, Epoch: 150, Algorithm: YOLOv5n. From this, it is understood that "Model 1" is the best detection model to be used in robotic cucumber harvesting to separate cucumber from the branch.

Keywords: Deep learning, cucumber, location, harvesting

1.GİRİŞ

Derin öğrenme (deep learning), yapay sinir ağları kullanarak karmaşık problemleri çözmek için tasarlanmış bir makine öğrenmesi yöntemidir. Derin mimariye dayanan, gizli katmanların sayısı arttırılmış ve her katmanda probleme dair bir özneliğin (feature) öğrenildiği yapay sinir ağlarından oluşan yöntemler bütünüdür. Bu mimaride her katmanda probleme ait bir öznelik öğrenilir ve bu öğrenilen nitelik bir üst katmana bir girdi oluşturur. Böylelikle en alt katmandan en üst katmana doğru en basitten en karmaşık niteliğin öğrenildiği bir yapı kurulmuş olur(Anonim,2023).Derin öğrenme algoritmaları, bir dizi katman veya tabaka arasındaki veri işleme sürecini ifade eden ve çıkışları girdi olarak kullanarak nihai sonucu üreten bir model oluşturur. Bu katmanlar, her biri farklı türden işlemler gerçekleştiren düğümlerden oluşur. Bu düğümler, çıktıklarına göre ağı daha yüksek katmanlarına veya nihai sonuca giden bir sonraki katmana sinyal gönderirler.

Derin öğrenme algoritmaları, ses, görüntü ve doğal dil işleme gibi birçok alanda başarılı bir şekilde kullanılmaktadır. Örnek olarak, yüz tanıma, nesne tanıma, doğal dil işleme ve oyun oynama gibi alanlarda önemli başarılar elde edilmiştir.

Günümüzde birçok uygulama alanı bulan derin öğrenme tarımsal otomasyonda da kendine yer bulmuştur. Özellikle hasat uygulamalarında görüntü işleme ve tahminleme alanlarında kullanılmaktadır. Tarım alanındaki hasat uygulamaları için kullanılan tarım robotlarının, arazi tarımı faaliyetlerini yürütmek için kullanıldığı durumlarda, bitkilerin büyümesi, bitkilerin sağlık durumu ve verimliliklerinin belirlenmesi için derin öğrenme teknikleri kullanılabilir. Ayrıca, hasat öncesi tahminler yapmak için derin öğrenme teknikleri kullanılabilir. Bu, çiftçilerin hasat zamanlamasını, hasat verimliliğini ve kalitesini arttırmalarına yardımcı olabilir. Böylece hasat uygulamalarında derin öğrenme teknikleri, tarımsal verimliliği artırmak ve çiftçilerin işlerini daha kolay hale getirmek için önemli bir araç haline gelmiştir.

Salatalık hasadı için derin öğrenme, özellikle otomatik hasat makinelerinin geliştirilmesinde kullanılan bir teknolojidir. Derin öğrenme, yapay sinir ağlarının çok katmanlı yapılarını kullanarak karmaşık verileri işleyebilen bir makine öğrenme yöntemidir.

Bu hasat uygulamasında kullanılan derin öğrenme, öncelikle salatalık tarlasından elde edilen görüntü verilerini işleyerek salatalıkların nerede olduğunu, hangi olgunluk seviyesinde olduklarını ve hangi salatalıkların hasat edilebileceğini belirlemek için kullanılır. Bu işlem, salatalık hasadı sırasında işgücü maliyetlerini azaltırken hasat verimliliğini artırabilir.

Bir derin öğrenme algoritması, salatalıkların rengini, şeklini ve büyüklüğünü analiz edebilir ve olgunlaşmış salatalıkları hasat etmek için uygunluğunu belirleyebilir. Öncelikle, konum belirleme için kullanılacak veriler toplanmalıdır. Bu veriler, salatalık tarlasından elde edilen görüntüler veya sensörler tarafından toplanan veriler olabilir. Bu veriler derin öğrenme algoritmaları tarafından işlenebilir. Görüntüler öncelikle ön işleme adımlarından geçirilebilir ve ardından bir yapay sinir ağı kullanılarak konum belirleme yapılabilir. Sensör verileri de benzer bir şekilde işlenebilir. Derin öğrenme algoritmaları, salatalık bitkilerinin fiziksel özellikleri ve hasat edilecek salatalıkların belirtileri gibi çeşitli özellikleri öğrenebilir. Bu özellikleri kullanarak, algoritma salatalık bitkilerinin konumunu tespit edebilir ve hasat edilecek salatalıkları belirleyebilir.

Bu şekilde, işçilerin manuel olarak her bir salatalığı kontrol etmesi yerine, otomatik hasat makineleri tarafından tarama yapılabilir ve olgunlaşmış salatalıklar hızlı ve verimli bir şekilde toplanabilir. Mao ve ark.(2020) yılında yapmış oldukları bir çalışmada salatalık hasat robotları için tanıma algoritması geliştirmişlerdir. Bu çalışmada renk analizi kullanarak salatalığın fide üzerinde tanımlamasını yapmışlardır. Yapılan çalışma sonucunda doğru tanıma oranını %90 dan fazla , yanlış tanıma oranını %22'den düşük ve doğru yanlış oranını %4 'ün üzerinde bulmuşlardır. Bir başka çalışmada Sane ve ark.(2021) yılında robotik hasat uygulamasında derin öğrenme metodu kullanmışlardır. Derin öğrenme ile robotik hasat uygulamalarında mahsulün yerini tespitinde kullanılabileceğini tespit etmişlerdir. Bai ve ark(2023) yılında yapmış oldukları çalışmada robotik domates hasadı için derin öğrenme yöntemi kullanarak görüntü analizi yöntemi kullanmışlardır. Domatesin robotik olarak toplanmasında kesme noktasının belirlenmesini yapmışlardır. Li ve ark.(2023) yılında elma hasadı için çoklu robot kol kullanımı için derin öğrenme çalışmasında daha az kayıpla daha hızlı hasat yapılabileceğini tespit etmişlerdir. Droukas ve ark..(2023) robotik hasat sistemleri ve etkinleştirici teknolojiler üzerine yaptıkları araştırmada özellikle derin öğrenme yönteminin robotik sistemlerde büyük kolaylık sağlayacağını belirtmişlerdir. Meyve ve sebze hasadı için yeni bir uç-efektör robot: mekanizma ve saha deneyi çalışmasında görüntü işleme yöntemi ile hasat uygulaması yapılmıştır. Bu çalışmada toplam 160 küme domatesler hasadı yapılmış. Toplam başarı oranı %80,6 ve toplam hasat süresi her bir giriş açısı için başarı oranları sırasıyla %75.0, %71.9, %93.8, %81.2 ve %81.2 ve hasat süreleri sırasıyla 20,2, 16,0, 13,5, 13,7 ve 14,1 sn olmuştur.(Park ve ark.(2022))

Derin öğrenme teknolojileri, tarım sektöründeki sadece hasat uygulamalarında değil bitki hastalıklarının tespit edilmesinde, sulama sistemlerinin kontrol edilmesinde, toprağın analizi ve daha pek çok alanda tarımsal üretim verimliliğini arttırmada da kullanılabilir.

Sonuç olarak, derin öğrenme yöntemleri kullanılarak meyve ve sebzelerin hasadında konum belirleme yapmak mümkündür. Bu yöntemler, çiftçilere daha verimli bir hasat süreci sağlayabilir ve tarım sektöründe dijitalleşmeye katkıda bulunabilir.

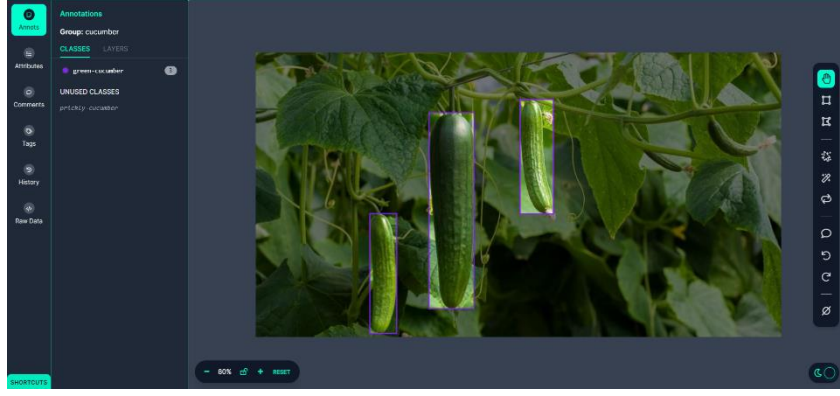
2.MATERYAL VE YÖNTEMLER

Veri Setinin Hazırlanması:

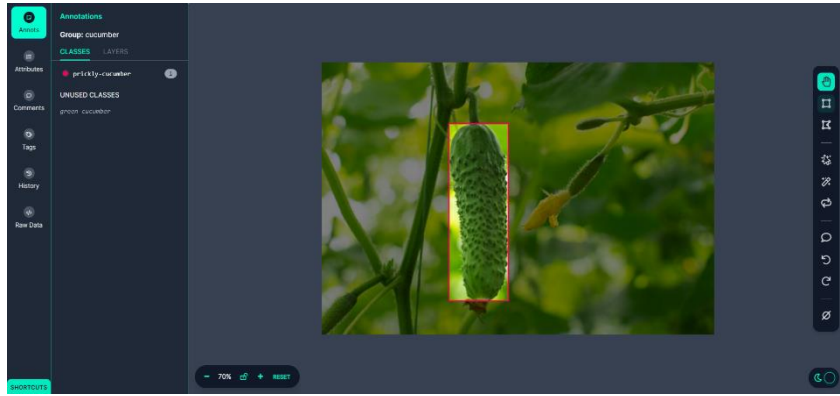
Proje kapsamında nesne tespiti ve analizi hedeflenen salatalık meyvesinin veri setini hazırlarken, sera ve tarlada çekilmiş hasat fotoğrafları kullanılmıştır. Salatalık, yeşil ve dikenli salatalık olarak çeşitlenen bir meyve olduğu için, elde edilen fotoğraflarda iki çeşit salatalığa rastlamak mümkündür. Hasat esnasında ve yetiştirme sırasında bağında çekilmiş pek çok salatalık görseli toplanmıştır. Elde edilen görseller arasında, yapmış olduğumuz proje kapsamında değerlendiremeyeceğimiz görseller elenmiştir. Yapacağımız nesne tespit çalışması için sağlıklı olacak 64 adet görsel belirlenmiştir. Ayrıca her bir görselde birden fazla salatalık bulunabilmektedir.

Etiketleme:

Bir nesne tespiti modelinin, bir veri seti üzerinde eğitim gerçekleştirebilmesi için, tespit edilmesi hedeflenen nesnelere eğitileceği veri setinde etiketlenmiş/imzalanmış olması gerekmektedir. Bu sebeple 64 görselin her birinde salatalık görüntüsünü içeren kısımların sınırlayıcı kutu alanı ile işaretlenmesi ve ait olduğu nesne sınıfı olan “yeşil salatalık veya dikenli salatalık” sınıfına atanması gerekmektedir. Görsel etiketleme yapmak için, açık kaynak topluluklarında çok sayıda program, internet sitesi ve yardımcı araç bulunmaktadır. Bu araçlardan bir tanesi ise, nesne tespiti projelerinde sıklıkla kullanılan, popüler bir web sitesi olan Roboflow’dur. Roboflow, ham görüntüleri özel olarak eğitilmiş bir bilgisayar görme modeline dönüştürmek ve onu uygulamalarda kullanmak üzere dağıtmak için gereken tüm araçları sağlayan; görüntüler üzerinde alan seçimleri, işaretlemeleri ve sınıf etiketlemeleri yapılmasını sağlayan bir web sitesidir. Bu işaretleme ve etiketleme işlemi, sitenin sahip olduğu grafiksel kullanıcı arayüzü aracılığıyla kolaylıkla yapılmaktadır. Şekil 1 ve Şekil 2’de Label (Etiket) ekranı gösterilmiştir.



Şekil 1.Label Ekranı(yeşil salatalık)



Şekil 2.Label Ekranı(dikenli salatalık)

Açılan görsel arayüzün sol ve sağ kısımları kullanılarak, programın genel işlevleri yerine getirilmektedir. Açılan görüntünün işaretlemesi, sağdaki menüden “Bounding Box Tool” seçeneği ile aktifleşen işaretleme aracı ile yapılmaktadır. Araç ile ilgili nesnenin sınırlayıcı kutu (Bounding Box) alanının belirlenmesinin ardından, belirtilen nesnenin sınıf adının etiketlenmesi gerekmektedir. Projemiz dahilinde, bu sınıf adlarını “green cucumber ve prickly cucumber” olarak belirledi. İlgili nesne tespit modelinin eğitimi bu görüntülerle yapılacağından dolayı, seçim işleminin nesneyi içeren şekliyle doğru bir biçimde yapılması gerekmektedir. Seçim ve etiketleme işleminin ardından, ana menü kısmındaki “generate” sekmesinden yapılan işaretlemelerin çıktı formatı seçilmelidir. Proje kapsamında, kullanılacak modele uygun olan YOLO seçeneği seçilmiştir. Tüm bu işlemlerin ardından görüntü işlenerek otomatik kaydedilebilmektedir.

Veri seti kullanılarak, derin öğrenme modelinin eğitimine başlanması:

Ön Gereksinimler:

YOLOv5 modelinin, projenin hedeflediği amacı tamamlayabilmesi ve eğitimin yapılabilmesi için, aşağıdaki gereksinimler karşılandı:

Python ile geliştirilmiş araçların, programların ve YOLOv5 modelinin kodlarının çalıştırılabilmesi için, Python'un proje geliştirilmesi sırasında son sürümü olan Python 3.11.1 kurulumu yapıldı.

Modelinin eğitiminin yapılmasını, eğitimi yapılan model kullanılarak projenin çalıştırılmasını ve gerçek zamanlı salatalık tespiti sağlayacak kodların çalıştırılabilmesi için, Torch kütüphanesine dayanan, Facebook AI Araştırma laboratuvarı tarafından geliştirilen bir açık kaynaklı makine öğrenme kütüphanesi olan PyTorch kurulumu yapıldı.

Project Jupyter projesi dahilinde geliştirilen, Python programlama dili ve diğer bazı programlama dilleri için interaktif bir defter görevi gören, yazılan kodların hem saklanıp sunulmasını hem de adım adım çalıştırılabilmesini sağlayan bir sunucu-istemci uygulaması olan Jupyter Notebook kurulumu yapıldı.

YOLOv5 modelinin ve diğer programlama bileşenlerinin çalışması için bağlı oldukları paketlerin bilgisayara indirilmesini ve indirildikten sonra yönetilmesini sağlayan Pip (PIP Instann Packages) aracının kurulumu yapıldı.

YOLOv5 modelinin GitHub deposu, projenin yürütüldüğü bilgisayara aktarıldı ve repo içerisinde bulunan, modelin sağlıklı çalışabilmesi için gerekli olan araçları içeren "requirements" metin belgesi içerisinde bulunan paketlerin kurulumu, Pip aracılığıyla yapıldı.

YOLOv5 modelinin reposunun "releases" kısmında bulunan, bu proje kapsamında kullanılacak YOLOv5n modelinin eğitilmiş ağırlık katsayılarını içeren "yolov5n.pt" dosyası indirilerek, bilgisayara aktarılan YOLOv5 klasörü içerisine aktarıldı.

Eğitim Model Seçimi:

Yapmış olduğumuz projede, CNN yöntemiyle geliştirilmiş YOLO model ailesinin açık kaynak olarak geliştirilen YOLOv5 ailesi tercih edilmiştir. RCNN benzeri iki aşamalı ağ kullanan modellere göre oldukça avantaja sahip olan YOLO model ailesinin YOLOv5 modeli, kendisinden önce geliştirilmiş sürümlere doğruluk değerleri ve hız oranı açısından avantaj sağladığı için tercih edilmiştir. YOLOv5 modeli de kendi içerisinde modeller barındırmaktadır. YOLOv5n (nano) modeli derin öğrenme eğitimi için tercih edilmiştir.

Eğitimin Başlatılması:

Salatalık tespiti yapacak olan modelin eğitiminin başlatılması için, YOLOv5 modelinin bilgisayardaki konumuna gidildi ve burada bir Python çalıştırıcı editör açıldı. Ana dizinde bulunan ve YOLOv5 eğitimini sağlayan train.py programı, çalıştırılmak üzere kontrol edildi. Bu Python programının çalıştırılması, çeşitli parametreler ile özelleştirilebilmektedir.

Proje dahilinde, salatalık meyvesi için aşağıda yazılı olan kod içerisindeki parametreler ve düzenlemeler tercih edildi.

```
python train.py --img 640 --batch 100 --epochs 400 --data dataset.yaml --weights yolov5n.pt
```

--img: Eğitimi yapılacak görsellerin YOLOv5 modeli tarafından düşürüleceği piksel boyutu. Varsayılan değeri 640x640 olarak belirlenmektedir ve burada da bu şekilde seçilmiştir.

--batch: Modeli eğitirken, ekran kartı tarafından bir seferde kullanılacak veri noktası paketi sayısıdır.

--epochs: Modelin eğitimi yapılırken, tüm eğitim verilerinin eğitilen ağa gösterilme, ağırlıkların güncellenmesi sayısıdır.

--data: Veri setini içeren dosyanın genel yol ve sınıf bilgisini içeren .yaml dosyasının yoludur.

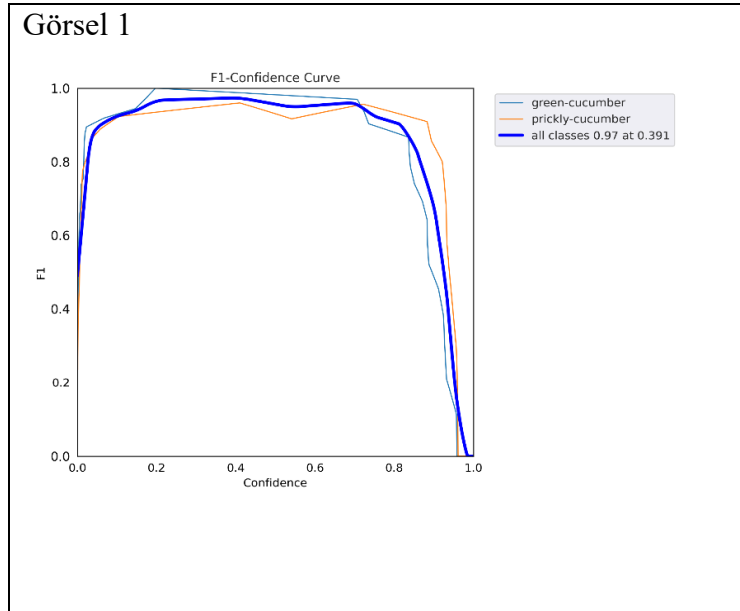
--weights: Modelin eğitiminde kullanılacak eğitim katsayılarını içeren ağırlık dosyasının konumudur.

Bu kod satırlarının doğru şekilde çalıştırılması sonucunda, modellerin eğitim işlemi başlamıştır. Program, öncelikle YOLOv5 dosyalarını kontrol edip, herhangi bir güncelleme durumunu kontrol etmektedir. Ardından, belirlenen döngü sayısı (epoch) boyunca eğitim işlemi yapılmaktadır.

YOLOv5 algoritmalarının sonuçlarının hata matrisi metriklerine göre incelenmesi:

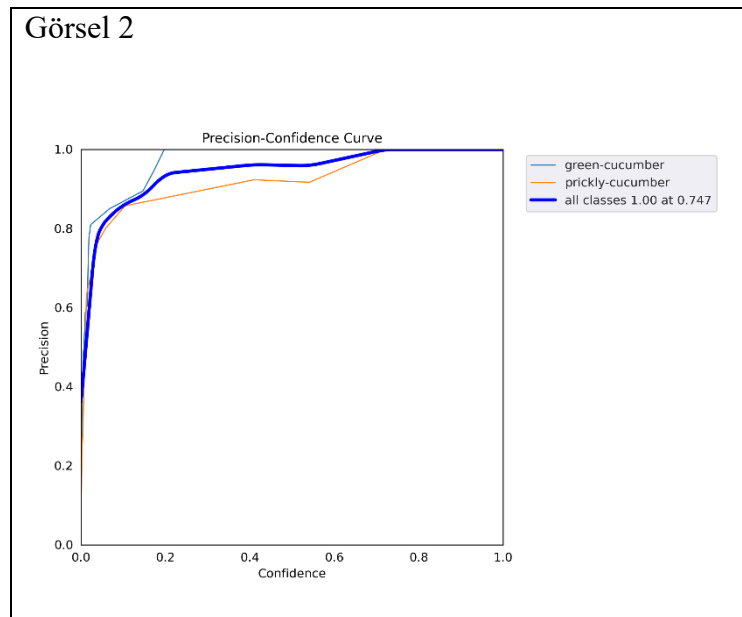
F1 Score:

Görsel 1: Size: 640x640, Batch: 100, Epoch: 400, Algorithm: YOLOv5n



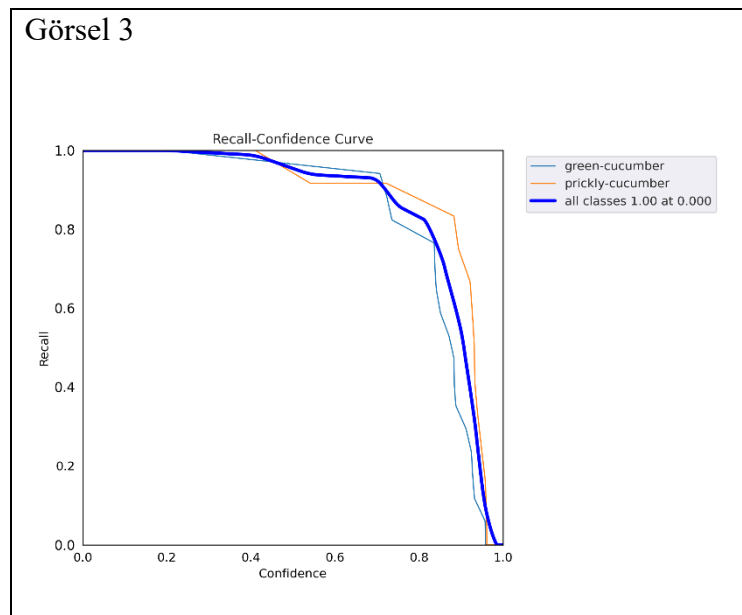
Precision:

Görsel 2: Size: 640x640, Batch: 100, Epoch: 400, Algorithm: YOLOv5n



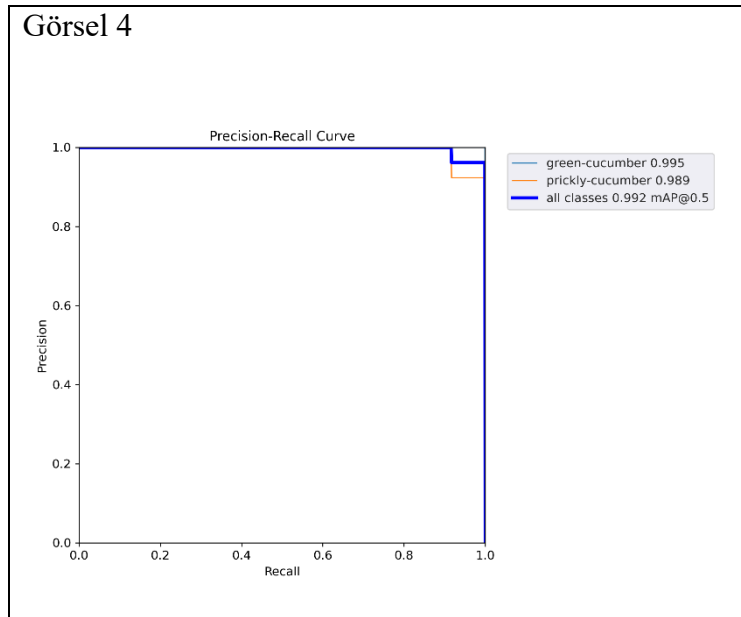
Recall:

Görsel 3: Size: 640x640, Batch: 100, Epoch: 400, Algorithm: YOLOv5n



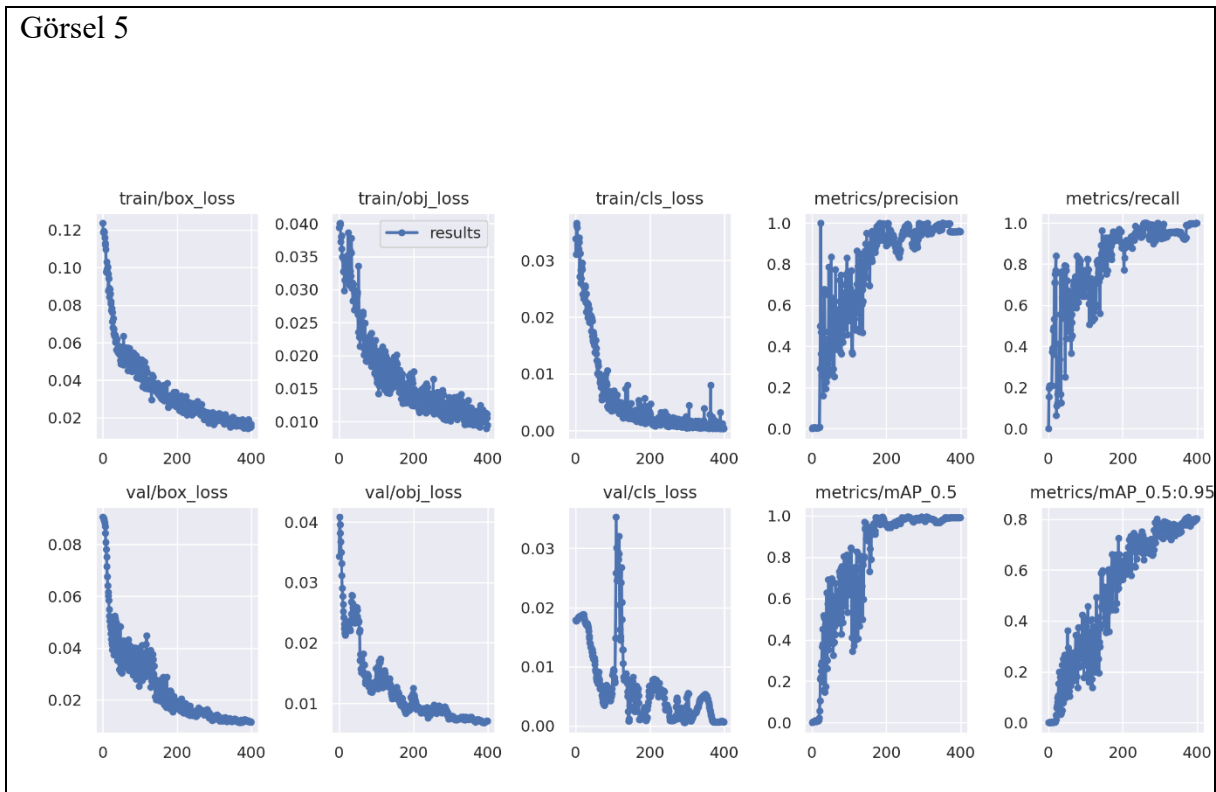
Precision Recall:

Görsel 4: Size: 640x640, Batch: 100, Epoch: 400, Algorithm: YOLOv5n



Loss Function:

Görsel 5: Size: 640x640, Batch: 100, Epoch: 400, Algorithm: YOLOv5n

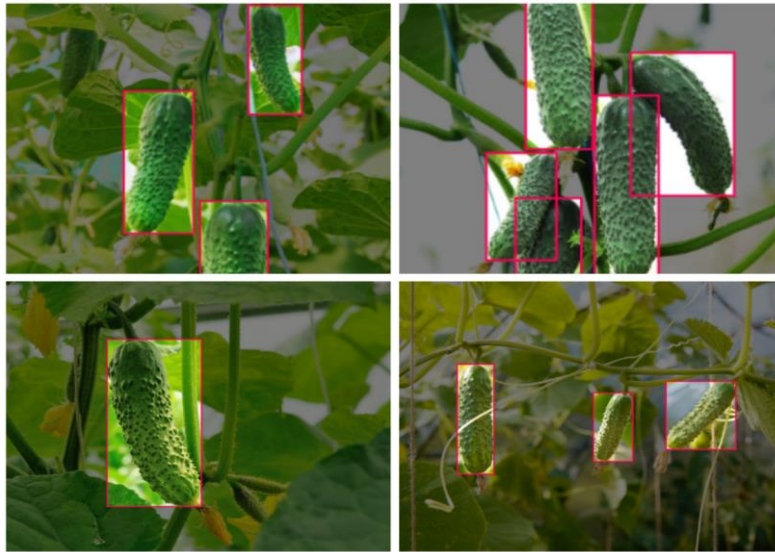


Eđitimde Kullanılan Veri Seti:

Şekil 3 ve 4’de eğitim sırasında kullanılan salatalık çeşitlerinin veri setinin hazırlanması gösterilmiştir.



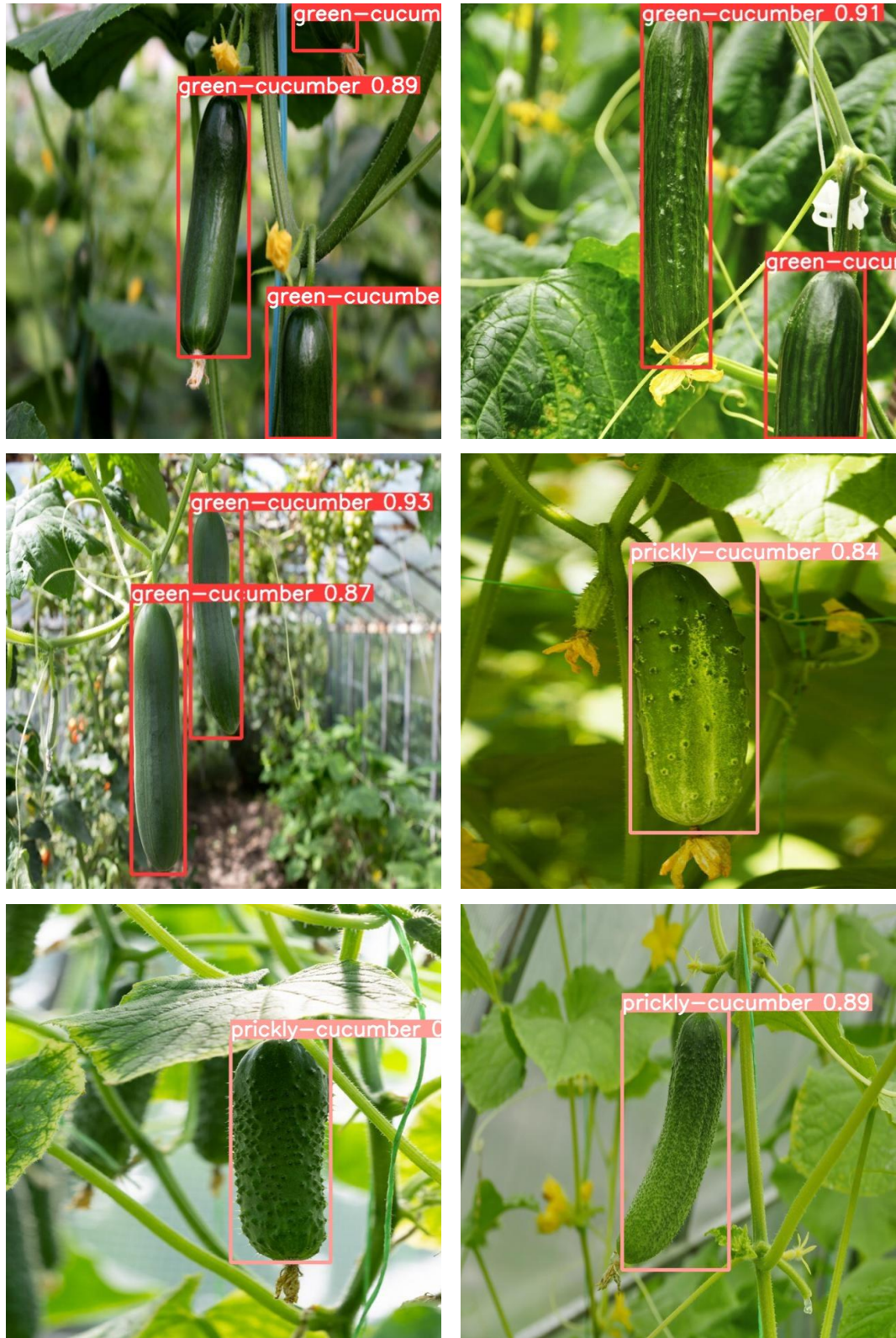
Şekil 3.Modellerin eğitimmesi sırasında kullanılan eğitim setinden görüntüler (yeşil salatalık)



Şekil 4.Modellerin eğitimmesi sırasında kullanılan eğitim setinden görüntüler (dikenli salatalık)

Eđitim Sonucu:

Şekil 6’ da eğitim sonucunda elde edilen sonuç ekranları gösterilmiştir.



Şekil 5. Modellerin eğitimlerinin sonucunda ortaya çıkan "Validation Batch" tahmin işaretlemeleri

SONUÇ

YOLOv5 Nano modeli ve hazırlanan veri seti ile yapılan örnek eğitim ve doğrulama görsellerindeki nesne tespiti doğrulukları incelenmiştir. Modellerin nesne tespit başarılarını

belirten metrik verileri ve doğruluk tahmin oranları incelendiğinde, modelin eğitim sonucunun başarılı olduğu doğrulanmıştır. Fakat farklı büyüklükteki ve çeşitlilikteki veri kümeleri üzerinde çalışıldığında veya eğitim algoritmalarına bağlı hiperparametreler ve genel çalışma parametreleri üzerinde değişiklik yapıldığında veya nesne tespit başarısından ziyade hız performansı odaklı bir başarı sıralaması yapıldığında bu sonuçların değişebileceği göz önünde bulundurulmalıdır.

KAYNAKLAR

- Anonim 2023, http://tekinonlayn.github.io/files/siu_2016.pdf
- Gültekin Işık¹, Harun Artuner¹ ¹Bilgisayar Mühendisliği Bölümü, Hacettepe Üniversitesi, Radyo Sinyallerinin Derin Öğrenme Sinir Ağları ile Tanınması
- Bai, Y., Mao, S., Zhou, J., & Zhang, B. (2023). Clustered tomato detection and picking point location using machine learning-aided image analysis for automatic robotic harvesting. *Precision Agriculture*, 24(2), 727–743. <https://doi.org/10.1007/s11119-022-09972-6>
- Droukas, L., Doulgeri, Z., Tsakiridis, N. L., Triantafyllou, D., Kleitsiotis, I., Mariolis, I., Giakoumis, D., Tzovaras, D., Kateris, D., & Bochtis, D. (2023). A Survey of Robotic Harvesting Systems and Enabling Technologies. In *Journal of Intelligent and Robotic Systems: Theory and Applications* (Vol. 107, Issue 2). Institute for Ionics. <https://doi.org/10.1007/s10846-022-01793-z>
- Li, T., Xie, F., Xiong, Y., & Feng, Q. (n.d.). Multi-Arm Robot Task Planning for Fruit Harvesting Using Multi-Agent Reinforcement Learning.
- Mao, S., Li, Y., Ma, Y., Zhang, B., Zhou, J., & Kai Wang. (2020). Automatic cucumber recognition algorithm for harvesting robots in the natural environment using deep learning and multi-feature fusion. *Computers and Electronics in Agriculture*, 170. <https://doi.org/10.1016/j.compag.2020.105254>
- Park, Y., Seol, J., Pak, J., Jo, Y., Jun, J., & Son, H. Il. (2022). A novel end-effector for a fruit and vegetable harvesting robot: mechanism and field experiment. *Precision Agriculture*. <https://doi.org/10.1007/s11119-022-09981-5>
- Sane, T. U., & Sane, T. U. (2021, June 12). Artificial Intelligence and Deep Learning Applications in Crop Harvesting Robots-A Survey. 3rd International Conference on Electrical, Communication and Computer Engineering, ICECCE 2021. https://doi.org/10.1109/ICECCE52056.2021.9514232_

ÇUKUROVA KOŞULLARINDA MAKARNALIK BUĞDAY (*TRITICUM DURUM L.*)
GENOTİPLERİNDE SARI PAS (*Puccinia striiformis F. Sp. tritici*) HASTALIĞININ
BİPLOT YÖNTEMİ İLE DEĞERLENDİRİLMESİ

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ÖZET

Buğday, üretimi yapılan bölgelerde, özellikle Akdeniz bölgesinde, tane dolun döneminde abiyotik ve biyotik streslere maruz kalmaktadır. Buğdayda yaprak hastalıkları çiçeklenmeye doğru ve çiçeklenme sonrası yayılma ve artma eğilimindedir. Buğdayda sarı pas (*Puccinia striiformis f. sp. tritici*) hastalığı tane dolun döneminde toplam yaprak deformasyonuna sebep olabilir. Yapılan araştırmada 20 makarnalık buğday genotipinde doğal şartlarda ortaya çıkan sarı pas hastalığı değerlendirilmiştir. Araştırma 2021-2022 yetiştirme sezonunda Çukurova Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü Uygulama ve Araştırma alanlarında (taban ve kıraç koşullarında) gerçekleştirilmiştir. Araştırmada, iki farklı lokasyonda yirmi makarnalık buğday genotipinde $G \times E$ (Genotip x Çevre) interaksiyonunun sarı pas hastalığına karşı stabilitesi üzerindeki etkileri araştırılmıştır. Deneme her bir lokasyonda yedi tekerrürlü tesadüf blokları deneme desenine göre kurulmuştur. Sarı pas hastalığı için yapılan birleştirilmiş varyans analizinde, genotipler, çevre ve ($G \times E$) interaksiyonu arasındaki varyasyonlar önemli ($p < 0.01$) bulunmuştur. Birleştirilmiş varyans analizinde toplam $G + E + (G \times E)$ varyasyonunun sırasıyla %55.7, %44.3 olarak saptanarak; genotip x çevre etkileşimi ana bileşen ile açıklanmış ve hangi genotiplerin, nerede, nasıl kararlı oldukları genotip, çevre, genotip x çevre interaksiyon biplot grafiği ile gösterilmiştir. Bu çerçevede biplot analiz yöntemi kullanılarak hastalığa dayanıklı/toleranslı genotiplerin belirlenmesinin ıslah çalışmalarına katkı sağlayabileceği saptanmıştır.

Anahtar Kelimeler: Makarnalık Buğday (*Triticum durum L.*), Sarı pas (*Puccinia striiformis f.sp.tritici*), Çevre, Biplot

EVALUATION OF YELLOW RUST (*Puccinia striiformis* f. sp. *tritici*) DISEASE IN
DURUM WHEAT (*Triticum durum* L.) GENOTYPES BY BILOT METHOD IN
CUKUROVA CONDITIONS

ABSTRACT

Wheat is exposed to abiotic and biotic stresses during the grain-filling period in the regions where it is produced, especially in the Mediternean region. Leaf diseases in wheat tend to spread and increase towards flowering and after flowering. In wheat, yellow rust (*Puccinia striiformis* f.sp.*tritici*) disease can cause total leaf deformation during the grain-filling period. In the research, the occurrence of yellow rust disease under natural conditions in 20 durum wheat genotype was evaluated. The research was carried out at the Application and Research Areas (low land and arid land) of Field Crops Department of Agricultural faculty, Cukurova University, Adana during the growing season of 2021-2022. The experiment was arranged in a randomized block design with seven replications at each location. In the combined analysis of variance for yellow rust disease, variations between genotypes, environments, and (G × E) were found to be significant ($p < 0.01$). In the combined analysis of variance, total G + E + (G × E) variation was determined as 55.7% and 44.3%, respectively; genotype x environment interaction was explained with the principal component, and which genotypes, where and how they were stable, was shown with the genotype, environment, genotype x environment interaction biplot graph. From the results of the study, it was concluded that by using the biplot analysis method, the determination of disease-resistant/tolerance genotypes can contribute to breeding studies.

Keywords: Durum wheat (*Triticum durum* L.), Yellow rust (*Puccinia striiformis* f.sp.*tritici*), Environment, Biplot

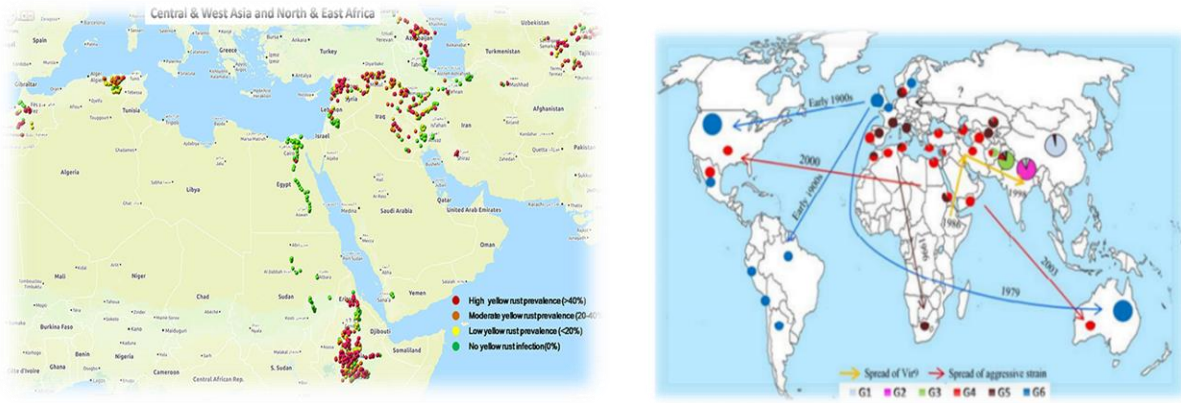
GİRİŞ

Buğday, üretimi yapılan bölgelerde ve özellikle Akdeniz iklim kuşağında, tane dolum döneminde çeşitli abiyotik ve biyotik streslere maruz kalmaktadır. Buğdayda yaprak hastalıkları çiçeklenmeye doğru ve çiçeklenme sonrası yayılma ve artma eğilimindedir. Sarı pas, kahverengi pas ve yaprak leke hastalıkları tane dolum döneminde toplam yaprak deformasyonuna sebep olabilir. Biyotik stres faktörleri arasında Basidiomycota bölümü Uredinales takımında yer alan *Puccinia* türlerinin sebep olduğu pas hastalıkları tüm dünyada ve ülkemizde buğday üretimini ayrıca beslenmesi buğdaya dayalı olan ülkelerin gıda güvenliğini tehdit etmektedir. Buğdayda pas hastalığına sebep olan önemli türlerden bir tanesi de sarı pas etmeni *Puccinia striiformis* f. sp. *tritici* (*Pst*)'dir (Resim 1). Buğdayda sarı pas hastalığı ilk kez 1777 yılında Gadd tarafından tanımlanmıştır (Roelfs ve ark. 1992). Daha sonra Eriksson (1894) bu sarı pas hastalığının ayrı bir patojen tarafından oluşturulduğunu bildirmiş ve hastalık etmenini *Puccinia glumarum* olarak isimlendirmiştir. En sonunda hastalık patojeninin ismi, Hylander ve ark. (1953) tarafından günümüzde de kullanılan şekliyle *Puccinia striiformis* olarak değiştirilmiştir (Singh ve ark. 2012). Sarı pas hastalık etmeninin, coğrafi olarak Amerika kıtasından Avustralya'ya, Avrupa'dan Doğu Afrika'ya ve Batı Asya'ya, Orta Doğu'dan Güney Afrika'ya kadar çok geniş buğday üretim alanlarına taşınabildiği bilinmektedir (Boshoff ve ark. 2002, Wellings 2007, Çat ve ark. 2017). Hastalık sporlarının uzak mesafelere taşınması; rüzgâr/böcek, ayrıca insanların eşya/kıyafetleriyle gerçekleşebilir (Resim2). Sarı pas etmeni (*Puccinia striiformis* f. sp. *tritici*), bitkilerin tek yapraklı döneminden olum dönemine kadar hastalık için şartlarının uygun olduğu her zaman bitki yapraklarını enfekte edebilmektedir. Bu durum enfekte olan yapraklarda ve özellikle bayrak yaprakta fotosentezi sınırladığı için verim ve kalite kayıplarına neden olmaktadır (Chen, 2005).

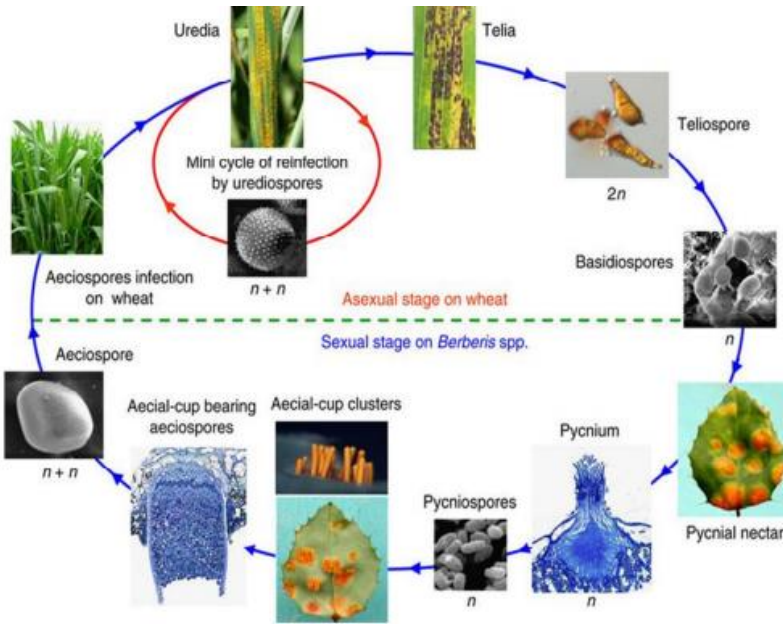


Resim1. Sarı pas (*Puccinia striiformis f. sp. Tritici*) hastalığına genel bakış bakış

Biyotik bir stres faktörü olan ve buğday üretimini sınırlayan sarı pas hastalığı (*Puccinia striiformis f. sp. tritici*) çok önemlidir ve dünya buğday üretiminin % 88'inin bu hastalığa karşı hassas olduğu bilinmektedir. Bu nedenle, yıllık beş milyon ton ürün kaybının gerçekleştiği, yok olan bu ürünün pazar değerinin en az bir milyar dolar olduğu düşünülmektedir (Wellings 2011, Beddow ve ark. 2015, Çat ve ark. 2017, Schwessinger 2017). Hassebrauk ve Schröder (1964), hastalık etmeninin üredosporlarının çimlenmesi için maksimum sıcaklığın 26°C olduğunu bildirmişlerdir. Düşük sıcaklıkta ve ılıman bölgelerde ve yüksek nem seviyesindeki iklim koşullarında sarı pas hastalığı (*Puccinia striiformis f. sp. tritici*) hastalığının etkileri görülebilmektedir. Sarı pas hastalığının yaşam döngüsü Resim 3'te verilmiştir. Son yıllarda hastalığın az veya rastlanmadığı sıcak iklim koşullarında da önemli epidemilerin olduğu bilinmektedir. Bu durum, sarı pas hastalığının yüksek sıcaklıklara adapte olan yeni bir ırk geliştirdiği yönünde değerlendirilmektedir (Milus ve ark. 2008, Mboup ve ark. 2009; Hovmoller ve ark. 2010). Biplot analiz yöntemi, birleşik analiz yöntemi olup, G (Genotip) ve GE (Genotip x Çevre) interaksiyon etkisini iki temel değerlendirme faktörünü aynı görsel grafik üzerinde bir araya getirerek ilgili konu üzerinde araştırma yapan araştırmacılara, çalışmalarını sonucu elde ettikleri verileri görsel olarak çift yönlü değerlendirme olanağı sağlamaktadır ve bu şekilde yapılan değerlendirme biplot analizi olarak tanımlanmaktadır. Denemelerde kullanılacak materyallerin farklı çevrelerde bulunan aynı hastalığın farklı popülasyonlarında yürütülen araştırmalarda elde edilen verilerin biplot analiz yöntemi kullanarak değerlendirilmesi sonucu, incelenen özellikler birlikte görsel olarak değerlendirilebilmektedir. Ayrıca amaca yönelik materyal seleksiyonunda başarıyı olumlu yönde etkilediği için bitki ıslahı çalışmalarında yenilikçi bir uygulama olarak kabul edilebilir (Yan 2001). Yapılan bu çalışmanın amacı sarı pas hastalığının farklı baskın ırk/ırklarında hastalık tesirine göre oluşturulan biplot grafiğinin, hastalığa dayanıklılık ıslah programlarında sarı pas hastalığına toleranslı/ dayanıklı hatların seçilmesi ve etkin bir şekilde kullanılabilirliğini saptamaktır.



Resim2. Sarı pas patojeni popülasyonlarının orijini ve olası taşınma yolları (Ali ve ark. 2014).



Resim3. Sarı pas (*Puccinia striiformis f.sp. tritici*) Zheng et al., 2013.

ARAŞTIRMA VE BULGULAR

Deneme Yeri ve Bitki Materyali; Araştırma 2021/2022 yetiştirme sezonunda Çukurova Üniversitesi Ziraat Fakültesi Tarla Bitkileri taban ve kıraç alanlarında yürütülmüştür. Bu araştırmada bitki materyali olarak, yirmi adet makarnalık buğday hattında doğal şartlarda gerçekleşen sarı pas hastalığı değerlendirilmiştir (Çizelge1).

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Çizelge 1. Sarı pas Hastalığının Değerlendirilmesi İçin Makarnalık Buğday Hatlarının İsimleri

NO	Makarnalık Buğday Hat İsimleri	NO	Makarnalık Buğday Hat İsimleri
1	cuzf0001	11	cuzf00040
2	cuzf0002	12	cuzf00042
3	cuzf0007	12	cuzf00044
4	cuzf0009	14	cuzf00045
5	cuzf00012	1	cuzf00051
6	cuzf00014	16	cuzf00053
7	cuzf00015	17	cuzf00054
8	cuzf00026	18	cuzf00056
9	cuzf00031	19	cuzf00057
10	cuzf00032	20	cuzf00060

2021/2022 makarnalık buğday yetiştirme sezonuna ait meteorolojik veriler Çizelge2’de verilmiştir. Çizelge 2’nin incelenmesinden anlaşılacağı üzere çalışmada kritik dönemler olarak bilinen sapa kalkma, çiçeklenme, dölleme ve tane dolun dönemlerine rastlayan Nisan, Mayıs ve Haziran aylarında düşen yağış miktarı beklenenden düşük gerçekleşmiştir.

Çizelge 2. Adana ilinde Makarnalık Buğday Yetiştirme Sezonuna Ait İklim Verileri

AYLAR (MONTHS)	TOPLAM	ORTALAMA	MAKSİMUM	MİNİMUM	ORTALAMA
	YAĞIŞ (mm)	SICAKLIK (00-24) °C	SICAKLIK (06-18) °C	SICAKLIK (18-06) °C	NEM %
	2021/22	2021/22	2021/22	2021/22	2021/22
Aralık	214.0	10.7	17.4	5.9	68.3
January	74.10	6.46	11.85	2.06	64.68
February	64.60	11.10	18.72	5.42	70.45
March	66.00	10.00	17.46	3.94	59.88
April	2.60	19.06	28.11	10.97	56.28
May	9.00	21.73	30.23	13.61	60.76
June	21.40	25.70	32.50	19.32	67.70

Ekim-bakım ve hasat; araştırmada, ekim işlemi 10 Aralık 2021 yılında gerçekleştirilmiştir. Tarla denemeleri iki farklı lokasyonda her bir lokasyonda yedi tekerrürlü olacak şekilde tesadüf blokları deneme desenine göre kurulmuştur. Denemede parsel boyutları 3.5 m*1.2 m (4.2 m²) olarak belirlenmiş, makarnalık buğdayların çimlenmesi tamamlandıktan sonra doğal çevre koşullarında sarı pas (*pst*) hastalık gözlemleri yapılmıştır. Bitkiler olgunlaştıktan sonra 6 Haziran 2022 tarihinde hasat işlemi gerçekleştirilmiştir.

Elde edilen verilerin değerlendirilmesi; iki farklı lokasyonda yirmi makarnalık buğday hattında G × E (Genotip x Çevre) interaksyonunun sarı pas hastalığına karşı stabilitesi üzerindeki etkileri araştırılmıştır. Araştırma sonunda elde edilmiş olan hastalık derecelerine (0-9 skalası)

ait analizler ve tanımlayıcı analizler GGE-biplot Version 4.1 istatistik paket programı kullanılarak yapılmıştır.

Araştırmada kullanılan makarnalık buğday hatlarının tanımlayıcı analizi Çizelge3'te verilmiştir. Buna göre, birleştirilmiş genotipler gruplandırıldığında; f grubu cuzf00031 genotipi ortalama değeri 4.57 skoru ile sarı pasa orta düzeyde hassasiyet gösterdiği tespit edilmiştir, a grubunda bulunan cuzf00044 genotipi ortalama değeri 0.86 skoru ile sarı pasa iyi tolerans gösterdiği saptanmıştır.

Araştırmanın sonucuna göre; sarı pas hastalığı için yapılan birleştirilmiş varyans analizinde, genotipler, çevre ve (G × E) interaksiyon arasındaki varyasyonlar önemli (p < 0.01) bulunmuştur (Çizelge3).

Çizelge 3. İncelenen makarnalık buğday hatlarında saptanan sarı pas hastalığı skor değerlerine uygulanan birleştirilmiş varyans analizi sonuçları

	Kareler Toplamı (SS)	Kareler Ortalaması (MS)	Serbestlik derecesi (df)	F	Toplam Varyasyon Oranı
Çevre(ENV)	144991.1	144991.1	1	28.01278* **	10.21899
Genotip(GE N)	803204.5	33466.85	24	6.46591** *	66.82895
Çevre*Geno tip (ENV*GEN)	470644	19610.17	24	3.78875** *	100
PC1	470644	19610.17	24	3.75299** *	100
PC2	0	0	22	0	100
Residuals	776383.8	5175.892	150	NA	0

***P<0.01; olasılık düzeyinde önemli

Çizelge 4'e göre makarnalık buğday hatlarının sarı pas hastalığının tanımlayıcı analiz tablosunda iki farklı lokasyonun birleştirilmiş genotip gruplandırılması incelendiğinde, istatistiksel olarak farklılık olmasına rağmen elde edilen değerlerin genelde birbirine yakın olduğu görülmüştür. cuzf00044 nolu genotip değeri a birleştirilmiş grubunda sarı pasa toleranslı olarak yer alırken, cuzf00031 nolu genotip değeri ise f birleştirilmiş grubunda sarı pasa hassas olarak yer almıştır. Bu bağlamda, iki farklı lokasyondaki birleştirilmiş gruplandırmalarda aynı harfi alan gruplar arasında sarı pasa hassasiyet ya da tolerans bakımından önemli bir fark saptanmamıştır.

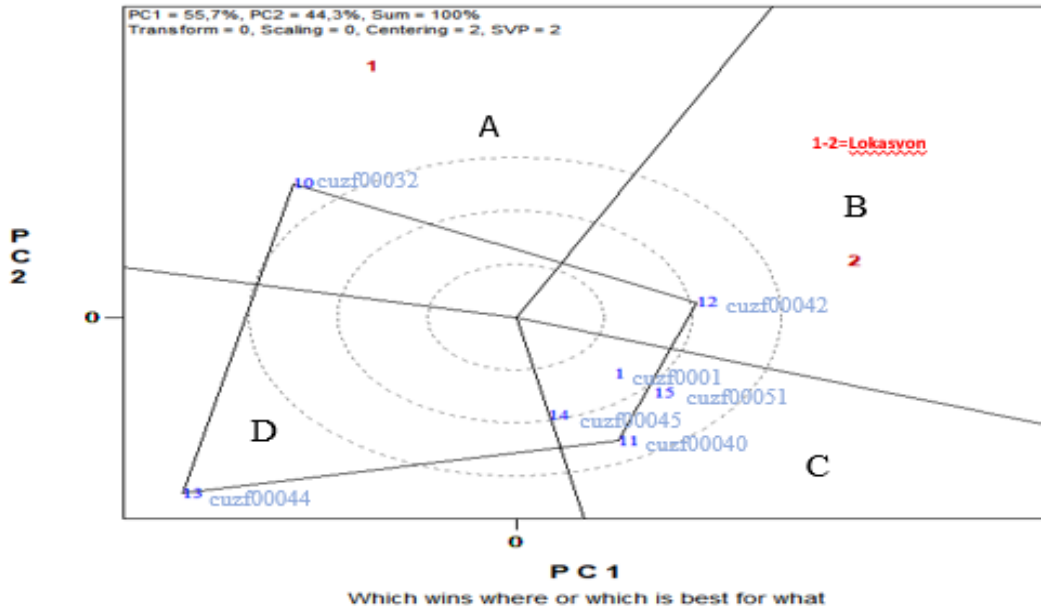
Çizelge 4. Makarnalık Buğday Hatlarında Sarı Pas (*Pst*) Hastalığının Tanımlayıcı Analiz Tablosu

	CULokasyon1(Taban)			CULokasyon2(Kıraç)			Birleştirilmiş			Genotip Gruplandırma
	Ortalama (Mean)	±	Standart Sapma (Std. Deviation)	Ortalama (Mean)	±	Standart Sapma (Std. Deviation)	Ortalama (Mean)	±	Standart Sapma (Std. Deviation)	
cuzf0001	2.00	±	1.414	2.43	±	1.813	2.21	±	1.578	a-d
cuzf0002	1.43	±	.976	2.00	±	2.000	1.71	±	1.541	a-c
cuzf0007	1.14	±	1.069	2.14	±	2.035	1.64	±	1.646	a-c
cuzf0009	0.43	±	0.535	2.43	±	1.618	1.43	±	1.555	ab
cuzf00012	2.14	±	1.069	2.57	±	1.512	2.36	±	1.277	a-d
cuzf00014	3.29	±	1.254	0.00	±	0.000	1.64	±	1.906	a-c
cuzf00015	6.71	±	2.215	0.00	±	0.000	3.36	±	3.795	d-f
cuzf00026	7.43	±	3.359	1.43	±	0.976	4.43	±	3.917	ef
cuzf00031	3.43	±	2.699	5.71	±	0.488	4.57	±	2.209	f
cuzf00032	4.71	±	2.138	1.29	±	1.604	3.00	±	2.542	b-e
cuzf00040	1.29	±	1.254	2.29	±	1.799	1.79	±	1.578	a-c
cuzf00042	2.57	±	0.535	3.00	±	3.742	2.79	±	2.577	b-d
cuzf00044	1.71	±	1.604	0.00	±	0.000	0.86	±	1.406	a
cuzf00045	1.71	±	1.604	2.00	±	2.000	1.86	±	1.748	a-d
cuzf00051	1.71	±	2.138	2.57	±	1.902	2.14	±	1.994	a-d
cuzf00053	2.00	±	2.000	4.43	±	2.149	3.21	±	2.359	c-f
cuzf00054	3.43	±	1.512	3.00	±	0.000	3.21	±	1.051	c-f
cuzf00056	3.14	±	.378	2.86	±	2.268	3.00	±	1.569	b-e
cuzf00057	1.71	±	1.604	1.29	±	1.604	1.50	±	1.557	ab
cuzf00060	4.29	±	2.812	0.00	±	0.000	2.14	±	2.931	a-d
Toplam	2.81		2.431	2.07		2.128	2.44		2.310	

Aynı harfi alan ortalamalar arasındaki fark $p \leq 0.01$ 'e göre önemli değildir

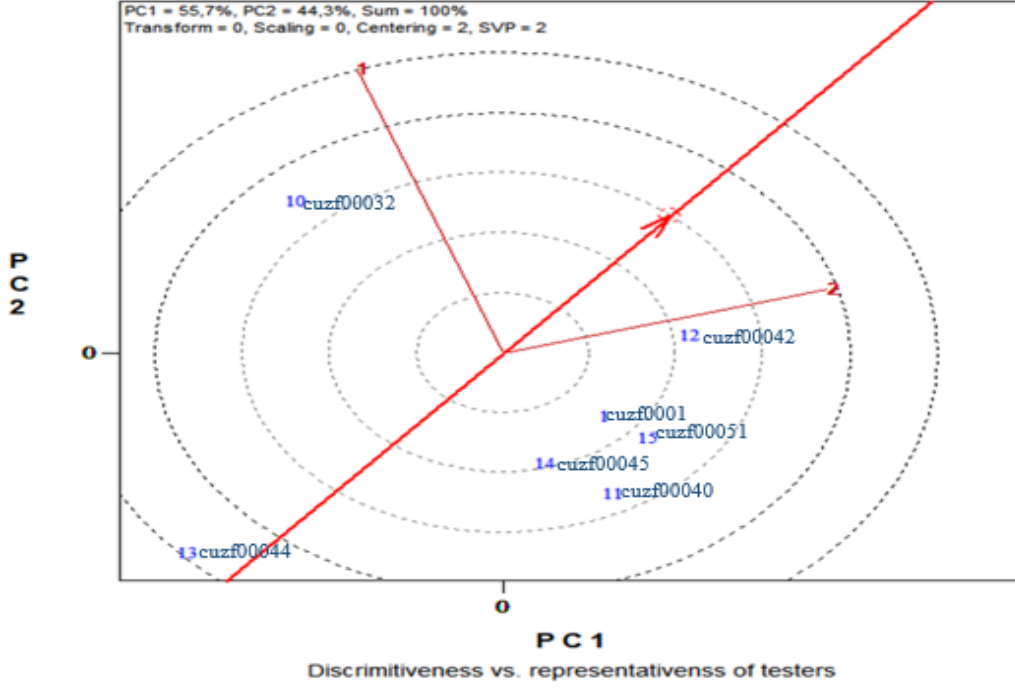
Birleştirilmiş varyans analizinde toplam $G + E + (G \times E)$ varyasyonunun sırasıyla %55.7, %44.3 olarak saptanarak; genotip x çevre etkileşimi ana bileşen ile açıklanmış ve hangi genotiplerin, nerede, nasıl kararlı oldukları genotip, çevre, genotip x çevre etkileşimini biplot grafiği ile gösterilmiştir (Şekil1). GGE-biplot grafiğinde; dar açı oluşmuşsa özellikler arasında pozitif

ilişkili, geniş açı varsa negatif ilişkili, dik açı ya da dik açuya yakınsa özellikler arasında ilişki yok veya bağımsız özellikler olarak adlandırılmaktadır (Yan, 2001). Şekil 1'e göre A, B, C ve D olmak üzere 4 ana bölüm oluşmuştur. Bölüm A'da, cuzf00042 genotipi sarı pasa tolerans özelliği ile yer almıştır. Bölüm B'de ise cuzf00032 genotipi sarı pas tolerans özelliği ile öne çıkmıştır. C bölümünde sarı pas bakımından cuzf00001, cuzf00040, cuzf00045, cuzf00051 genotipleri yer almıştır. Son olarak D bölümünde sarı pasa tolerans yönünden cuzf00044 genotipi dikkat çekmektedir.



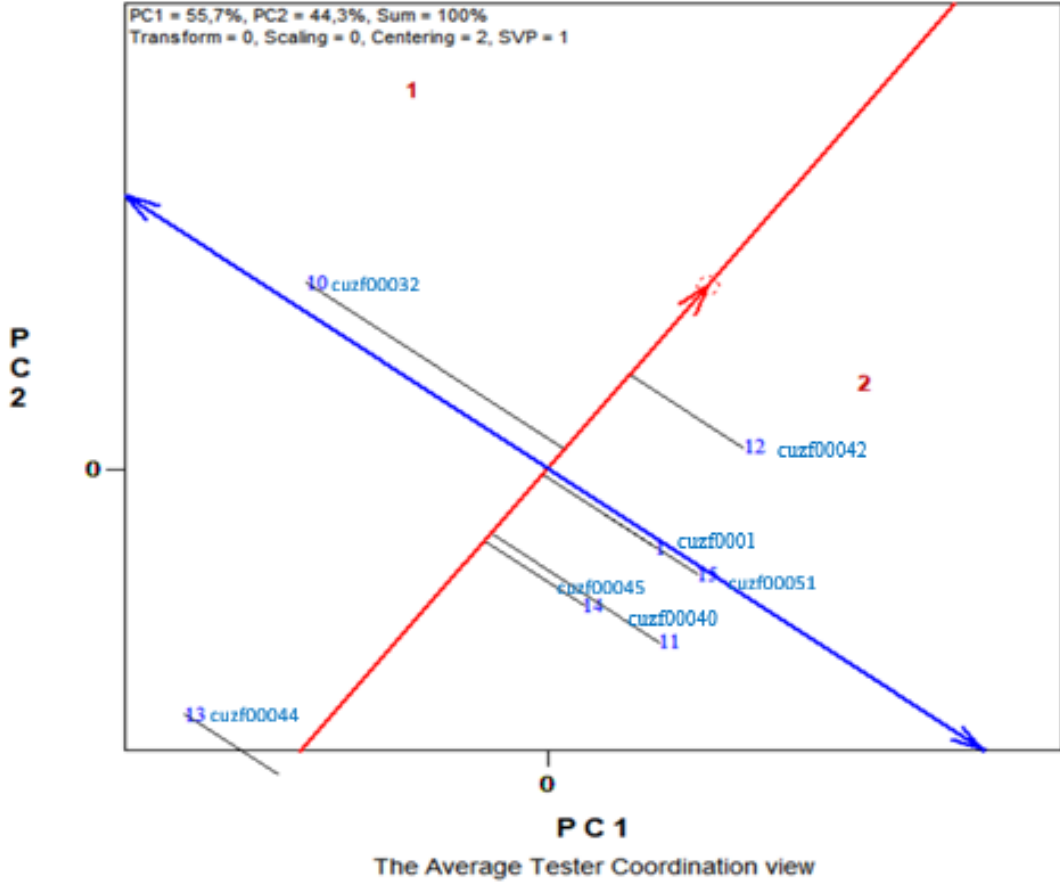
Şekil 1. Makarnalık buğdayda genotiplerinde incelenen özelliklerin gruplandırılmasına ait genotip*sarıpas biplot grafiği

Genel olarak genotipin bulunduğu dairede bulunmayan bir özellik varsa genotip sarı pasa hassasiyet özelliği bakımından zayıf olduğunu söylemek mümkündür. Bir başka deyişle genotip, sarı pas hastalığına (*Puccinia striiformis f. sp. tritici*) toleranslıdır (Şekil 2).



Şekil2. Makarnalık buğdayda genotiplerinde ortalamasına göre stabilitesi

Araştırmada tespit edilen sarı pas özelliklerinin ortalama verileri üzerinden stabilite çizgisini oluşturan ve genotipleri bu stabilite çizgisine göre sıralayan 'ranking biplot' metodu Şekil 3'te gösterilmiştir. Çok özellikli çalışmalarda tüm özellikler bakımından stabilite (yatay) ve ortalamayı (dikey) temel eğrilerine göre sıralayan bir modeldir. Şekil 3'te dikey eğrinin üzerinde ve yatay eğriye yakın olan cuzf0001, cuzf00040, cuzf00042 ve cuzf00051 genotipleri sarı pas özelliği bakımından stabil genotipler olarak tespit edilmiştir. cuzf00032 genotipi ise en zayıf stabiliteye sahip olarak tespit edilmiştir. cuzf00044 genotipi eğrinin dikey altında ancak sarı pas hastalığına tolerans/dayanıklılık bakımından iyi performans göstermiştir.



Şekil3. Makarnalık buğday genotiplerinin sarıpas özelliği bakımından sıralanması

SONUÇ

Genotip özellik biplot yönteminde PC1 varyasyonu %55,7, PC2 varyasyonu ise 44,3 ve toplam varyasyon %100 olarak açıklanmıştır. Yetiştirme sezonunda iki farklı lokasyonda çevre faktörlerine bağlı olarak sarı pas hastalığına tolerans ve hassasiyet (cuzf00044/cuzf00031 genotiplerinde) saptanmıştır. Dünya’da ve Türkiye’de *Puccinia striiformis* hastalığının özellikle serin ve nemli koşullarda çok etkili olduğu, ancak son yıllarda hastalığın az ya da gözlenmediği sıcak iklim koşullarında da önemli epidemiler meydana getirdiği bilinmektedir. Bu durum, *Puccinia striiformis f. sp. tritici* ’nin yüksek sıcaklıklara adapte olan yeni bir ırk geliştirdiği yönünde değerlendirilmektedir. Hastalığın epidemi oluşturduğu yetiştirme sezonlarında ürünün verim ve kalitesinin negatif yönde çeşitli düzeylerde etkilenecek ekonomik kayıplara neden olduğu bilinmektedir. Hastalığın kontrolünde toleranslı/dayanıklı çeşitlerin kullanımı üretici tarafından tercih edilmeli, böylece üretim alanlarında hastalığın kontrolünde pratik ve ekonomik bir yöntem olmalıdır. Ayrıca sarı pas patojenine ait ırk ve ırkların farklı bölgelere göre dağılımı ve oranı belirlenmeli, ırkların

bölgelere göre deęişiklik göstermesi fazlaysa, hedef bölge bazında farklı dayanıklılık genlerinin kullanıldığı ıslah programları yürütülmelidir. Bu çerçevede GGE-biplot analiz yöntemi kullanılarak sarı pas hastalığına toleranslı/dayanıklı kabul edilebilir genotiplerin belirlenerek seçilmesi amacıyla etkin bir şekilde ıslah çalışmalarına katkı sağlayabileceęi saptanmıştır. Gelecekte yapılacak farklı çalışmalarda hastalık deęerlendirmelerinin derecelerine göre daha fazla genotiplerin deęerlendirilebileceęi ortaya konulmuştur.

KAYNAKÇA

- Ali S., Gladieux, P., Gautier, Leconte, M., Gautier, A., Justesen, A. F., Hovmøller, M. S., Enjalbert, J., de Vallavieille-Pope, C. 2014. Origin, Migration Routes and Worldwide Population Genetic Structure of the Wheat Yellow Rust Pathogen *Puccinia striiformis f.sp. tritici*, plos.org <https://doi.org/10.1371/journal.ppat.1003903>
- Beddow, J.M., Pardey P.G., Chai Y., Hurley T.M., Kriticos D.J., Braun H.J., Park R.F., Cuddy W.S., Yonow T. 2015. Research investment implications of shifts in the global geography of wheat stripe rust. doi:10.1038/nplants.2015.132.
- Boshoff WHP, Pretorius ZA, van Niekerk BD, Komen JS. First Report of Virulence in *Puccinia graminis* f. sp. tritici to Wheat Stem Rust Resistance Genes Sr8b and Sr38 in South Africa. Plant Dis. 2002 Aug;86(8):922. doi: 10.1094/PDIS.2002.86.8.922B. PMID: 30818659.
- Chen, X.M. 2005. Epidemiology and control of stripe rust (*Puccinia striiformis f. sp. tritici*) on wheat. Canadian Journal of Plant Pathology 27: 314-337.
- Çat, A., Tekin, M., Çatal, M., Akan, K., Akar, T. 2017. Buğdayda sarı pas hastalığı ve dayanıklılık ıslahı çalışmaları. Mediterranean Agricultural Sciences(2017) 30(2): 97-105 www.ziraatdergi.akdeniz.edu.tr.
- Eriksson, J. 1894. Über die Spezialisierung des Parasitismus bei dem Getreiderostpilzen. Berichte der Deutschen Botanischen Gesellschaft 12: 292-331.
- Hassebrauk, K., Schröder, J. 1964. Studies on the germination of yellow rust urediospores. In: Proceedings of the Cereal Rusts Conference. Cambridge, UK, pp. 12-18.
- Hovmøller, M.S., Justesen, A.F. 2007. Rates of evolution of avirulence phenotypes and DNA markers in a northwest European population of *Puccinia striiformis f. sp. tritici*. Molecular Ecology 16: 4637.
- Hylander, N., Jorstad, I., Nannfeldt, J.A. 1953. Enumeratio uredinearum Scandinavicarum. Opera Botanica 1: 1-102.
- Mboup, M., Leconte, M., Gautie, A., Wan, A.M., Chen, W.Q., de Vallavieille-Pope, C., Enjalbert, J. 2009. Evidence of genetic recombination in wheat yellow rust population of a Chinese over-summering area. Fungal Genetics and Biology 46: 299–307.
- Milus E.A., Kristensen K., Hovmøller M.S. 2008. Increased aggressiveness of *Puccinia striiformis f. sp tritici* at least partially explains recent stripe rust epidemics. Phytopathology 98: 107.
- Roelsf A.P., Huerta-Espino J., Marshall D.1992. Barley stripe rust in Texas. Plant Disease 76: 538.
- Singh, R.P., Huerta-Espino J., Roefls, A.P. 2012. The wheat rusts. <http://www.fao.org/docrep/006/Y4011E/y4011e0g.htm> Erişim 26 Mart 2017.
- Schwessinger, B. 2017 Fundamental wheat stripe rust research in the 21st century. New Phytologist 213: 1625-1631.
- Wellings, C.R. 2011. Global status of stripe rust: a review of historical and current threats. Euphytica 179: 129-141.
- Yan, W. 2001. GGE biplot-a windows application for graphical analysis of multi-environment trial data and other types of two-way data. Agro J 93(5):1111–1118.
- Zheng, W. et al. 2013. High genome heterozygosity and endemic genetic recombination in the wheat stripe rust fungus. Nat. Commun. 4:2673doi: 10.1038/ncomms3673 (2013).

**TÜRKİYE'DE KIRMIZI ET FİYATLARINDAKİ DEĞİŞİM VE PAZARLAMA
MARJİ**

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ÖZET

İnsanların dengeli ve yeterli beslenmeleri için vazgeçilmez ürünlerin başında hayvansal ürünler gelmektedir. Tüm tarımsal ürünlerde olduğu gibi hayvansal ürünlerin de arzını etkileyen en önemli unsur fiyattır. Fiyatlardaki tahmin edilemeyen dalgalanmalar tarımsal ürün piyasalarında önemli bir risk oluşturmaktadır. Fiyatlardaki kalıcı dalgalanmalar belirsizliğin sürekli hale gelmesinde baş rol oynamaktadır. Bu çalışmada Türkiye'de kırmızı et tüketiminin %95'ini oluşturan dana ve koyun etinin 2008-2021 dönemindeki üretici ve tüketici fiyatları analiz edilmiştir. Veriler Türkiye İstatistik Kurumu web sayfasından elde edilmiştir. Cari fiyatlar Tüketici Fiyat Endeksi değerleri kullanılarak reel fiyatlara dönüştürülmüştür. 2008 yılında 828,5 bin ton olan kırmızı et üretimi 2021 yılında 1,95 milyon tona yükselmesine rağmen tüketimi karşılayacak düzeyde değildir. Sonuçlar dana ve koyun eti reel üretici fiyatlarının 2011 yılına kadar sürekli bir artış, 2011 yılından sonra dalgalı bir seyir izlediğini göstermiştir. Reel üretici fiyatları koyun ve dana etinde 2010 yılına kadar birbirine yakın değerler almış, 2015-2017 yılları hariç diğer yıllarda koyun lehinde artmıştır. Reel tüketici fiyatlarında da benzer bir durum gözlemlenmiştir. Pazarlama marjı incelenen dönemde koyun etinde sürekli bir artış gösterirken, dana etinde 2015 yılına kadar bir artış, 2015 yılından sonra stabil hale gelmiştir. Gerek üretici gerekse tüketici kırmızı et fiyatları aylara göre değişim göstermiştir. Türkiye'de uygulanan hayvancılık politikalarında gerekli düzenlemelerin yapılmasıyla kırmızı et fiyatlarında istikrarın sağlanabileceği düşünülmektedir.

Anahtar Kelimeler: Fiyat Analizi, indeks, mevsimsel dalgalanma, dana eti, kuzu eti.

CHANGES IN RED MEAT PRICES AND MARKETING MARGIN IN TÜRKİYE

ABSTRACT

Livestock products are the most indispensable products for a balanced and adequate diet. As with all agricultural products, the most important factor affecting the supply of animal products is price. Unpredictable fluctuations in prices constitute an important risk in agricultural product markets. Permanent fluctuations in prices play a leading role in making uncertainty permanent. In this study, producer and consumer prices of veal and lamb meat, which constitute 95% of red meat consumption in Türkiye, were analyzed for 2008-2021. Data were obtained from the web page of the Turkish Statistical Institute. Ruling prices are converted to real prices using Consumer Price Index values. Although red meat production of 828.5 thousand tons in 2008 increased to 1.95 million tons in 2021, it is not enough to meet consumption. The results showed that real producer prices of veal and lamb followed a steady increase until 2011 and a fluctuating course after 2011. Real producer prices for lamb and veal were close to each other until 2010 and increased in favor of lamb in all years except 2015-2017. A similar situation was observed in real consumer prices. While the marketing margin showed a continuous increase in lamb during the period analyzed, it increased in veal until 2015 and stabilized after 2015. Both producer and consumer red meat prices varied by month. It is thought that red meat prices can be stabilized by making the necessary adjustments in the livestock policies implemented in Türkiye.

Keywords: Price Analysis, Index, Seasonal Fluctuation, Veal, Lamb

Giriş

Hayvansal ürünler, yüksek besin değerleri, kolaylıkla bulunabilmeleri ve erişilebilmeleri nedeniyle insan beslenmesinde önemli rol oynamaktadır. Et, süt ve yumurta gibi hayvansal ürünler, temel amino asitler, yağ asitleri ve demir, çinko, kalsiyum, A, E ve B1 vitamini gibi diğer birçok temel mikro besin ögesini içeren değerli tam protein kaynaklarıdır (Idamokoro vd., 2020). Bu besinler büyüme, sağlıklı olma ve vücudun düzgün çalışması için önemlidir. Çoğu ülkede hayvansal ürünler, kalsiyum ve proteinin diyetle alımında en büyük kaynaktır. Bazı hayvansal kaynaklı gıdaların, özellikle de yağ ve doymuş yağ asidi içeriklerinin bazı yönleri, bu gıdaların kardiyovasküler hastalık ve metabolik sendrom gibi kronik hastalık riskine önemli ölçüde neden olduğuna dair endişelere yol açmıştır (Givens, 2005). Hayvansal ürünler içerisinde önemli bir paya sahip olan kırmızı et, protein ve temel besin maddeleri bakımından zengin dengeli beslenmenin önemli bir parçasıdır (Wyness, 2015). Kırmızı et esansiyel amino asitler, vitaminler (B12 dahil) ve mineraller (demir ve çinko dahil) açısından zengin bir kaynaktır (Williams, 2007). Ancak yüksek miktarda işlenmiş kırmızı et tüketimi kalp hastalıkları, tip 2 diyabet ve kolorektal kanser gibi kronik hastalık riskinin artmasıyla ilişkilendirilmiştir (Cocking et al., 2020; Sanders et al., 2023). Bu nedenle, kırmızı etin ölçülü tüketilmesi önerilmektedir (Holman et al., 2020).

Fiyat analizi, tarım da dahil olmak üzere çeşitli alanların önemli bir yönüdür. Yapılan araştırmalar fiyat dalgalanmalarının tarım piyasalarının normal bir özelliği olduğunu göstermektedir (Gilbert, 2010; Naylor ve Falcon, 2010). Tarımsal emtia fiyatları artmaktadır ve bu beklenen bir durumdur. Çünkü tarımsal ürün piyasalarında sadece yıldan yıla fiyat dalgalanmaları değil, aynı zamanda nispeten istikrarsız arz ve talep koşulları ve düşük talep ve arz esneklikleri nedeniyle değişken fiyatlar da yaşanmaktadır (Gilbert, 2010). Döviz kuru dalgalanmaları da tarımsal ürünlerin ihracatını ve fiyatını etkilemektedir (Piot-Lepetit ve M'Barek, 2011). Makroekonomik politikaların tarımdaki ekonomik koşulların önemli bir belirleyicisi olduğunu ve tarımsal fiyatlardaki dalgalanmaların geleneksel tarımsal faktörler kadar önemli bir kaynağı olduğunu unutmamak gerekir (Frankel, 1986). Fiyat dalgalanmaları tarım piyasalarının normal bir özelliğidir ve arz ve talep, mevsimsellik ve makroekonomik politika gibi çeşitli faktörler tarımsal mal fiyatlarını etkilemektedir (Goodman ve Thibodeau, 1998; Piercy et al., 2011; Zielke, 2011). Dolayısıyla fiyat analizi, piyasa dinamiklerini anlamak ve çeşitli alanlarda bilinçli kararlar almak için önemli bir araçtır.

Türkiye'de kırmızı et fiyatları, birçok faktörden etkilenmektedir. Kırmızı et, insan beslenmesindeki öneminin yanı sıra sosyal ve ekonomik fonksiyonları ile ülkelerin gelişmişlik

düzeylerini de ortaya koymaktadır. Kırmızı et tüketimi; nüfus, gelir seviyesi, kırmızı et fiyatları, ikame ürünlerin fiyatları ile tüketici zevk ve tercihlerindeki değişimler çerçevesinde ele alınmaktadır. Türkiye'de canlı hayvan ve kırmızı et ithalatının sürmesi yapısal çözümler getirecek politikaların gerekliliğini ortaya koymaktadır (Saygın ve Demirbaş, 2017). Ayrıca, et ithalatı, et fiyatları, et üretim miktarı vb. süreçlerde yaşanan değişimler kırmızı et sektörünü etkilemektedir (Öztürk ve Baysan, 2022). Sonuç olarak, Türkiye'de kırmızı et fiyatları, nüfus, gelir seviyesi, ikame ürünlerin fiyatları, tüketici zevk ve tercihleri, canlı hayvan ve kırmızı et ithalatı, et fiyatları, et üretim miktarı vb. birçok faktörden etkilenmektedir.

Pazarlama marjı, bir ürünün üretici satış fiyatı ile tüketici alış fiyatı arasındaki farktır. Pazarlama sisteminin verimliliğinin önemli bir ölçüsüdür ve iş sürdürülebilirliğinde teşvik edici veya caydırıcı bir rol oynayabilmektedir. Pazarlama marjları, pazarlama sistemlerinin etkinliğinin ya da etkinsizliğinin göstergesi olarak değerlendirilebilir (Achike ve Anziku, 2010). Pazarlama marjı pazarlama sisteminin etkinliğinin önemli bir ölçütüdür. Pazarlama marjlarının belirleyicileri sektöre ve pazar yapısına bağlı olarak değişmektedir. Araştırma sonuçları, pazar yoğunlaşması ve verimliliğin bazı sektörlerde pazarlama marjlarının önemli belirleyicileri olduğunu göstermektedir.

Tarımsal ürünlerin fiyat analizinin ve kar marjlarının değerlendirildiği çok sayıda çalışma yapılmıştır. Akpınar ve Gül (1998), Adana'da kütlü pamuk fiyatlarındaki gelişmeleri ve mevsimsel dalgalanmaları incelemiş, 1981-1996 döneminde fiyatların mevsimsel dalgalanma gösterdiği, Ekim ayında en düşük, Haziran ayında ise en yüksek seviyesine ulaştığını bildirmiştir. Ayrıca hasat dönemi boyunca pamuk fiyatlarının düştüğünü, Mart ayından sonra ise bir artış eğilimine girdiğine vurgu yapmıştır. Demirtaş ve Erkan (2002), Türkiye'de ve Mersin ilinde üretimi en yüksek sebze olan domatesin fiyatları ve mevsimsel dalgalanmaları analiz edilmiştir. Çalışmada fiyat dalgalanmalarının ana nedeni olarak tarım ürünlerinde arzın hasat mevsiminde artması ve buna karşılık talebin yıl boyunca sürekli olması gösterilmiştir. Ayrıca domates fiyatlarındaki reel artış trendi 7.678 TL/kg olarak hesaplanmıştır. Gül vd. (2009), 1997-2006 yıllarına ait verileri kullanarak 16 sebze için fiyat değişimlerini ve mevsimsel dalgalanmaları incelemiştir. İncelenen dönemde sebze fiyatlarının azalan bir eğilime sahip olduğu bildirilmiştir. Yılmaz ve Gül (2014) Antalya ili muz fiyatlarını inceledikleri çalışmada, muz reel fiyatlarının 1999-2013 periyodunda azalma eğiliminde olduğu, aylara göre fiyatın değiştiğini belirlemiştir. Kadanalı vd. (2010) limonda, Küzeci vd. (2019) kuru fasulyede, Ertek vd. (2020) portakalda, Bozdemir vd. (2021) domateste pazarlama marjlarını hesaplamışlardır.

Tarımsal ürünlerde olduğu gibi literatürde kırmızı et fiyatlarının incelendiği birçok çalışma bulunmaktadır. Cevger ve Sakarya (2006), Turhan vd. (2010) ve Aydın vd. (2011)) kırmızı et fiyat oluşumunu ve bu oluşumu etkileyen faktörleri incelemiştir. Kan ve Direk (2004) ise Konya ilinde kırmızı et fiyatındaki gelişmeleri değerlendirmiştir. Ayyıldız ve Çiçek (2018) kırmızı et fiyatlarını GARCH yöntemiyle analiz etmiştir. Saygın ve Demirbaş (2017), kırmızı et sektörüne ait sorunları ve çözüm önerilerini ortaya koymuştur. Topçu (2002), Erzurum ilinde sığır eti maliyeti ve pazarlama marjını hesaplamıştır.

Bu çalışmada, Türkiye İstatistik Kurumu internet sitesinden elde edilen 2008-2021 dönemindeki üretici ve tüketici fiyatları analiz edilmiştir.

Materyal ve Metot

Çalışmanın ana materyali Türkiye İstatistik Kurumundan elde edilen ikincil veriler oluşturmaktadır. Kırmızı et fiyatları 2008-2021 dönemini içeren 19 yıllık zaman dilimini kapsamaktadır. Cari fiyatların reel fiyatlara dönüştürülmesinde 2003=100 bazlı Türkiye İstatistik Kurumu tarafından periyodik olarak yayınlanan tüketici fiyat endeksi (TÜFE) kullanılmıştır. Fiyat serisinin basit indeksleri hesaplanmış ve yorumlanmıştır. Mevsimsel fiyat dalgalanmaları basit oran yöntemi ile belirlenmiştir (Güneş ve Arıkan, 1988). Ayrıca çalışmada kırmızı et fiyatlarının zaman içindeki değişimini farklı bir açıdan değerlendirebilmek için elma fiyatları ile karşılaştırılmıştır.

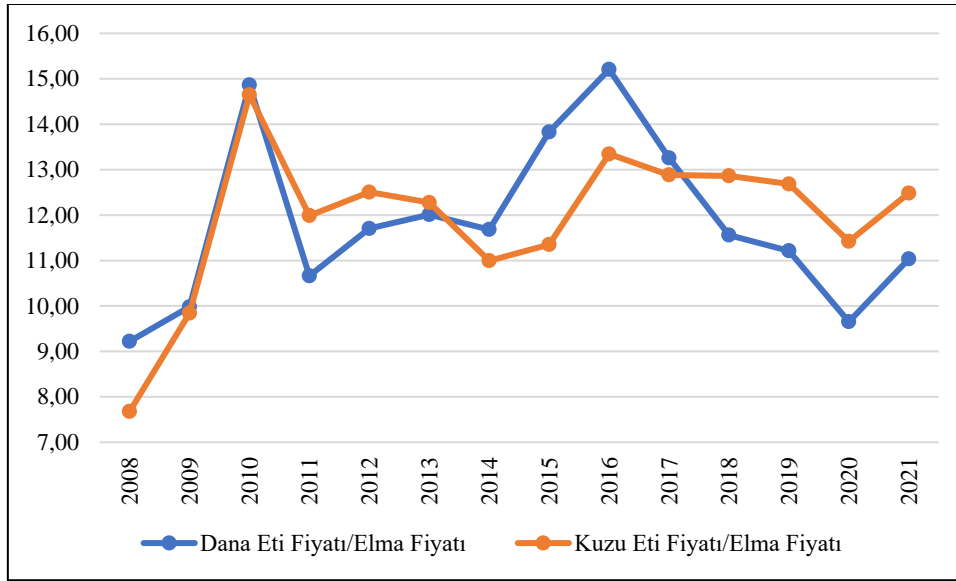
Araştırma Bulguları ve Tartışma

Kırmızı et sektörü, hayvan yetiştiriciliği, et işleme ve pazarlama faaliyetlerini içeren çok kapsamlı bir sektördür. Son yıllarda, et tüketimindeki artan sağlık endişeleri nedeniyle, bazı tüketiciler alternatif protein kaynaklarına yönelse bile dünya genelinde hala yüksek miktarda kırmızı et tüketilmektedir. Özellikle artan nüfusun yeterli ve dengeli beslenmesi kırmızı et sektörünü, dolayısı ile kırmızı et sektörünün kaynağı olan hayvancılığa olan ilgiyi daha da artırmaktadır. Çizelge 1’de Türkiye’de son beş yıldaki canlı hayvan sayısı, kesilen hayvan sayısı ve et üretim miktarı verilmiştir (TOB, 2023; TÜİK, 2023). Son beş yıllık veriler incelendiğinde tüm istatistiklerde yıllara göre bir artışın olduğu görülebilir. Ancak bu artışın kırmızı et talebini karşılamadığını belirtmek gerekir.

Çizelge 1. Türkiye canlı hayvan sayısı, kesilen hayvan sayısı ve et üretim miktarı

		2017	2018	2019	2020	2021
Büyükbaş	Canlı Hayvan Sayısı (1000 adet)	16.105	17.221	17.872	18.158	18.036
	Kesilen Hayvan Sayısı (1000 adet)	4.363	4.877	4.892	4.854	5.186
	Et Üretim Miktarı (1000 ton)	1.100	1.288	1.337	1.350	1.472
Küçükbaş	Canlı Hayvan Sayısı (1000 adet)	44.312	46.117	48.481	54.113	57.519
	Kesilen Hayvan Sayısı (1000 adet)	17.592	18.526	19.060	20.493	22.033
	Et Üretim Miktarı (1000 ton)	341	374	403	436	480
Toplam	Canlı Hayvan Sayısı (1000 adet)	60.417	63.338	66.353	72.271	75.555
	Kesilen Hayvan Sayısı (1000 adet)	21.955	23.403	23.952	25.347	27.219
	Et Üretim Miktarı (1000 ton)	1.440	1.662	1.741	1.786	1.952

Türkiye 2008-2021 arasındaki kırmızı et (koyun ve dana) fiyatları ile elma fiyatları arasındaki parite Şekil 1’de verilmiştir. 2008 yılında 1 kg kuzu eti ile 7,7 kg, 1 kg dana eti ile 9,2 kg elma alınabiliyorken, 2010 yılında 1 kg dana ve kuzu eti ile yaklaşık aynı miktarda elma alınabilmektedir. 2021 yılına gelindiğinde fiyat paritesi kuzu eti lehinde gelişmiş ve 1 kg dana eti ile yaklaşık 11 kg, 1 kg kuzu eti ile 12,5 kg elma alınır duruma gelmiştir. Kırmızı et-elma fiyat paritesi yıllara göre değişken bir yapı göstermiştir. Örneğin 2010-2013 ve 2018-2021 dönemlerinde kuzu eti ile daha fazla elma alınabiliyorken, 203-2017 döneminde dana eti lehine bir değişim olmuştur.



Şekil 1. Türkiye’de 2008-2021 dönemi kırmızı et-elma fiyatı paritesi

Koyun ve dana eti üretici reel üretici fiyatları Çizelge 2’de verilmiştir. Reel fiyatlar incelendiğinde koyun etinde 2011 yılına kadar sürekli bir artış, 2011-2014 döneminde bir düşüş, 2014 yılından sonra inişli çıkışlı bir artış olmuştur. Dana eti reel fiyatlarında da benzer bir seyir olmakla birlikte koyun eti lehine artışın daha fazla olması dana ve koyun eti fiyatı arasındaki makasın açılmasına neden olmuştur. Nitekim 2021 yılında 2008 yılına göre koyun eti reel fiyatları %21,93 artarken, dana eti fiyatları %2,18 oranında artmıştır.

Çizelge 2. Yıllara göre koyun ve dana eti reel üretici fiyatlarındaki gelişmeler

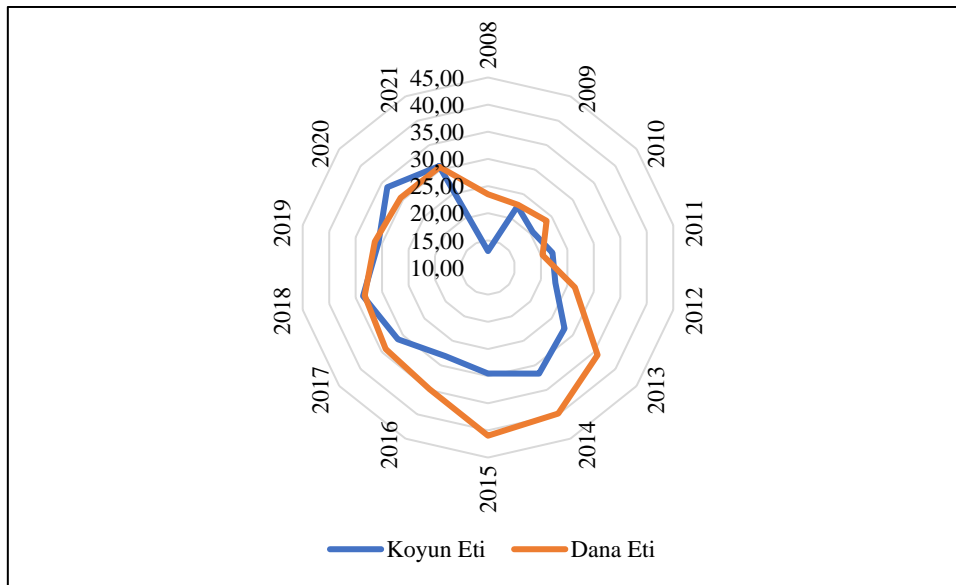
Yıllar	Koyun Eti Üretici Fiyatı (TL/kg)		Dana Eti Üretici Fiyatı (TL/kg)	
	Reel Fiyat	İndeks	Reel Fiyat	İndeks
2008	49,29	100,00	52,07	100,00
2009	55,34	112,28	55,95	107,45
2010	72,79	147,68	70,82	136,01
2011	73,66	149,44	67,11	128,90
2012	65,28	132,44	58,20	111,79
2013	56,08	113,77	48,92	93,97
2014	51,88	105,26	48,51	93,16
2015	54,60	110,78	55,69	106,97
2016	59,28	120,26	61,23	117,61
2017	61,20	124,16	60,40	116,01
2018	60,37	122,49	54,55	104,77
2019	58,80	119,29	51,47	98,85
2020	58,96	119,61	52,18	100,22
2021	60,10	121,93	53,20	102,18

Kırmızı et reel tüketici fiyatları Çizelge 3’te verilmiştir. Tüketici fiyatlarının üretici fiyatlarına göre daha fazla artmıştır. 2021 yılında 2008 yılına göre koyun eti fiyatı %49,78, dana eti fiyatı %10,18 oranında artmıştır.

Çizelge 3. Yıllara göre koyun ve dana eti reel tüketici fiyatlarındaki gelişmeler

Yıllar	Koyun Eti Tüketici Fiyatı (TL/kg)		Dana Eti Üretici Fiyatı (TL/kg)	
	Reel Fiyat	İndeks	Reel Fiyat	İndeks
2008	56,63	100,00	68,01	100,00
2009	71,43	126,12	72,50	106,60
2010	91,53	161,62	92,92	136,63
2011	94,63	167,09	84,16	123,75
2012	84,50	149,21	79,06	116,25
2013	77,90	137,55	76,18	112,02
2014	75,97	134,15	80,64	118,57
2015	77,47	136,80	94,35	138,74
2016	82,45	145,59	93,98	138,18
2017	89,00	157,15	91,64	134,75
2018	90,90	160,50	81,72	120,17
2019	84,82	149,78	74,93	110,18
2020	88,93	157,03	75,23	110,62
2021	86,82	153,31	76,47	112,44

Koyun ve dana eti pazarlama marjları yıllara göre değişim göstermektedir. Koyun eti pazarlama marjı %13,02-33,70 arasında değişirken, dana etinde bu oranlar %20,31-40,97 arasında seyretmiştir. 2021 yılında hem dana hem de koyun etinin pazarlama marjı yaklaşık %31 olarak gerçekleşmiştir (Şekil 2).



Şekil 2. Türkiye’de kırmızı et pazarlama marjı (%)

Kırmızı et fiyatındaki mevsimsel dalgalanmalar reel tüketici fiyatları için hesaplanmıştır. Reel fiyatlar koyun etinde 79,24 TL/kg ve dana etinde 79,29 TL/kg ile en düşük Ocak ayında gerçekleştiği belirlenmiştir. Koyun eti fiyatı Ağustos ayında, dana eti Eylül ayında en yüksek değere ulaşmıştır. Koyun eti fiyatlarına ait varyasyon katsayısının dana eti fiyatlarına göre daha yüksek olması koyun eti fiyatının daha değişken olduğunun göstergesidir.

Çizelge 4. Kırmızı et reel fiyatlarında mevsimsel dalgalanmalar

Aylar	Koyun Eti			Dana Eti		
	Reel Fiyat (TL/kg)	Varyasyon Katsayısı	Mevsimsel İndeks	Reel Fiyat (TL/kg)	Varyasyon Katsayısı	Mevsimsel İndeks
Ocak	79,24	13,77	96,22	79,29	11,59	97,23
Şubat	80,17	12,38	97,35	79,49	11,47	97,46
Mart	81,60	12,43	99,08	79,60	11,15	97,60
Nisan	82,47	13,30	100,14	80,67	11,56	98,91
Mayıs	82,73	13,32	100,45	81,09	10,44	99,43
Haziran	83,15	13,79	100,96	82,09	10,66	100,66
Temmuz	83,67	13,87	101,60	82,98	11,42	101,75
Ağustos	84,19	13,44	102,23	83,64	11,14	102,56
Eylül	84,03	12,79	102,03	84,00	11,39	103,00
Ekim	82,81	12,26	100,55	82,55	11,62	101,21
Kasım	82,35	11,71	99,99	81,79	10,96	100,29
Aralık	81,86	11,4	99,39	81,48	10,46	99,91

Sonuç ve Öneriler

Bu çalışmada önemli besin kaynaklarından biri olan kırmızı etin fiyat analizleri yapılmış, fiyatların mevsimsel dalgalanmaları incelenmiştir. Sonuçlar yıllara göre değişmekle birlikte reel fiyatların genel bir artış eğiliminde olduğunu göstermiştir. Koyun ve dana eti fiyatları aylara göre değişiklik göstermiştir. Genel olarak kış aylarından yaz aylarına doğru kırmızı et fiyatları artış, sonbahara doğru ise bir azalış eğiliminde olmuştur.

Türkiye et üretimi yıllara göre artmasına rağmen yurtiçi talep karşılanamamaktadır. Türkiye'nin kırmızı et tüketimi diğer ülkelere kıyasla nispeten düşüktür ve ülke kırmızı et talebini karşılamak için büyük ölçüde ithalata bağımlıdır. Bu nedenle, ithalata olan bağımlılığı azaltmak için ülkede kırmızı et üretiminin artırılması gerekmektedir. Üretimde verimliliği artıracak politikalara hız verilmelidir. Bunun için modern teknolojiler kullanarak hayvanların beslenmesi, barındırılması ve kesimi gibi süreçlerde daha verimli yöntemler kullanılmalıdır.

Bu, üretim maliyetlerini azaltacak ve kırmızı et fiyatlarını düşürecektir. Türkiye'de küçük ve orta ölçekli işletmeler kırmızı et üretiminde büyük bir rol oynamaktadır. Bu işletmelerin desteklenmesi, hayvanların sağlıklı yetiştirilmesi, hastalıkların önlenmesi ve beslenme sorunlarının giderilmesi için gerekli kaynakların sağlanması gerekmektedir. Pazarlama marjı, pazarlama sisteminin etkinliğinin önemli bir ölçüsüdür. Bu nedenle, pazarlama marjını azaltmak ve sektörün karlılığını artırmak için pazarlama sisteminin iyileştirilmesi gerekmektedir.

Kırmızı etin kalitesi ve güvenliği, kırmızı et talebini etkileyen temel faktörlerdir. Bu nedenle, ülkede kırmızı ete olan talebi artırmak için kırmızı etin kalitesini ve güvenliğini iyileştirmek gerekmektedir. Kırmızı et sektöründe Ar-Ge çalışmalarının da teşvik edilmesi diğer önemli bir konudur. Özellikle hayvanların daha verimli beslenmesi, hastalıkların önlenmesi ve kırmızı et kalitesinin artırılması için Ar-Ge çalışmaları desteklenmelidir.

Sonuç olarak, Türkiye'de kırmızı et sektörünün gelişmesi için yenilikçi uygulamaların benimsenmesinin artırılması, kırmızı et üretiminin artırılması, pazarlama sisteminin iyileştirilmesi, kırmızı et tüketiminin teşvik edilmesi ve kırmızı etin kalite ve güvenliğinin iyileştirilmesi gerekmektedir.

Kaynaklar

- Achike, A. I., Anziku, T. A. K., 2010. Economic analysis of the marketing margin of benniseed in Nasarawa state, Nigeria. *Journal of Tropic Agriculture, Food, Environment and Extension*, 9(1), 47-55.
- Akpınar, M. G., Gül, M., 1998. Adana ilinde kütlü pamuk fiyatlarındaki gelişmeler ve mevsimsel dalgalanmalar. *Kahramanmaraş Sütçü İmam Üniversitesi Fen ve Mühendislik Dergisi*, 2(1), 100-107.
- Aydın E., Aral Y., Can M. F., Cevger Y., Sakarya E., İşbilir S., 2011. Türkiye’de son 25 yılda kırmızı et fiyatlarındaki değişimler ve ithalat kararlarının etkilerinin analizi. *Veteriner Hekimler Derneği Dergisi*, 82(1), 3-13.
- Ayyıldız, M., Çiçek, A., 2018. Kırmızı Et Fiyatlarının GARCH Yöntemiyle Analizi: Türkiye Örneği. *Türk Tarım - Gıda Bilim Ve Teknoloji Dergisi*, 6(12), 1775–1780. <https://doi.org/10.24925/turjaf.v6i12.1775-1780.2095>
- Bozdemir, M., Bayramoğlu, Z., Karakayacı, Z., Ağızan, K., Ağızan, S., 2021. Domates Pazarlama Kanalları ve Pazar Marjının Belirlenmesi. *Yuzuncu Yıl University Journal of Agricultural Sciences*, 31(1), 179-187. <https://doi.org/10.29133/yyutbd.748026>
- Cevger, Y., Sakarya, E., 2006. Meat Prices and Factors Affecting them in Turkey. *Turkish Journal of Veterinary & Animal Sciences*, 30(1), 1-6.
- Cocking, C., Walton, J., Kehoe, L., Cashman, K., Flynn, A., 2020. The role of meat in the European diet: Current state of knowledge on dietary recommendations, intakes and contribution to energy and nutrient intakes and status. *Nutrition Research Reviews*, 33(2), 181-189. <https://doi.org/10.1017/S0954422419000295>
- Demirtaş, B., Erkan, O., 2022. Mersin İlinde 1988-1997 Dönemi Domates Fiyatları Analizi. *Alatarım*, 1(2), 17-22.
- Ertek, N., Dağdemir, V., Keskin, A., 2020. Türkiye’de Mandalina Piyasasının Ekonomik Analizi ve Pazarlama Marjları. *Atatürk Üniversitesi Ziraat Fakültesi Dergisi*, 51(2), 119-125. <https://doi.org/10.17097/ataunizfd.562118>
- Frankel, J. A., 1986. Expectations and Commodity Price Dynamics: The Overshooting Model. *American Journal of Agricultural Economics*, 68(2), 344-348. <https://doi.org/10.2307/1241436>
- Gilbert, C. L., 2010. How to Understand High Food Prices. *Journal of Agricultural Economics*, 61(2) 398-425. <https://doi.org/10.1111/j.1477-9552.2010.00248.x>
- Givens, D., 2005. The role of animal nutrition in improving the nutritive value of animal-derived foods in relation to chronic disease. *Proceedings of the Nutrition Society*, 64(3), 395-402. <https://doi.org/10.1079/PNS2005448>
- Goodman, A. C., Thibodeau, T. G., 1998. Housing Market Segmentation, *Journal of Housing Economics*, 7(2), 121-143. <https://doi.org/10.1006/jhec.1998.0229>
- Gül, M., Dağistan, E., Demirtaş, B., Yılmaz, H., Karataş, A., Yılmaz, Y., 2009. Antalya ilinde bazı sebze fiyatlarındaki gelişmeler ve mevsimsel dalgalanmalar. *Mustafa Kemal Üniversitesi Ziraat Fakültesi Dergisi*, 14(2), 57-68.
- Güneş, T., Arıkan, R., 1988. *Tarım Ekonomisi İstatistiği*, Ankara Üniversitesi Ziraat Fakültesi, Yayın No: 1049, Ankara Üniversitesi Basımevi, Ankara.
- Holman, W. B., Fowler, S. M., Hopkins, D. L., 2020. Red meat (beef and sheep) products for an ageing population: A review. *International Journal of Food Science & Technology*, 55(3), 919-934. <https://doi.org/10.1111/ijfs.14443>
- Idamokoro, E. M., Falowo, A. B., Oyeagu, C. E., Afolayan, A. J., 2020. Multifunctional activity of vitamin E in animal and animal products: A review. *Animal Science Journal*, 91(1), e13352. <https://doi.org/10.1111/asj.13352>

- Kadanalı, E., Kızıloğlu, R., Dağdemir, V., 2010. Türkiye’de Limon Fiyatlarının Analizi ve Pazarlama Marjları. Türkiye IX. Tarım Ekonomisi Kongresi, 22-24 Eylül, Şanlıurfa, 326-333.
- Kan, A., Direk, M., 2004. Konya İlinde Kırmızı Et Fiyatlarındaki Gelişmeler. Selçuk Üniversitesi Ziraat Fakültesi Dergisi, 18(34), 35-40.
- Küzeci, U., Dağdemir, V., Demir, O., 2019. Türkiye’de Kuru Fasulye Piyasasının Ekonomik Analizi ve Pazarlama Marjları. ÇOMÜ Ziraat Fakültesi Dergisi, 7(2), 379-386. <https://doi.org/10.33202/comuagri.545838>
- Naylor, R. L., Falcon, W. P., 2010. Food Security in an Era of Economic Volatility. Population and Development Review, 36(4), 693-723. <https://doi.org/10.1111/j.1728-4457.2010.00354.x>
- Öztürk, S., Baysan, İ., 2022. 2003-2019 Döneminde Türkiye’de Kırmızı Et Sektörü: Seçili Göstergeler Üzerine Bir İnceleme. Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 2022(51), 223-239. <https://doi.org/10.30794/pausbed.982603>
- Piercy, N. F., Cravens, D. W., Lane, N., 2010. Thinking strategically about pricing decisions. The Journal of business strategy, 31(5), 38 – 48. <https://doi.org/10.1108/02756661011076309>
- Piot-Lepetit, I., M’Barek, R., 2011. Methods to Analyse Agricultural Commodity Price Volatility. In: Piot-Lepetit, I., M’Barek, R. (eds) Methods to Analyse Agricultural Commodity Price Volatility. Springer, New York, NY. https://doi.org/10.1007/978-1-4419-7634-5_1
- Sanders, L. M., Wilcox, M. L., Maki, K. C., 2023. Red meat consumption and risk factors for type 2 diabetes: A systematic review and meta-analysis of randomized controlled trials. European Journal of Clinical Nutrition, 77(2), 156-165. <https://doi.org/10.1038/s41430-022-01150-1>
- Saygın, Ö., Demirbaş, N., 2017. Türkiye’de Kırmızı Et Sektörünün Mevcut Durumu ve Çözüm Önerileri. Hayvansal Üretim, 58 (1), 74-80. <https://doi.org/10.29185/hayuretim.335515>
- TOB, 2023. Tarım ve Orman Bakanlığı. <https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/HAYGEM.pdf> Erişim Tarihi: 10.04.2023.
- Topcu, Y., 2004. Erzurum ili Sığır Besiciliği işletmelerinde Et Maliyeti ve Pazarlama Marjı Üzerine Bir Araştırma. Turkish Journal of Veterinary & Animal Sciences, 28(6), 1007-1015.
- TUİK, 2023. Türkiye İstatistik Kurumu. <https://data.tuik.gov.tr/Kategori/GetKategori?p=tarim-111&dil=1> Erişim Tarihi: 10.04.2023.
- Turhan, Ş., Erdal, B., Çetin, B., 2010. Türkiye’de Kırmızı Ette Fiyat Olusumu Ve Etkileyen Faktörler. Türkiye IX. Tarım Ekonomisi Kongresi, 22-24 Eylül, Şanlıurfa, 387-395.
- Williams, P., 2007. Nutritional composition of red meat. Nutrition & Dietetics, 64(s4), S113-S119. <https://doi.org/10.1111/j.1747-0080.2007.00197.x>
- Wyness, L., 2016. The role of red meat in the diet: Nutrition and health benefits. Proceedings of the Nutrition Society, 75(3), 227-232. <https://doi.org/10.1017/S0029665115004267>
- Yılmaz, Ş. G., Gül, M., 2014. Muz fiyatlarında mevsimsel fiyat dalgalanmalarının analizi. Mustafa Kemal Üniversitesi Ziraat Fakültesi Dergisi, 19(2), 1-15.
- Zielke, S., 2011. Integrating emotions in the analysis of retail price images. Psychology & Marketing, 28(4), 330-359. <https://doi.org/10.1002/mar.20355>

DÜNYADA VE TÜRKİYE’DE ELMA ÜRETİMİ VE DIŞ TİCARETİ

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ÖZET

Bu çalışmanın amacı dünyada ve Türkiye’de elmacılık sektörünün mevcut durumunu ortaya koymaktır. Bu amaçla TUIK, FAO ve USDA verilerinden yararlanılarak üretim, alan ve verim ile ilgili değişimler incelenmiştir. Elma, dünya üretiminde muzdan sonra en fazla üretilen ve ticarete konu olan meyve türüdür. Dünya elma üretiminin yaklaşık %85,5’i Asya ve Avrupa kıtasında üretilmektedir. Çin %49,4’lük üretim payıyla dünya elma üretiminin yaklaşık yarısını karşılamaktadır. Türkiye ve ABD Çin’den sonra en fazla üretim yapan ülkelerdir. Dünya elma alanlarında önemli bir artış olmazken üretim miktarlarında sürekli bir artış trendinin varlığı birim alandan alınan ürünün arttığına bir göstergesidir. Son yıllarda elma verimliliğini artırmaya yönelik politikaların uygulanmasıyla Türkiye’de birim alandan alınan elma miktarı dünya ortalamasının üstünde olmasına rağmen, önemli elma üreten Şili, İtalya, Fransa, ABD, Yeni Zelanda ve Güney Afrika gibi ülkelere göre düşük bir verimliliğe sahiptir. Nüfusunun yüksekliği Çin’i en fazla elma tüketen ülke konumuna getirmiştir. Türkiye’de kişi başı elma tüketimi dünya ortalamasının çok üstünde yaklaşık 36 kg’dır. Dünya elma ticareti değerlendirildiğinde sırasıyla Çin, Polonya, İtalya, ABD ve Şili en fazla ihracat yapan ülkeler olarak ilk sıralarda yer alırken, ithalatta bu sıralama Rusya, Almanya, Hindistan, İngiltere ve Hollanda şeklindedir. Türkiye’de ihracatın üretime oranı yaklaşık %7,9’dur. Türkiye dünya elma ticaretinden %4,2’lik bir pay almakla birlikte bu payın artırılmasına yönelik politikaların etkin bir şekilde yürürlüğe koyulması elmacılık sektörünün gelişimi açısından önemli olduğu değerlendirilmektedir.

Anahtar Kelimeler: Elma, ithalat, ihracat, verim, tüketim

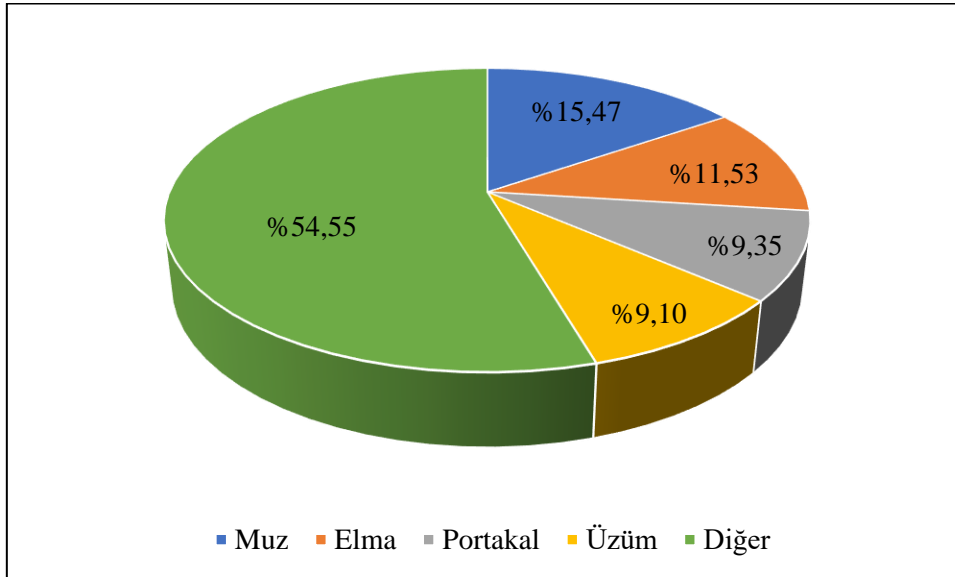
ABSTRACT

This study aimed to lay out the current situation of the apple sector in the world and Türkiye. For this purpose, changes in production, area, and yield were analyzed by using TurkStat, FAO, and USDA data. Apple is the most produced and traded fruit after bananas in the world. Approximately 85.5% of the world's apple production was made in Asia and Europe. China accounted for about half of the world's apple production, with a production share of 49.4%. Türkiye and the USA had the highest production after China in 2021. While there is no significant increase in the world apple area, a continuous upward trend in production indicates that the product obtained from the unit area is increasing. With implementing policies to increase apple productivity in recent years, Türkiye has low productivity compared to major apple-producing countries such as Chile, Italy, France, the USA, New Zealand, and South Africa, although the yield of apples obtained from the unit area is above the world average. China's high population has made it the country with the highest apple consumption. Per capita, apple consumption in Türkiye is about 36 kg, much higher than the world average. When the world apple trade is evaluated, China, Poland, Italy, the USA, and Chile were the leading exporting countries, while Russia, Germany, India, the UK, and the Netherlands were the leading importing countries. In Türkiye, the ratio of exports to production was approximately 7.9%. Although Türkiye has a share of 4.2% in the world apple trade, effective implementation of policies to increase this share is considered important for developing the apple sector.

Keywords: Apple, import, export, yield, consumption

Giriş

Meyvecilik sektörü, insan beslenmesinde rol alması, istihdam sağlaması, meyve işleyen sanayiye hammadde sağlaması, katma değerinin diğer tarım ürünlerine göre daha yüksek olması ve dış ticarete konu olmasından dolayı önemli bir sektördür. Son yıllarda pazara erişimin kolaylaşması, tüketici tercihlerinin değişmesi, soğuk zincirle taşıma olanaklarındaki ve gelişmiş soğuk hava depo sayısındaki artış nedeniyle meyvecilik sektöründe önemli gelişmeler sağlanmıştır. 2002 yılında 600,9 milyon ton olan dünya meyve üretimi 20 yıllık süreçte %51,38 artarak 909.6 milyon tona ulaşmıştır. Aynı dönemde meyve üretim alanı %22,1 artarak 2021 yılında 66.482.017 ha'ya yükselmiştir. Söz konusu 2002-2021 yıllarını kapsayan 20 yıllık süreçte Türkiye'de meyve üretimi %47,33, meyve alanı ise %0,66 artarak sırasıyla 25 milyon ton ve 1.34 milyon ha olarak gerçekleşmiştir. Türkiye 25 milyon tonluk meyve üretimiyle dünya meyve üretiminin yaklaşık %2.75'ini karşılamakta; Çin, Hindistan ve Brezilya'nın ardından dördüncü sırada yer almaktadır. 2021 yılında dünya meyvecilik sektörü yaklaşık 556,6 milyar dolar, Türkiye ise 8,1 milyar dolar brüt üretim değerine sahiptir (FAO, 2023). Bu sektörde 2021 yılı verilerine göre elma %11,53'lük üretim payıyla; muzdan sonra en fazla üretilen ikinci büyük türdür (Şekil 1).

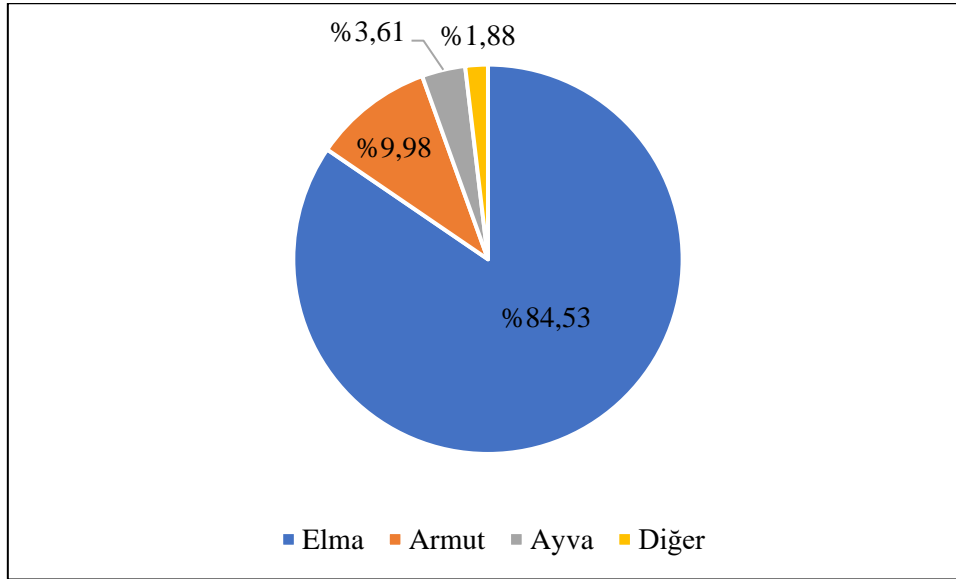


Şekil 1. Türler'e göre dünya meyve üretim oranları (FAO, 2023)

Son yıllarda kronik hastalıkların artışı tüketicilerin meyveye olan ilgisini teşvik etmiş, bu nedenle tüm dünyada meyve üretim ve ticareti artmıştır (Güneş vd., 2017).

Elma ılıman iklim bölgelerinde kolayca yetiştirilebilmesine rağmen, ticari elma üretimi, üretim ve pazarlamada karşılaştırmalı üstünlüğe sahip ülkelerde ve bölgelerde artan bir şekilde yoğunlaşmaktadır (O'Rourke, 2003). Sıcağa toleranslı çeşitlerin geliştirilmesi, uzun yetiştirilme periyodu gerektiren çeşitlerin popülaritesinin artması (Granny Smith ve Fuji gibi) ve sulama teknolojisinin gelişmesi elma üretiminin başarılı bir şekilde sıcak iklimlerde yetiştirilmesine olanak tanımaktadır (O'Rourke, 1994).

Türkiye'de birçok meyve türü sahip olduğu coğrafi konum nedeniyle yetiştirilebilmekte, bu nedenle Türkiye bahçe bitkileri kültürünün doğuş yeri ve çok sayıda meyve türünün anavatanı olarak kabul edilmektedir (Ağaoğlu vd., 1997). Türkiye'de yaklaşık 5,32 milyon ton yumuşak çekirdekli meyve üretimi gerçekleştirilmektedir. Yumuşak çekirdekli meyve grubunda yer alan elma %84,53 ile en fazla üretilen türdür (Şekil 2). Dünya ticaretine de konu olan elma, değişik ekolojilere adaptasyon kabiliyetinin yüksek olmasından dolayı çok geniş bir yayılma alanında üretilen bir türdür. Son yıllarda depolama, taşıma ve işleme teknolojilerindeki gelişmeler elmanın uluslararası ticarete önemini artırmıştır (Öztürk vd., 2011).



Şekil 2. Türkiye'de türlere göre yumuşak çekirdekli meyve üretim oranları (TUİK, 2023)

Elmanın bu derece yaygın olmasında; türün değişik ekolojilere uyabilme yeteneği, klonal anaçlı bahçelerin erken meyveye yatması, meyvelerin kendine has güzel rengi, kokusu ve tadı ile organik ve mineral maddelerce zengin olan bir meyve olması, çeşitlerin değişik zamanlarda olgunlaşması nedeni ile üretimin geniş bir periyotta yapılabilmesi ve kolay depolanabilmesi gibi özellikleri önemli rol oynamaktadır.

Materyal ve Metot

Materyal

Çalışmanın materyalini ikincil veriler oluşturmuştur. Türkiye İstatistik Kurumu (TUIK), Birleşmiş Milletler Tarım ve Gıda Örgütü (FAO) ve ABD Tarım Bakanlığı (USDA) sitelerinde yayınlanan verilerden ve bu konuda yayınlanmış yayın, rapor ve belgelerden yararlanılmıştır.

Metot

Çalışmada dünya ve Türkiye elma üretim, tüketim ve ticaret yapısı değerlendirilmiştir. Elde edilen verilerle basit indeksler hesaplanmış, artış ve azalışlar yorumlanmıştır.

Araştırma Bulguları ve Tartışma

Üretim ve Alan

2021 yılı verilerine göre dünyada yaklaşık 93 milyon ton elma üretilmiştir. Çin 45,98 milyon tonluk üretimiyle dünya elma üretiminin yaklaşık yarısını (%49,37) tek başına gerçekleştirmektedir. Çin'i sırasıyla Türkiye (%4,82), ABD (%4,80), Polonya (%4,37) ve birbirine yakın oranlarıyla Hindistan, İran, Rusya Federasyonu, İtalya, Fransa ve Şili takip etmektedir. Bu on ülke dünya elma üretiminin %76,38'ini karşılamaktadır (Çizelge 1). İklim kuşağında bulunan alanlarının çokluğu ve elmanın anavatanı olması nedeniyle en fazla üretim (%65,78) Asya kıtasında yapılmaktadır. Avrupa kıtası %19,72'lik üretimiyle ikinci, %9.78'lik üretimiyle Amerika kıtası üçüncü sırada yer almaktadır (FAO, 2023). Dünya elma üretimi son 20 yılda %68,43 artmış; bu artışın %70,67'lik kısmı Çin'deki üretim artışından kaynaklanmıştır. II. Dünya savaşından sonra Çin'de elma üretimi sürekli artmakta ve bu artışın nedeni olarak ekonomik büyümenin etkisi ile ülkede meyve için var olan gizli talebin ortaya çıkması ve neticesinde hükümetin tarım üzerindeki baskıyı azaltması, tarım işletmelerinin birim alandan daha yüksek getirisi olan meyve üretimine yönelmeleri şeklinde açıklanabilir (Öztürk vd., 2011).

Çizelge 1. Elma üretiminde lider ülkelerin üretim miktarları ve payları

Ülke	Üretim Miktarı (ton)			Pay (%)	Değişim (%)*
	2002	2012	2021		
Çin	19.240.984	38.491.000	45.983.400	49,37	138,99
Türkiye	2.200.000	2.888.985	4.493.264	4,82	104,24
ABD	3.866.376	4.078.839	4.467.206	4,80	15,54
Polonya	2.167.518	2.877.336	4.067.400	4,37	87,65
Hindistan	1.160.000	2.203.400	2.276.000	2,44	96,21
İran	2.333.896	3.103.883	2.241.100	2,41	-3,98
Rusya Federasyonu	1.950.000	1.403.000	2.216.200	2,38	13,65
İtalya	2.199.219	1.991.312	2.211.740	2,37	0,57
Fransa	1.995.306	1.306.333	1.633.080	1,75	-18,15
Şili	1.150.000	1.607.415	1.556.805	1,67	35,37
İlk 10 Ülke	38.263.298	59.951.503	71.146.195	76,38	85,94
Diğer Ülkeler	17.038.400	18.646.575	21.998.163	23,62	29,11
Dünya	55.301.698	78.598.078	93.144.358	100,00	68,43

* 2002 yılına göre 2021 yılındaki değişimi ifade etmektedir.

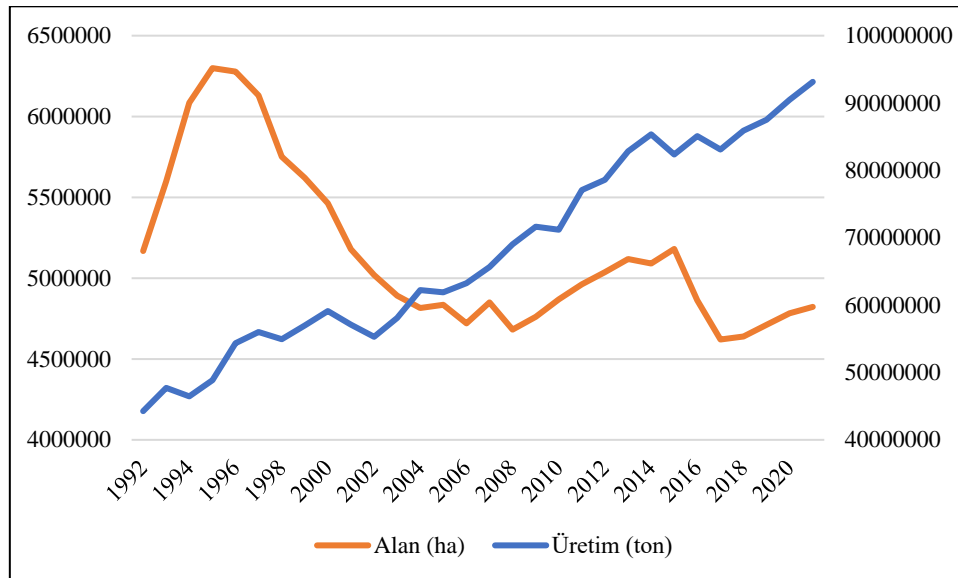
Ilıman iklim meyve türlerinden biri olan elma çok geniş bir yayılma alanına sahiptir. Dünyada 2021 yılında yaklaşık 4,82 milyon ha'lık alanda elma yetiştiriciliği yapılmaktadır. Elma alanlarının %69,22'si (3,34 milyon ha) Asya kıtasında, %20,28'i (0,98 milyon ha) Avrupa kıtasında yer almaktadır (FAO, 2023). Elma üretiminde önemli ülkelerin 2021 yılı elma üretim alanları Çizelge 2'de verilmiştir. Elma üretiminde önde gelen ilk 10 ülke dünya elma üretim alanlarının yaklaşık %69,47'sini karşılık gelen 3,35 milyon ha alanda elma üretimi gerçekleştirmektedir. Çin ve Hindistan dünya elma alanlarının yaklaşık yarısına sahiptir. Son 20 yıllık veriler dikkate alındığında dünya elma üretim alanı %3,93 azalmıştır. Mutlak olarak üretim alanını en fazla artıran ülke Çin, en fazla azaltan ülke ise Rusya Federasyonu olmuştur. Elma üretim alanının azaldığı, buna karşın elma üretiminin %68,43 arttığı dikkate alındığında birim alandan alınan ürün miktarında önemli miktarlarda artış olduğunu söylemek mümkündür. Bu çarpıcı tablonun ortaya çıkmasının en büyük nedeni Çin'in son 20 yılda üretim miktarını yaklaşık 2,38 kat artırmasına karşılık üretim alanında 1,08 kat artmış olmasından kaynaklanmaktadır. Çizelge 2 incelendiğinde önemli elma üreticisi ülkelerden ABD, Polonya, İran, Rusya Federasyonu, İtalya, ve Şili'de elma üretim alanları azalmıştır.

Çizelge 2. Elma üretiminde lider ülkelerin üretim alanları ve payları

Ülke	Üretim Alanı (ha)			Pay (%)	Değişim (%)*
	2002	2012	2021		
Çin	1.938.300	2.231.350	2.092.326	43,39	7,95
Türkiye	150.000	174.811	168.811	3,50	12,54
ABD	159.770	131.604	117.441	2,44	-26,49
Polonya	168.456	194.680	161.900	3,36	-3,89
Hindistan	240.000	321.900	313.000	6,49	30,42
İran	149.457	197.348	131.815	2,73	-11,80
Rusya Federasyonu	523.000	182.000	225.256	4,67	-56,93
İtalya	60.529	54.684	54.470	1,13	-10,01
Fransa	49.477	38.714	54.210	1,12	9,57
Şili	34.865	35.667	30.967	0,64	-11,18
İlk 10 Ülke	3.473.854	3.562.758	3.350.196	69,47	-3,56
Diğer Ülkeler	1.545.524	1.474.101	1.472.030	30,53	-4,76
Dünya	5.019.378	5.036.859	4.822.226	100,00	-3,93

* 2002 yılına göre 2021 yılındaki değişimi ifade etmektedir.

Şekil 3'te 1993-2021 yıllarında dünya elma üretim miktarı ve üretim alanları verilmiştir. Dünya elma üretimi yıllara göre değişmekle beraber sürekli bir artış eğilimindedir. Buna karşın dünya elma üretim alanları 1995 yılına kadar artış, 1995 yılından sonra azalış eğiliminde olmuş, 2007 yılından sonra küçük oranlarda artış-azalış göstermiştir.



Şekil 3. Dünya elma üretimi (ton) ve alanı (ha) (1992-2021)

Çizelge 1'de görüleceği üzere Türkiye dünya elma üretiminde 2021 yılında ikinci sırada yer almaktadır. Ancak dünya üretiminde ön sıralarda olmasına rağmen Türkiye'de hala büyük bir

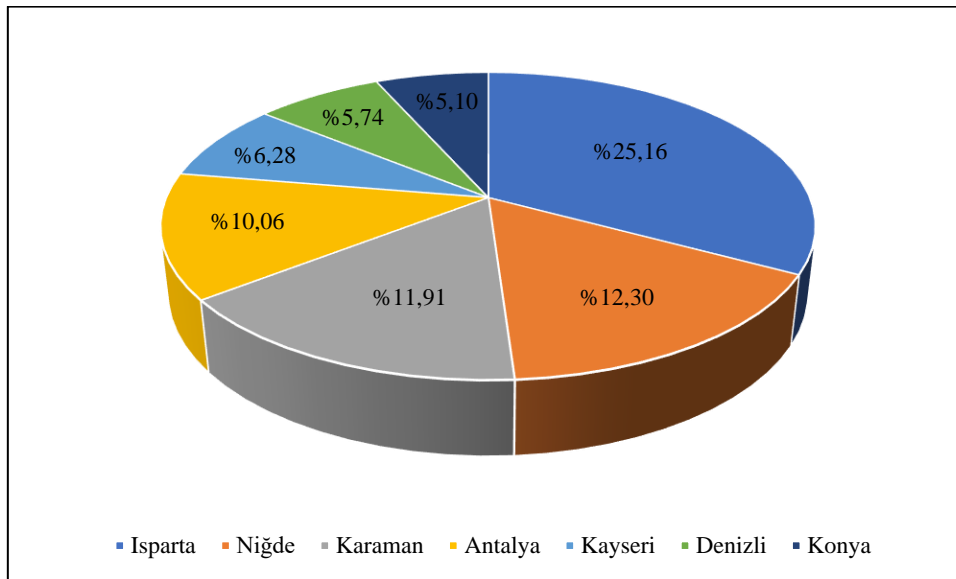
çoğunlukla geleneksel metotlarla üretim yapılmaktadır. Son yıllarda yeni çeşit ve klonal anaçlarla tesis edilen bahçeler modern yetiştiricilik metotlarına uygun olarak tesis edilmekle birlikte bu dönüşümün arzu edilen seviyede olmadığı ve yavaş bir dönüşüm yaşandığı söylenebilir. Bu dönüşüm bir taraftan yeni alanların tesisi şeklinde, diğer taraftan ekonomik ömrünü tamamlamış eski bahçelerin sökülmesi şeklinde de olmaktadır. Modern yetiştiricilik metotlarına geçiş hızının düşük olmasının en önemli nedeni işletmelerin küçük ölçekli olmasıdır.

Türkiye İstatistik Kurumu (TÜİK) verilerine göre Türkiye’de tüm illerde elma yetiştiriciliği yapılmaktadır. Ancak ticari olarak değerlendirildiğinde Isparta, Niğde, Karaman, Antalya, Kayseri, Denizli ve Konya illeri ön plana çıkmaktadır (Çizelge 3). En fazla üretimin yapıldığı Isparta ili aynı zamanda depolama kapasitesi ve Ar-Ge alt yapısıyla da öne çıkmaktadır.

Çizelge 3. Türkiye Elma üretiminde önemli illerin üretim miktarları

Elma Çeşidi	Üretim Miktarı (ton)							Türkiye
	Isparta	Niğde	Karaman	Antalya	Kayseri	Denizli	Konya	
Golden	487.095	87.195	74.528	78.156	39.664	15.781	26.017	1.091.226
Starking	542.089	114.630	289.738	335.887	81.404	40.857	31.929	1.698.067
Amasya	0	159.858	151	1	13.781	292	5.948	242.251
Granny Smith	23.745	15.364	30.117	16.990	3.802	8.032	14.987	184.709
Diğer Çeşitler	77.495	175.570	140.816	20.893	143.532	192.805	150.277	1.277.011
TOPLAM	1.130.424	552.617	535.350	451.927	282.183	257.767	229.158	4.493.264

En fazla üretimin yapıldığı ilk yedi il, Türkiye elma üretiminin %76,55’ini karşılamaktadır. Sırasıyla illerin üretimdeki payı Isparta %25,16, Niğde %12,30, Karaman %11,91, , Antalya %10,06, Kayseri %6,28, Denizli %5,74 ve Konya %5,10’ dur (Şekil 4).



Şekil 4. Elma üretiminde lider illerin elma üretimindeki payları

Verim

Dünyada elma üretim alanlarının daralmasına rağmen elma üretiminin sürekli bir artış eğiliminde olması verimlilik artışının bir göstergesi olarak karşımıza çıkmaktadır. Son 20 yılda yetiştirme tekniklerindeki gelişim, girdi kullanımı ve birim alandan yüksek verim alma eğilimindeki gelişmeler sonucunda verimlilik yaklaşık %75 artış sağlanmıştır (Çizelge 4). Özellikle klonal anaçlarla bodur ve yarı bodur kapama elma bahçesi tesisiyle birim alana dikilen fidan sayısındaki artış beraberinde birim alandan alınan ürünün artışını da sağlamaktadır.

Çizelge 4. Elma üretiminde lider ülkelerin verim durumu (ton/ha) ve değişimleri

Ülkeler	2002	2012	2021	% Değişim*
Çin	9,93	17,25	21,98	121,39
Türkiye	14,67	16,53	26,62	81,48
ABD	24,20	30,99	38,04	57,18
Polonya	12,87	14,78	25,12	95,25
Hindistan	4,83	6,85	7,27	50,45
İran	15,62	15,73	17,00	8,88
Rusya Federasyonu	3,73	7,71	9,84	163,88
İtalya	36,33	36,41	40,60	11,76
Fransa	40,33	33,74	30,13	-25,30
Şili	32,98	45,07	50,27	52,41
Dünya	11,02	15,60	19,32	75,32

* 2002 yılına göre 2021 yılındaki değişimi ifade etmektedir.

Çin hektara verimini yaklaşık iki kattan fazla artırarak dünya verim artışını en fazla etkileyen faktör olmuştur. Çizelgede yer almayan ancak önemli elma üretici ülkelerinden biri olan Yeni Zelanda hektara yaklaşık 58 ton verimlilikle en verimli ülkelerin biridir. Şili, İtalya, Fransa ve ABD dünya ortalamasının çok üzerinde bir verimliliğe sahip ülkeler olarak ön plana çıkmaktadır. Üretimde ilk onda yer alan ülkeler içerisinde verimliliğini azalan tek ülke Fransa'dır. Türkiye'nin hektara verimliliği 26,62 ton olarak gerçekleşmiş ve dünya ortalamasının üstünde yer almıştır.

Tüketim

Küresel taze elma tüketim oranları dikkate alındığında Çin baskın liderliğini burada da devam ettirmektedir. 2020 yılı verilerine göre dünya taze elma tüketiminin %44,87'sini Çin tüketmektedir. Çin'i sırasıyla ABD (%7,82), Türkiye (%4,55), Hindistan (%4,09) ve Rusya Federasyonu (%3,51) takip etmektedir. Kişi başı tüketim dikkate alındığında Türkiye 35,68 kg ile ilk sırada yer alırken, 32,96 kg ile Arnavutluk ikinci sırada ve 31,05 kg ile Macaristan üçüncü sırada yer almaktadır (USDA, 2023). Dünya kişi başı ortalama elma tüketimi 8,53 kg olarak

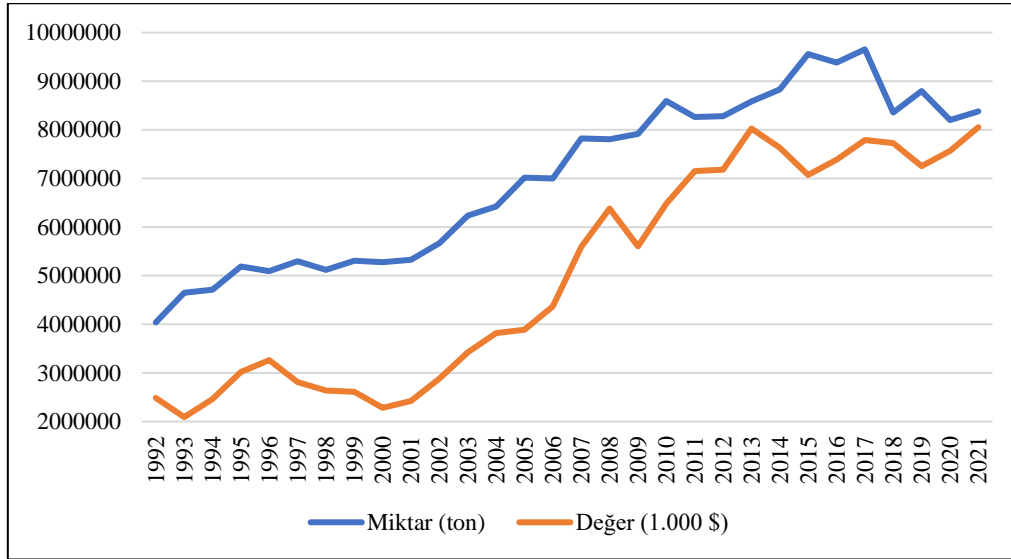
hesap edilmiştir. Türkiye kişi başı elma tüketiminin bu derece yüksek olmasının en büyük nedeni ihracatının düşüklüğünden kaynaklanmaktadır.

Uluslararası Ticaret

Uzun yıllar ortalaması dikkate alındığında dünya elma üretiminin % 9-10'u uluslararası ticarete konu olmaktadır. Elma ticaretinin desteklenmesi, pazarlama stratejilerinin gelişmesi, insanların sağlıklı beslenme eğilimi, nüfusun ve gelirin artması beraberinde dünya elma ticaretini de geliştirmektedir ve geliştirmeye de devam edecektir.

İhracat

Dünya elma üretiminde önde olan ülkeler bu özelliğini ihracatta da sürdürmektedir. Ancak aynı şeyi Türkiye için söylemek mümkün değildir. Türkiye dünya elma ihracatından %4,23'lük pay almış, ihracatının üretime oranı %7,9 gibi düşük oranlarda gerçekleşmiştir. Yeni Zelanda üretimde ilk on ülke arasında yer almamasına rağmen ihracattan aldığı pay %5,35, ihracatın üretime oranı ise %79'dur. Şekil 5'te dünya ihracat miktar ve değerleri verilmiştir. Yıllara göre değişmekle beraber ihracat değeri sürekli bir artış eğilimindedir.



Şekil 5. Dünya elma ihracat miktar ve değerleri

Çizelge 5'te verilen önemli ihracatçı ülkelerin ihracat miktarı, ihracat değeri ve ihracattan aldıkları paylar değerlendirildiğinde; Çin gerek miktar ve gerekse değer bakımından aldığı pay ile ilk sırada yer almaktadır. Ürünü 1,70 \$/kg ile en iyi fiyata pazarlayan ülke Yeni Zelanda'dır. Türkiye ihracattan %4,23 pay alırken değer bakımından aldığı pay %2,22'ye düşmektedir. Bu durum Türkiye'nin ürünü düşük fiyata sattığının göstergesidir. Nitekim

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hesaplamalar Türkiye'nin 1 kg elmayı 0,50 \$'a sattığını, Yeni Zelanda elmasını Türkiye'ye göre 3,37 kat, Fransa 2,81 kat daha fazla fiyata pazarladığını göstermiştir.

Çizelge 5. Dünya elma ihracatında önemli ülkelerin ihracat miktar ve değerleri

Ülke	İhracat (ton)	Aldığı Pay (%)	İhracat (1.000 \$)	Aldığı Pay (%)
Çin	1.078.352	12,87	1.429.582	17,75
Polonya	921.863	11,00	414.324	5,14
İtalya	920.271	10,98	1.037.372	12,88
ABD	752.738	8,98	916.434	11,38
Şili	644.442	7,69	614.621	7,63
Güney Afrika	589.186	7,03	485.404	6,03
Yeni Zelanda	448.528	5,35	760.816	9,45
Türkiye	354.560	4,23	178.718	2,22
Fransa	308.227	3,68	437.206	5,43
Moldova	206.123	2,46	87.616	1,09
Dünya	8.378.082	100,00	8.053.441	100,00

Dünya elma ihracatında önde giden ilk on ülke toplam ihracatın %74,29'unu gerçekleştirmektedir. Türkiye'de diğer birçok meyve türünde olduğu gibi elma üretiminin de ihracatla desteklendiği söylenemez (Bayav vd., 2005). İhracata konu olan çeşitler Starking Delicious, Golden Delicious, Granny Smith ve Starkrimson Delicious'dır. 2021 yılında 354.560 ton elma 77 ülkeye ihraç edilmiştir. Ancak ihracatın %85'inden fazlası Hindistan, Rusya Federasyonu, Suriye, Libya ve Irak'a yapılmıştır (ITC-TRADE MAP, 2023). Irak ve Suriye, Türkiye'nin en önemli elma pazarları olarak değerlendirilmektedir.

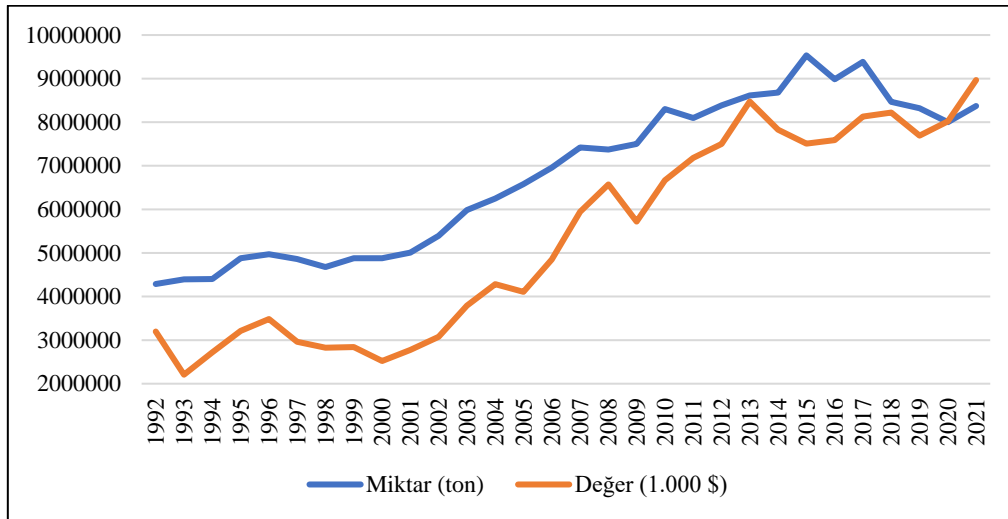
İthalat

Dünya elma ithalatı ihracatın artmasıyla birlikte artmıştır. Dünya elma ithalatında önde giden ilk on ülke toplam ithalatın %43,61'ini gerçekleştirmektedir (Çizelge 6)(FAO, 2023). Türkiye elma ithalatı dikkate alınmayacak düzeyde düşüktür ve genellikle sezon sonunda Güney Yarımküre ülkelerinden yapılmaktadır.

Çizelge 6. Dünya elma ithalatında önemli ülkelerin ithalat miktar ve değerleri

Ülke	İthalat (ton)	Payı (%)
Rusya	615.999	7,36
Almanya	606.143	7,24
Hindistan	436.194	5,21
İngiltere	327.473	3,91
Hollanda	300.964	3,59
Meksika	299.875	3,58
Vietnam	295.144	3,52
Irak	282.910	3,38
Bangladeş	262.742	3,14
Fransa	224.054	2,68
İlk 10 Ülke	3.651.497	43,61
Diğer Ülkeler	4.721.494	56,39
Dünya	8.372.991	100,00

Belarus önemli bir elma üreticisi ülke olmadığı halde ihracatçı ülkeler arasında yer alması re-export yaptığını göstermektedir. Rusya %7,36'lık payla dünya ülkeleri arasında en fazla ithalatı yapan ülke konumundadır. Dünya elma ithalat miktar ve değerleri Şekil 6'dan da görüldüğü gibi sürekli bir artış eğilimindedir. Elma ithalat değerleri zaman zaman dalgalanmalar gösterse de üretim artışına paralel bir gelişim göstermektedir.



Şekil 6. Dünya elma ithalat miktar ve değerleri

Sonuç ve Öneriler

Üretim, tüketim ve ticaret bakımından değerlendirildiğinde elma sektörü meyvecilik sektörü içerisinde önemli bir paya sahiptir. Bu sektörün sürdürülebilirliği için etkin bir politikaya,

mevcut gerçekler dikkate alınarak bir genişleme vizyonuna ve bu vizyonun uygulanmasında cesaretli ve istekli uygulayıcılara ihtiyaç vardır.

Bu sektörü sürdürülebilir kılmak için sektörün desteklenmesi, paketleme, depolama ve pazarlama seviyelerinin daha uygun hale getirilmesi gereklidir. Sürdürülebilirliğini sağlayabilmek için üretici ülkeler birim alandan fazla ürün alabilmek ve maliyetleri düşürebilmek için gelişmiş teknolojileri kullanmak zorundadır. İslah programlarıyla tüketici isteklerine cevap veren yeni çeşit arayışlarının ve ürünleri pazarlayabilmek için yeni pazarlama stratejileri çabaları devam etmelidir.

Elma dünya genelinde gerek gelir seviyesi gerekse damak tadı bakımından büyük bir kesime hitap etmesinden dolayı geniş bir üretim ve ticaret hacmine sahiptir. Bu özelliğiyle en fazla ticarete konu olan ve tüketici talebinin en hızlı değiştiği meyvelerden biridir (Bayav ve Armağan, 2008). Uluslararası arenada rekabet edebilmek ancak kalite odaklı yüksek verim ile mümkün olacaktır.

Kaynaklar

- Ağaoğlu, Y. S., Çelik, H., Çelik, M., Fidan, Y., Gülşen, Y., Günay, A., Halloran, N., Köksal, A.İ., Yanmaz, R., 1997. Genel Bahçe Bitkileri. Ankara Üniversitesi Ziraat Fakültesi Eğitim, Araştırma ve Geliştirme Vakfı Yayınları, 369s. Ankara.
- Bayav, A., Konak, K., Karamürsel, D., Öztürk, F. P., 2005. Türkiye'de Elma Üretimi, Pazarlaması ve Dış Satımı. IV. GAP Tarım Kongresi, 21-23 Eylül, Şanlıurfa, 427-437.
- Bayav, A., Armağan, G., 2008. Isparta İlinde Elma İşletmelerinde Yeniliklerin ve Araştırma Sonuçlarının Benimsenme Düzeyleri ve Etki Değerlendirmeleri. Türkiye VIII. Tarım Ekonomisi Kongresi, 25-27 Haziran, Bursa, 168-181.
- FAO, 2023. Birleşmiş Milletler Gıda ve Tarım Örgütü. <http://www.fao.org/faostat/en/#data> Erişim Tarihi: 10.04.2023.
- Güneş, N. T., Horzum, Ö., Güneş, E., 2017. Economic and Technical Evaluation of Fruit Sector in Turkey. *Balkan and Near Eastern Journal of Social Sciences*, 03(02): 37-49.
- ITC-TRADE MAP, 2023. Uluslararası Ticaret Merkezi. <https://www.trademap.org/>. Erişim Tarihi: 10.04.2023.
- O'Rourke, A.D., 1994. *The World Apple Market*. Haworth Press, 237p. New York.
- O'Rourke, A.D., 2003. *World Production, Trade, Consumption and Economic Outlook for Apples*. Ferree, D.C. and Warrington, I.J. (Ed.), *Apples, Botany, Production and Uses* (15-29). CABI Publishing, 660p. London.
- Öztürk, F.P., Karamürsel, D., Emre, M., 2011. Dünyada Elmanın Ekonomik Yeri. Akgül, H., Kaçal, E., Öztürk, F.P., Özongun, Ş., Atasay, A., Öztürk, G. (Ed.), *Elma Kültürü* (9-20). Eğirdir Bahçe Kültürleri Araştırma Enstitüsü Yayınları, 510s. Isparta.
- TÜİK, 2023. Türkiye İstatistik Kurumu. <https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr> Erişim Tarihi: 10.04.2023.
- USDA, ABD Tarım Bakanlığı. <https://apps.fas.usda.gov/psdonline/app/index.html#/app/downloads> Erişim Tarihi: 10.04.2023.

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Özet

Bu araştırma, 2018 ve 2019 yıllarında Bursa ekolojik koşullarında farklı ekim zamanı (15 Nisan, 1 Mayıs, 15 Mayıs ve 1 Haziran) ve hasat dönemlerinin (çiçeklenme öncesi, çiçeklenme ve tohum bağlama) kinoa bitkisinin silaj kalitesi üzerine etkilerini belirlemek amacıyla yürütülmüştür. Denemeler tesadüf blokları bölünmüş parseller düzenlemesine göre 3 tekrarlamalı olarak Bursa Uludağ Üniversitesi Ziraat Fakültesi Tarımsal Uygulama ve Araştırma Merkezi deneme alanlarında, Tarla Bitkileri Bölümü ile Toprak Bilimi ve Bitki Besleme Bölümü Laboratuvarları'nda yapılmıştır. Çalışmada silajların kuru madde oranı, pH, ham protein, ADF, NDF, P, K, Ca, Mg, Na, Fe, Cu, Zn ve Mn içerikleri gibi özellikler incelenmiştir. İki yıllık ortalama verilere göre; en yüksek kuru madde oranı 1 Haziran, en yüksek ham protein oranları 15 Nisan ve 1 Haziran, en düşük pH değeri ise 15 Nisan tarihlerinde yapılan ekimlerden elde edilen bitkilerle yapılan silajlarda tespit edilmiştir. Silajlarda ekim zamanı geciktikçe (1 Haziran ekimi hariç) pH değerleri artış eğilimi göstermiştir. Ekim zamanlarının K, Ca, Mg, Na, Fe, Cu, Zn ve Mn içerikleri üzerine etkileri de önemli bulunmuştur. Hasat dönemleri bakımından en yüksek kuru madde oranı tohum bağlama döneminde, en yüksek ham protein ile en düşük ADF ve NDF içerikleri ise çiçeklenme öncesi dönemde hasat edilen bitkilerden yapılan silajlarda tespit edilmiştir. Hasat dönemlerinin silajların P, K, Mg, Na, Fe, Cu, Zn ve Mn içerikleri üzerine etkileri de önemli bulunmuştur.

Anahtar Kelimeler: Kinoa, ekim zamanı, hasat dönemi, silaj, makro ve mikro besin elementleri

THE EFFECTS OF SOWING DATE AND HARVEST STAGES ON SILAGE
QUALITY IN QUINOA (*Chenopodium quinoa* Willd.)

Abstract

This study was carried out to determine the effect of different sowing dates (15 April, 1 May, 15 May and 1 June) and harvest stages (beginning of flowering, full flowering and seed setting) on the silage quality of quinoa. Field experiments were conducted in 2018 and 2019 in Bursa Uludag University Agriculture Faculty Agricultural Application and Research Center experiment areas and laboratories of Department of Field Crops and Department of Soil Science and Plant Nutrition. The experiment arranged a randomized complete block design with split plot arrangement having three replications. Several parameters such as dry matter rate, pH, crude protein, ADF, NDF, P, K, Ca, Mg, Na, Fe, Cu, Zn and Mn contents have been examined in the experiment. According to the two-year average results; the highest dry matter content was determined on June 1, the highest crude protein content was determined on April 15 and June 1, the lowest pH value was determined on April 15. As the sowing dates was delayed (except June 1), the pH of the silages tended to increase. The effects of sowing date on K, Ca, Mg, Na, Fe, Cu, Zn and Mn contents were also found to be significant. In terms of harvest stages, the highest dry matter content was determined in the seed setting stage, the highest crude protein and the lowest ADF and NDF contents were determined in the silages made from the plants harvested during the beginning of flowering stage. The effects of harvest stages on the P, K, Mg, Na, Fe, Cu, Zn and Mn contents of silages were also found to be significant.

Keywords: Quinoa, sowing date, harvest stage, silage, macro and micro nutrients

1.GİRİŞ

Kinoa (*Chenopodium quinoa* Willd.) Amaranthaceae familyasına ait tek yıllık otsu bir bitki olup, 30-150 cm boylanabilmektedir. Genellikle kendine döllenen kinoa bitkisinde yabancı dölllenme oranı %10-15'tir (Erdemli, 2020). Orijinini Güney Amerika'nın And dağlarından alan kinoanın en önemli tarımsal özelliklerinden birisi toprak tuzluluğuna dayanıklı olmasıdır (Vega-Galvez ve ark., 2010).“Süper Besin” veya “Mucize Tahıl” olarak adlandırılan kinoa sahip olduğu yüksek vitamin, mineral, protein ve antioksidan içeriğinden dolayı insan ve hayvan beslenmesinde yaygın olarak kullanılmaktadır (Tan ve Temel, 2019). En iyi gelişmesini tınlı-kumlu topraklarda yapmasına rağmen her türlü toprağa uyum sağlayabilen kinoa bitkisinde; gelişme süresi çeşitlere bağlı olarak 90-220 gün arasında değişmektedir (Geren ve ark., 2014). Kinoa bitkisinin kalın, dik ve odunsu gövde yapısı ile kazayağına benzeyen sarmal dizilişli geniş yaprakları vardır (Tan ve Yöndem, 2013).

Ekstrem koşullara yüksek toleransıyla bilinen kinoa; birim alanda üretmiş olduğu yüksek miktar ve kaliteli otu ile hayvan beslenmesinde alternatif kaba yem kaynağı olarak tercih edilmektedir (Güner ve Temel, 2022). Kinoa kurutulduğunda yaprakları ufalanarak döküldüğü ve sapları da sertleştiği için sindirilebilirlik oranı ve lezzeti azalmaktadır. Bunun için kinoanın kuru ot olarak kullanımından daha çok otunun silaj olarak değerlendirilmesi bir avantaj olarak görülmektedir (Güner ve Temel, 2022).

Kinoa silajının değerlendirilmesine yönelik sınırlı sayıda çalışma yapılmış olmakla birlikte ekim zamanları ve hasat dönemlerinin kinoa silajının kalitesi üzerine etkilerini inceleyen çalışmalar bulunmamaktadır. Podkówka ve ark., (2018) Polonya koşullarında yaptıkları bir çalışmada kinoa silajının ADF oranının % 34.24 ve NDF oranının ise % 45.31 olduğu tespit etmişlerdir. Güner ve Temel (2022), Iğdır koşullarında yürüttükleri bir çalışmada kinoa çeşitlerinin kuru madde oranının % 23.64-24.39, ham protein oranının % 16.67-17.20, NDF oranının % 37.02-37.62 ve ADF içeriğinin ise %17.60-17.91 arasında değiştiğini tespit etmişlerdir.

Bu çalışma farklı ekim zamanı ve hasat dönemlerinin kinoa silajının bazı kalite özellikleri üzerine etkilerini incelemek amacıyla yürütülmüştür.

2. MATERYAL ve METOD

Araştırma 2018 ve 2019 yıllarında Bursa ekolojik koşullarında Bursa Uludağ Üniversitesi Ziraat Fakültesi Tarımsal Uygulama ve Araştırma Merkezi deneme alanlarında, Tarla Bitkileri Bölümü ile Toprak Bilimi ve Bitki Besleme Bölümü Laboratuvarları'nda Tesadüf Blokları Bölünmüş Parseller düzenlemesine göre üç tekrarlamalı olarak yürütülmüştür. Araştırmada, bitki materyali olarak Titicaca çeşidi kullanılmıştır. Araştırmada ana parsellere ekim zamanı,

alt parsellere ise hasat dönemleri yerleştirilmiştir. Denemede dört farklı ekim zamanı (15 Nisan, 1 Mayıs, 15 Mayıs ve 1 Haziran) ile üç farklı hasat dönemi (çiçeklenme öncesi, çiçeklenme ve tohum bağlama dönemi) ele alınmıştır. Denemede sıra arası mesafe 35 cm, parsel boyu ise 5 m'dir. Her parsel 6 sıradan oluşup, alt parsel büyüklüğü 10.5 m²'dir. Araştırmada ekimle birlikte 7.5 kg N/da ve 8 kg P₂O₅/da gübre uygulanmıştır. Bitkiler 30-40 cm boya ulaştığında 5 kg N/da gübre verilmiştir. Denemede damla sulama sistemi kullanılarak sulamalar yapılmıştır. Yetiştirme dönemi boyunca yabancı otlara karşı elle mekanik mücadele yapılmıştır.

Denemede her bir hasat döneminde alınan bitki örnekleri 1.5-2 cm büyüklükte parçalanmış ve torbalara doldurularak etiketlenip çok kısa bir süre içerisinde laboratuvara götürülmüştür. Laboratuvara getirilen örnekler 1 litrelik anaerobik kavanozlara (Weck) bir pres ile sıkıştırılarak doldurulmuştur. Silaj kavanozları karanlık bir odaya yerleştirilerek 60 gün fermantasyona tabi tutulmuştur. Bu dönem sonunda, açılan kavanozların her birinden 150 g örnek alınmış ve 70 °C'de 48 saat kurutularak kuru madde oranları belirlenmiştir. Ayrıca açılan silajlardan örnekler alınarak pH değerleri ölçülmüştür (Budaklı Çarpıcı ve ark., 2017). Kuru madde oranını belirlemek amacıyla kullanılan örnekler öğütülmüş ve bu örneklerde ham protein, ADF, NDF, P, K, Ca, Mg, Na, Fe, Cu, Zn ve Mn içeriklerini belirlemek amacıyla analizler yapılmıştır (AOAC, 1997; Van Soest et al., 1991; Kacar 2014).

Araştırma sonucunda ölçüm ve analizlerden elde edilen veriler JUMP paket programı yardımıyla 'Tesadüf Blokları Deneme Deseni'ne uygun olarak varyans analizine tabi tutulmuştur. Hesaplamalarda paket programı kullanılmıştır. Önemlilik testlerinde % 1 ve % 5, farklı grupların belirlenmesinde ise % 5 olasılık düzeyi kullanılmış ve farklı grupların belirlenmesinde Asgari Önemli Fark testinden yararlanılmıştır.

3. BULGULAR ve TARTIŞMA

İki yıllık ortalama verilere ilişkin varyans analiz sonuçlarına göre; ekim zamanlarının kinoa silajının kuru madde, pH, ham protein, Mg, Na ve Zn içerikleri üzerine etkisi % 1, K, Ca, Fe, Cu ve Mn içerikleri üzerine etkisi % 5 düzeyinde önemli çıkmıştır. Hasat dönemlerinin ise kinoa silajının kuru madde, pH, ham protein, ADF, NDF, K, Mg, Na, Fe, Cu, Zn ve Mn içerikleri üzerine etkisi % 1, P içerikleri üzerine etkisi ise % 5 olasılık düzeyinde önemli olmuştur. Ekim zamanı x hasat dönemi interaksyonunun kinoa silajının P, Mg, Na ve Mn içerikleri hariç incelenen tüm özellikler üzerindeki etkisi % 1 olasılık düzeyinde önemli olmuştur.

Ekim zamanı bakımından en yüksek kuru madde oranı % 18.47 ile 1 Haziran, en düşük ise 15 Nisan ve 1 Mayıs tarihlerinde yapılan ekimlerden elde edilmiştir. Araştırmada en düşük pH değeri 15 Nisan tarihinde ekilen bitkilerden yapılan silajlarda tespit edilmiştir. Kinoa

silajlarında en yüksek ham protein oranı (% 18.96 ve % 19.20) 15 Nisan ve 1 Haziran tarihlerinde yapılan ekimlerde ortaya çıkmıştır. Ekim zamanının ADF ve NDF içerikleri üzerine etkisinin önemsiz olduğu belirlenmiştir (Çizelge 1). ADF içerikleri % 21.95 - % 23.18 değerleri arasında değişim gösterirken, NDF içerikleri ise % 33.81 ve % 34.33 değerleri arasında değişmiştir (Çizelge 2).

Çizelge 1. Ekim Zamanı ve Hasat Dönemlerinin Kinoa Silajının Bazı Kalite Özelliklerine İlişkin Varyans Analiz Sonuçları (Kareler Ortalaması)

Varyasyon Kaynağı	SD	KM	pH	HP	ADF	NDF	P	K	Ca	Mg	Na	Fe	Cu	Zn	Mn
Yıl (Y)	1	**	**	öd	**	**	öd	**	**	**	**	**	**	**	**
EZ	3	**	**	**	öd	öd	öd	*	*	**	**	*	*	**	*
Y X EZ	3	**	öd	öd	*	öd	**	öd	**	**	**	*	**	**	*
HD	2	**	**	**	**	**	*	**	öd	**	**	**	**	**	**
Y X HD	2	**	**	**	**	**	**	öd	öd	*	öd	**	**	öd	öd
EZ X HD	6	**	**	**	**	**	öd	**	**	öd	öd	**	**	**	öd
Y X EZX HD	6	**	**	**	**	öd	öd	*	*	**	*	**	**	**	öd

Y: Yıl, EZ: Ekim zamanı, HD: Hasat dönemi, SD: Serbestlik derecesi, öd: önemli değil

KM: Kuru madde, HP: Ham protein, ADF: Asit deterjanda çözünmeyen lif, NDF: Nötr deterjanda çözünmeyen lif, P: Fosfor, K: Potasyum Ca: Kalsiyum, Mg: Magnezyum, Na: Sodyum, Fe: Demir, Cu: Bakır, Zn: Çinko, Mn: Mangan

**,* Sırasıyla % 1 ve % 5 düzeyinde önemlidir.

Kinoa silajının kuru madde oranı hasat döneminin gecikmesine bağlı olarak artmış ve bunun sonucunda en yüksek kuru madde oranı % 21.78 ile tohum bağlama döneminde yapılan biçimlerden elde edildiği belirlenmiştir. Silajın pH değeri en düşük 4.40 ile çiçeklenme döneminde hasat edilen bitkilerden yapılan silajlarda tespit edilmiştir. Kinoa silajında ham protein oranı hasat dönemlerinin gecikmesine bağlı olarak azalmış ve bunun sonucunda en yüksek ham protein oranı % 21.15 ile çiçeklenme öncesinde hasat edilen bitkilerden yapılan silajdan elde edilmiştir. ADF ve NDF oranlarının hasat dönemlerinin gecikmesine bağlı olarak arttığı tespit edilmiştir. En düşük ADF oranları % 18.48 ile çiçeklenme öncesi hasat döneminde, en düşük NDF oranları ise % 27.73 ile çiçeklenme öncesi hasat döneminde biçilen bitkilerden yapılan silajlardan elde edilmiştir (Çizelge 2).

Çizelge 2. Farklı Ekim Zamanı ve Hasat Dönemlerinin Kinoa Silajının Kuru Madde, pH, Ham Protein, ADF ve NDF İçeriklerine Etkisi (iki yıllık ortalama veriler)

Ekim Zamanı	Kuru madde (%)	pH	Ham protein (%)	ADF (%)	NDF (%)
15 Nisan	15.30 c	4.37 c	18.96 a	22.597	33.81
1 Mayıs	15.82 c	4.77 a	17.53 b	23.18	33.94
15 Mayıs	17.22 b	4.59 ab	17.55 b	23.09	34.33
1 Haziran	18.47 a	4.44 bc	19.20 a	21.95	33.88
Hasat Dönemi					
Çiçeklenme Öncesi	11.82 c	4.62 a	21.15 a	18.48 c	27.73 c
Çiçeklenme	16.51 b	4.40 b	17.45 b	23.68 b	35.24 b
Tohum Bağlama	21.78 a	4.59 a	16.33 c	26.22 a	38.99 a
Yıl					
2018	15.78 b	4.32 b	18.49	23.79 a	36.15 a
2019	17.62 a	4.76 a	18.13	21.80 b	31.82 b

Yılların kinoa silajının ham protein oranı üzerine etkisi önemsiz bulunmuştur (Çizelge 1). Denemede en yüksek kuru madde oranı % 17.62 ile 2019 yılında hasat edilen bitkilerden yapılan silajlarda tespit edilmiştir. Kinoa silajının en düşük pH değerleri 4.32 ile 2018 yılında hasat edilen bitkilerin silajlarından elde edilmiştir. En düşük ADF ve NDF içerikleri ise 2019 yılında hasat edilen bitkilerden yapılan silajlarda belirlenmiştir.

Ekim zaman x hasat dönemi interaksyonu bakımından en yüksek kuru madde oranı (% 24.47 ve % 21.38) 15 Mayıs ve 1 Mayıs ekimlerinin tohum bağlama döneminde hasat edilen bitkilerden yapılan silajlarda belirlenmiştir. İkili interaksyonun silajın pH değeri üzerine etkisi incelendiğinde, en düşük pH değeri 4.14 ile 1 Haziran tarihinde ekilen ve çiçeklenme öncesi hasat döneminde biçilen bitkilerle yapılan silajlardan elde edilmiştir. Kinoa silajının ekim zamanlarında hasat dönemlerinin geciktirilmesiyle silajın ham protein oranı azalış göstermiştir. Araştırmada en yüksek ham protein oranı (% 23.08 ve % 22.50) 15 Nisan ve 1 Haziran tarihlerinde ekilen çiçeklenme öncesi hasat döneminde hasat edilen bitkilerinden yapılan silajlardan elde edilmiştir. Silajın ADF içerikleri incelendiğinde, en düşük ADF içerikleri % 17.02 ile 15 Nisan tarihinde ekilen ve çiçeklenme öncesinde hasat edilen bitkilerden yapılan silajlarda tespit edilmiştir. NDF içerikleri en düşük % 24.14 ile 15 Nisan ekimlerinin çiçeklenme öncesi hasat döneminde hasat edilen bitkilerden yapılan silajlarda belirlenmiştir (Çizelge 3).

Çizelge 3. Ekim Zamanı x Hasat Dönemi İnteraksiyonunun Kinoa Silajının Kuru Madde, pH, Ham Protein, ADF ve NDF İçeriklerine Etkisi (iki yıllık ortalama veriler)

Ekim Zamanı	Hasat Dönemi		
	Çiçeklenme öncesi	Çiçeklenme	Tohum bağlama
Kuru madde (%)			
15 Nisan	12.67 h	15.08 g	18.16 e
1 Mayıs	11.56 hı	14.52 g	21.38 a
15 Mayıs	10.40 ı	16.80 f	24.47 a
1 Haziran	12.67 h	19.65 d	23.10 b
pH			
15 Nisan	4.34 d-f	4.32 ef	4.42 de
1 Mayıs	5.29 a	4.46 c-e	4.55 b-e
15 Mayıs	4.70 bc	4.46 c-e	4.60 b-d
1 Haziran	4.14 f	4.38 d-f	4.80 b
Ham protein (%)			
15 Nisan	23.08 a	16.77 ef	17.03 d-f
1 Mayıs	19.82 b	17.24 de	15.52 fg
15 Mayıs	19.19 bc	18.56 b-d	14.92 g
1 Haziran	22.50 a	17.24 de	17.87 c-e
ADF (%)			
15 Nisan	17.02 f	24.49 b	27.40 a
1 Mayıs	17.66 ef	24.08 b	27.80 a
15 Mayıs	18.89 e	24.00 b	26.38 a
1 Haziran	20.37 d	22.17 c	23.32 bc
NDF (%)			
15 Nisan	24.14 g	36.96 a-c	40.32 a
1 Mayıs	26.20 fg	35.15 b-d	40.47 a
15 Mayıs	29.44 ef	35.27 bc	38.26 ab
1 Haziran	31.16 de	33.58 cd	36.92 a-c

Silajların ekim zamanı bakımından P içerikleri 3.21-3.37 g kg⁻¹ değerleri arasında değiştiği tespit edilmiştir. Fakat bu değişimin istatistiki anlamda önemsiz olduğu belirlenmiştir (Çizelge 1). Deneme en yüksek K içerikleri (74.43 g kg⁻¹ ve 76.83 g kg⁻¹) 15 Nisan ve 1 Mayıs tarihlerinde ekilen bitkilerden yapılan silajlarda tespit edilmiştir. Kinoa silajlarının Ca ve Mg içerikleri incelendiğinde en yüksek değerler 1 Mayıs, 15 Mayıs ve 1 Haziran tarihlerinde yapılan ekimlerden elde edilmiştir. En yüksek Na içeriği 1 Mayıs tarihlerinde yapılan ekimlerde belirlenmiştir. Silajlarda en yüksek Fe içerikleri 15 Mayıs ve 1 Haziran tarihlerinde yapılan ekimlerde ortaya çıkmıştır (Çizelge 4). Silajların en yüksek Cu içerikleri 7.04 mg kg⁻¹ ile 1 Haziran tarihinde yapılan ekimlerden elde edilmiştir. Araştırmada Zn içerikleri incelendiğinde 15 Nisan tarihleri hariç diğer ekim zamanları arasında istatistiki anlamda bir farklılık ortaya çıkmamış ve bunun sonucunda da 1 Mayıs, 15 Mayıs ve 1 Haziran ekimlerinden yapılan silajlarda en yüksek içerik belirlenmiştir. En yüksek Mn içerikleri 1 Mayıs ve 1 Haziran tarihlerinde yapılan ekimlerden yapılan silajlarda tespit edilmiştir (Çizelge 4).

Kinoa silajının hasat dönemleri incelendiğinde; Ca içerikleri üzerine hasat dönemlerinin etkisinin önemsiz olduğu belirlenmiştir (Çizelge 1). Hasat döneminin geçikmesiyle Mg ve Mn

İçerikleri arttığı tespit edilmiştir. Araştırmada en yüksek P, Fe ve Cu içerikleri çiçeklenme öncesi hasat döneminde hasat edilen bitkilerden yapılan silajlardan elde edilmiştir. Silajların en yüksek K, Na ve Zn içerikleri incelendiğinde ise çiçeklenme öncesi ve çiçeklenme döneminde hasat edilen bitkilerden yapılan silajlarda belirlenmiştir (Çizelge 4).

Çizelge 4. Farklı Ekim Zamanı ve Hasat Dönemlerinin Kinoa Silajının P, K, Ca, Mg, Na, Fe, Cu, Zn ve Mn İçeriklerine Etkisi

Ekim Zamanı	P (g kg ⁻¹)	K (g kg ⁻¹)	Ca (g kg ⁻¹)	Mg (g kg ⁻¹)	Na (g kg ⁻¹)	Fe (mg kg ⁻¹)	Cu (mg kg ⁻¹)	Zn (mg kg ⁻¹)	Mn (mg kg ⁻¹)
15 Nisan	3.37	74.43 a	19.62 b	8.02 b	3.58 b	186.19 ab	6.49 b	26.93 b	77.95 b
1 Mayıs	3.32	76.83 a	21.46 a	8.92 a	3.70 a	154.03 b	6.52 b	31.27 a	96.04 a
15 Mayıs	3.21	69.49 b	21.65 a	9.52 a	3.53 bc	191.82 a	6.36 b	30.32 a	89.11 ab
1 Haziran	3.36	69.36 b	22.43 a	9.01 a	3.44 c	193.37 a	7.04 a	32.47 a	93.72 a
Hasat Dönemi									
Çiçeklenme Öncesi	3.55 a	77.60 a	21.36	8.36 b	3.70 a	206.01 a	7.25 a	32.73 a	73.87 b
Çiçeklenme	3.35 ab	75.12 a	21.04	8.84 ab	3.64 a	163.95 b	6.22 b	32.57 a	91.19 a
Tohum Bağlama	3.05 b	64.86 b	21.47	9.40 a	3.34 b	174.10 b	6.34 b	25.45 b	102.54 a
Yıl									
2018	3.33	68.18 b	18.80 b	8.11 b	3.41 b	134.31 b	8.21 a	35.33 a	79.62 b
2019	3.29	76.88 a	23.78 a	9.62 a	3.72 a	228.40 a	5.00 b	25.16 b	98.79 a

Yılların kinoa silajının mineral madde içerikleri üzerine etkisi incelendiğinde P içerikleri üzerine etkisinin önemsiz olduğu tespit edilmiştir (Çizelge 1). Araştırmada en yüksek K, Ca, Mg, Na, Fe ve Mn içerikleri 2019, Cu ve Zn içerikleri ise 2018 yılında tespit edilmiştir (Çizelge 4).

Ekim zamanı x hasat dönemi interaksyonunun kinoa silajının P, Mg, Na ve Mn içerikleri üzerine etkisinin önemsiz olduğu belirlenmiştir (Çizelge 1). Araştırmada en yüksek K içerikleri 86.67 g kg⁻¹ ile 1 Mayıs tarihinde ekilen ve çiçeklenme öncesi hasat döneminde hasat edilen bitkilerden yapılan silajlardan elde edilmiştir. İkili interaksyonun silajın Ca ve Zn içerikleri üzerine etkisi incelendiğinde; 15 Mayıs tarihinde ekilen ve çiçeklenme öncesi hasat döneminde hasat edilen bitkilerden yapılan silajlarda belirlenmiştir. En yüksek Fe içerikleri 301.12 mg kg⁻¹ ile 15 Nisan tarihinde ve çiçeklenme öncesi hasat döneminde hasat edilen bitkilerden elde edilirken, en yüksek Cu 8.74 mg kg⁻¹ ile 1 Haziran tarihinde ve çiçeklenme öncesi hasat döneminde hasat edilen bitkilerden elde edilmiştir (Çizelge 5).

Çizelge 5. Ekim Zamanı x Hasat Dönemi İnteraksiyonunun Kinoa Silajının K, Ca, Fe, Cu ve Zn İçeriklerine Etkisi

Ekim Zamanı	Hasat Dönemi		
	Çiçeklenme Öncesi	Çiçeklenme	Tohum Bağlama
K (g kg⁻¹)			
15 Nisan	78.37 bc	79.49 b	65.42 fg
1 Mayıs	86.67 a	78.36 bc	65.47 fg
15 Mayıs	74.29 b-d	72.81 c-e	61.37 g
1 Haziran	71.09 d-f	69.83 d-f	67.16 e-g
Ca (g kg⁻¹)			
15 Nisan	17.98 c	17.73 c	23.14 ab
1 Mayıs	19.89 bc	21.99 ab	22.51 ab
15 Mayıs	24.45 a	22.15 ab	18.36 c
1 Haziran	23.12 ab	22.28 ab	21.88 ab
Fe (mg kg⁻¹)			
15 Nisan	301.12 a	135.83 f	121.64 f
1 Mayıs	135.06 f	135.33 f	148.67 ef
15 Mayıs	199.16 bc	227.64 bc	191.70 cd
1 Haziran	188.71 c-e	157.00 d-f	234.41 b
Cu (mg kg⁻¹)			
15 Nisan	7.033 bc	6.31 c-e	6.12 de
1 Mayıs	6.28 c-e	6.82 b-d	6.46 b-d
15 Mayıs	6.95 bc	6.63 b-d	5.51 ef
1 Haziran	8.74 a	5.11 f	7.27 b
Zn (mg kg⁻¹)			
15 Nisan	30.60 b-e	26.40 d-f	23.78 fg
1 Mayıs	25.33 ef	39.09 a	29.41 d-f
15 Mayıs	38.83 a	33.06 bc	19.06 g
1 Haziran	36.16 ab	31.73 b-d	29.54 c-e

4. SONUÇ

Sonuç olarak; farklı ekim zamanı ve hasat dönemlerinin kinoa bitkisinin silaj kalitesi üzerine etkilerinin incelendiği bu çalışmada, incelenen özelliklerin ekim zamanı ve hasat dönemi bakımından önemli farklılıklar gösterdiği tespit edilmiştir. Ekim zamanının gecikmesine bağlı olarak silajların kuru madde oranı artış göstermiştir. Yüksek kuru madde ve düşük pH bakımından 1 Haziran tarihinde ekilen bitkilerden yapılan silajlar ön plana çıkmıştır. Hasat dönemlerinin silaj kalitesi üzerine etkisi önemli olmuş ve hasat döneminin gecikmesine bağlı olarak silaj kuru madde oranı artmasına karşılık diğer kalite özelliklerinde önemli düşüşler tespit edilmiştir. Araştırmadan elde edilen sonuçlar bir bütün olarak değerlendirildiğinde; kinoa bitkisinin silaj için 1 Mayıs tarihinden sonra ekilmesi ve çiçeklenme döneminde hasat edilmesi gerektiği tespit edilmiştir. Ayrıca kinoa bitkisinden kaliteli bir silaj elde etmek için kuru madde oranını artıran ve pH'yı düşüren katkı maddelerinin ilave edilmesine yönelik çalışmaların yapılması gerekmektedir.

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KAYNAKLAR

- AOAC International. 1997. Official methods of analysis of AOAC international, 16th ed. 3rd rev. Method 955.04. The Association, Gaithersburg, MD.
- Budaklı Çarpıcı. E.. Tatar. N.. Öztürk. Y.. Erol. S. ve Arslan Ö.. 2017. Farklı oranlarda mısır ve şeker mısırı atığı ile karıştırılan yonca silajında kalitenin belirlenmesi. *KSÜ Doğa Bil. Derg.* 20 (Özel Sayı): 65-67.
- Erdemli, H. 2020. Kinoa (*Chenopodium quinoa* Willd.) bitkisine uygulanan farklı azot ve çinko dozlarının verim ve verim öğeleri üzerine etkileri. *Doktora Tezi*. Eskişehir Osmangazi Üniversitesi Fen Bilimleri Enstitüsü, Tarla Bitkileri Anabilim Dalı. Eskişehir.
- Güner, Z., Temel, S. 2022. Kuru şartlarda farklı sıra aralıklarıyla yetiştirilen Kinoa (*Chenopodium quinoa* Willd.) çeşitlerinin silaj kalitesinin belirlenmesi. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 12(4): 2506 - 2519.
- Kacar, B. 2014. Plant, soil and fertilizer analysis 2: Nobel Publishers, Ankara, 423.
- Podkówka Z, Geśiński K, Podkówka L, 2018. The influence of additives facilitating ensiling on the quality of quinoa (*Chenopodium quinoa* Willd.) silage. *Journal of Central European Agriculture*, 19(3), 607-614.
- Tan M, Temel S, 2019. Her yöneyle kinoa, önemi, kullanılması ve yetiştiriciliği. *Iksad Publishing House*, Ankara.
- Tan, M., Yöndem, Z. 2013. İnsan ve hayvan beslenmesinde yeni bir bitki: Kinoa (*Chenopodium quinoa* Willd.). *Alinteri*. 25 (B); 62-66.
- Van Soest, P.J., Robertson J.B., B.A. Lews, 1991. Methods for dietary fiber, neutral detergent fiber and nonstarch polysaccharides in relation to animal nutrition. *Journal of Dairy Science*, 74: 3583-3597.
- Vega-Galvez A, Miranda M, Vergara J, Uribe E, Puente L, Martinez EA, 2010. Nutrition facts and functional potential of quinoa (*Chenopodium quinoa* Willd.), an Ancient Andean grain: a review. *Journal of the Science Food Agriculture*. 90: 25412547.

TARIM TOPRAKLARINDA ZAMANLA BOZULAN VERİMLİLİK
PARAMETRELERİ: Toprak Reaksiyonu (pH) ve Edirne İli Keşan İlçesi Örneği

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ÖZET

Fazla verim alma amacıyla yıllardan beri yoğun olarak işlenen tarım alanlarında zamanla meydana gelen bozulmalar, ürün miktar ve kalitesini de olumsuz olarak etkilemektedir. Özellikle yoğun olarak kullanılan bazı kimyasal tarım ilaçları ve kimyasal gübreler, zamanla toprak reaksiyonu (pH) değerini bozacak nitelikte etkilemektedir. Bu çalışmada Edirne ili, Keşan ilçesini temsilen alınan toplam 20 adet toprak örneği analiz edilmiş ve sonuçları bilimsel kıstaslara göre incelenip, toprakların pH değerleri ön planda tutularak elde edilen veriler değerlendirilmiştir. Toprak örneklerinin pH içerikleri en düşük 5,84 ve en yüksek 8,10 olarak belirlenmiştir. Tuz içerikleri bakımından en düşük %0,01 ve en yüksek %0,22; organik madde içerikleri en düşük %0,92, en yüksek %2,91 ve kireç (CaCO₃) içerikleri ise en düşük %0,00 ile en yüksek %22,07 olarak ölçülmüştür. Tekstür sınıfı olarak toprakların 9 tanesinin “kil (C)” sınıfında olduğu belirlenmiştir. Toprak pH değerinin, tarımsal alanlarda uygulanan gübre etkinliğine doğrudan etkisi bulunmaktadır. Bu nedenle gübreleme programlarının yapılması için toprakların pH ve akabinde organik madde değerleri göz önünde bulundurulmalı ve doğru gübreleme yapılarak sürdürülebilir tarımın desteklenmesi sağlanmalıdır. İlçe üreticilerinin yoğunlukla kimyasal gübre kullandıkları bilinmektedir. İhtiyaç kadar kimyasal ve beraberinde organik gübre kullanılması, ancak toprak analizlerinin yaptırılması ve sonuçlarına uyularak gübreleme yapılması ile mümkündür. İlçe genelinde bundan sonraki gübreleme uygulamalarında pH değerinin olumsuz etkileriyle karşılaşmamak için toprakları iyileştirme özelliği bulunan organik gübreleri de (örneğin vermikompost, leonardit vb.) kullanmak gerektiği konusunda üreticiler bilgilendirilmelidir. Özellikle vermikompost uygulaması toprak organik madde miktarını ve su tutma kapasitesini artırır ve ayrıca topraklar için önemli bir besin kaynağı olarak görev alır.

Anahtar Kelimeler: Toprak reaksiyonu, organik gübre, vermikompost.

PRODUCTIVITY PARAMETERS DESTROYED OVER TIME IN AGRICULTURAL SOILS: Soil Reaction (pH) and The Case of Keşan District of Edirne Province

ABSTRACT

Deterioration in agricultural lands, which have been intensively processed for years for the purpose of obtaining higher yields, also negatively affects the amount and quality of the product. Particularly, some chemical pesticides and chemical fertilizers, which are used intensively, affect the soil reaction (pH) value over time. In this study, a total of 20 soil samples taken from Edirne province, Keşan district were analysed and the results were determined according to scientific criteria and the data obtained by keeping the pH values of the soils in the foreground. The pH contents of the soil samples were determined as the lowest 5,84 and the highest 8,10. In terms of salt content, the lowest 0,01% and the highest 0,22%. The lowest soil organic matter contents were 0,92%, the highest 2,91%, and the lime (CaCO₃) contents were measured as the lowest 0,00% and the highest 22,07%. As a texture class, it was determined that 9 of the soils were in the "clay (C)" class. Soil pH has a direct effect on the effectiveness of fertilizer applied in agricultural lands. For this reason, soil pH and organic matter values should be taken into account in order to make fertilization programs, and sustainable agriculture should be supported by correct fertilization. It is known that Keşan district producers use chemical fertilizers intensively. The use of chemical and organic fertilizers as needed is only possible with soil analysis and fertilization according to the soil analysis results. Producers should be informed that it is necessary to use organic fertilizers (for example, vermicompost, leonardite, etc.) that have property of improving the soil in order not to encounter the negative effects of pH value in future fertilization applications throughout the district. In particular, the application of vermicompost increases the amount of soil organic matter and water holding capacity, and also acts as an important nutrient source for the soil.

Keywords: Soil reaction, organic fertilizer, vermicompost.

GİRİŞ

Buğday ve ayçiçeği, Trakya Bölgesi için son derece yaygın olarak yetiştirilen iki ana münavebe bitkisidir. Ayçiçeği ülkemizin bitkisel yağ ihtiyacını karşılamak için bölgenin birçok yöresinde hem kuru ve hem de sulu koşullarda yetiştirilse de buğdaydan sonra kuru koşullarda en fazla yetiştirilen ana münavebe bitkisidir. Edirne ilinin Keşan ilçesinde de ağırlıklı olarak buğday, ayçiçeği ve arpa yetiştiriciliği yapılmaktadır. İlçe, iklim ve toprak yapısı bakımından tarıma son derece uygundur. Bitkisel ve hayvansal üretimde elde edilen verimlerin Türkiye ortalamasının üzerinde olduğu bilinmektedir. Ancak bölgede tarımsal açıdan önemli sorunlar arasında ise yoğun tarımsal faaliyetler nedeniyle toprak yapısının bozulması (pH bakımından asitleşme, organik maddenin düşmesi vb.) ve amaç dışı tarım arazilerinin kullanılması olduğu görülmektedir.

Toprak pH değeri çok yüksek (alkali) veya çok düşük (kuvvetli asit) olduğu durumlarda kimyasal gübrelerden ziyade organik gübrelemenin etkisi oldukça fazladır. Bu nedenle toprak ıslah programlarında organik gübrelemenin mutlaka “gübreleme programlarında” yer alması hem pH düzenleme ve hem de organik maddenin artırılması yanında tarım topraklarının su tutma kapasitelerinin de yükseltilmesi açısından oldukça önemlidir. Küresel ısınmanın ve kuraklığın giderek arttığı ülkemizde bu konu oldukça önemlidir (Bellitürk ve ark. 2018; Bellitürk, 2019; Bellitürk ve Vardar, 2019).

Marmara Bölgesi’ndeki tarım topraklarının bitki besin maddesi durumlarının belirlenmesi amacıyla yapılan bir çalışmada, toplam 1752 farklı noktadan GPS ile koordinatları belirlenerek alınan toprakların pH bakımından %50,6’sının hafif alkali, %30’unun nötr, %13,8’inin hafif asit, %5,1’inin orta derecede asit, %0,3’ünün kuvvetli asit, %0,2’sinin ise kuvvetli alkali topraklar olduğu belirtilmiştir. Aynı çalışmada Toprak reaksiyonu bakımından Marmara bölgesinin %19,2’sini asit karakterli toprakları kapsamaktadır. Özellikle Kırklareli ve Tekirdağ illerinin kuzeyinde, Edirne ilinin kuzey ve kuzey-batı bölümünde, Kocaeli ve Sakarya illerinin genelinde geniş alanlar kaplayan asit karakterli topraklar bulunduğu da belirtilmiştir (Taşova ve Akın, 2013).

Solucanların topraklardaki pH, organik madde, tekstür ve strüktür yapılarına olan çeşitli olumlu etkilerinin yanında, toprak nemi ve toprak sıcaklığı gibi çevresel parametreler için de olumlu katkılar sağladığı ve hatta toprakta bulunan olası ağır metallerin biyoakümülatör olarak tutulmasında da solucanların önemli rol oynadığı belirtilmektedir (Richardson ve ark., 2020). Topraklar üzerindeki birçok olumlu etkileri yanında vermikompost yapımında bitkisel ve hayvansal atıklar da değerlendirilmiş olmaktadır. Organik atıkların mutlak surette geri dönüşümünün özellikle vermikompost yöntemi ile sağlanması ve elde edilen materyalin de

tarım ve peyzaj alanlarına “organik gübre” olarak kazandırılması ülkemizin gelecek kuşaklara verimli tarım topraklarını ve peyzaj alanlarını taşıyabilmelerinde oldukça önemlidir (Bellitürk ve Goldmann Benardete, 2020). Kale ve ark. (1992) yaptığı bir araştırmada, vermikompost uygulanmış topraklarda birçok iyileşme görmüş olup, ayrıca azot fikse eden bakteriler, mikorizal mantarlar ve aktinomisetlerin sayısında artış olduğu buna bağlı olarak da topraktaki azot miktarının yükseldiği de ifade edilmiştir.

Bu araştırmada buğday-ayçiçeği münavebesinin yaygın olduğu Edirne ili Keşan ilçesini temsilen alınan 20 adet toprak örneğinin analiz sonuçları bilimsel kıstaslara göre incelenmiş ve son yıllarda karşılaşılan sorunlardan birisi olan pH dengesinin bozulması açısından alınacak önlemlere ilişkin bazı değerlendirmeler yapılmıştır. Ülkemiz tarım sisteminde önemli bir toprak yapısına sahip olan Keşan ilçesindeki tarım topraklarının sürdürülebilir olarak kullanılması, gelecek nesiller açısından son derece önemlidir.

MATERYAL VE METOT

Araştırmada kullanılan toprak örnekleri ekimden önce son toprak hazırlığı yapıldığında (herhangi bir gübre ve tarım ilacı uygulaması yapılmadan önce) 0-30 cm derinlikten Edirne ili, Keşan ilçesinin değişik köy ve merkeze bağlı mevkilerinden (Çizelge 1) usulüne uygun olarak zig zag yöntemiyle alınmış ve akabinde analiz yapılacak laboratuvara getirildikten sonra, havada kurutulup ardından 2 mm’lik elekten geçirilerek analize hazır hale getirilmiştir (Jackson, 1958). Toprak örneklerinin tekstür sınıfı su ile doymuşluğuna göre; toprak reaksiyonu, Uluslararası Toprak İlmi Derneğinin önerdiği üzere 1:2.5 (toprak:su) oranında toprağın sulandırılarak, cam elektrotlu pH metre ile ölçülerek; tuz içeriği ise EC-metre ile ölçülüp % birimi cinsinden belirlenmiştir (Lindsay ve Norvell 1978, Richards 1954). Kireç miktarlarının belirlenmesi Scheibler Kalsimetresi ile volümetrik olarak yapılmıştır (Ülgen ve Yurtsever 1974).

Topraklarda organik madde, Walkley-Black yöntemi ile belirlenmiştir (Sağlam, 2012). Toprak analizlerinin değerlendirilmesinde önceki çalışmalarda belirtilen standart değerler kullanılmıştır (Lindsay ve Norwell, 1969; FAO, 1990; TOVEP, 1991; Güneş ve ark., 1996; Güneş ve ark., 2010; Bellitürk, 2013).

Toprak örneklerinin alındığı yerlere ait bilgiler Çizelge 1’de gösterilmiştir.

SONUÇLAR VE ÖNERİLER

Araştırma bölgesine ait incelenen toprak örneklerinin bazı kimyasal ve fiziksel analiz sonuçları Çizelge 1’de topluca gösterilmiştir.

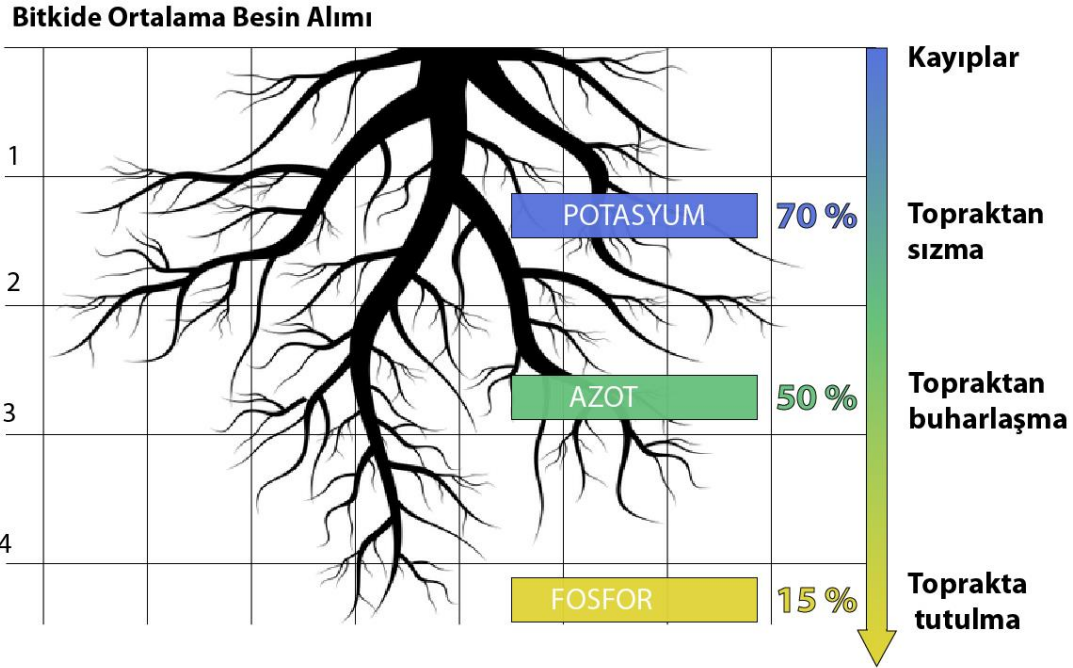
Çizelge 1. Toprak örneklerine ait bazı fiziksel ve kimyasal analiz sonuçları.

Örnek No	Örnek Alınan Yerlerin Köy-Mah.-Mevkii Adı	pH (1:2,5)	Topl. Tuz (%)	Org. Mad. (%)	Kireç (%)	Doygunluk (%)	
						(%)	Tekstür Sınıfı
1	İspat Cami Mah.	8,10	0,01	1,20	7,95	45,1	Tın
2	Büyük Cami Mah.	6,60	0,11	0,92	0,00	69,0	Killi Tın
3	Karahisar Köyü	7,48	0,18	2,91	9,06	111,1	Ağır Kil
4	Karahisar Köyü	7,66	0,10	2,04	7,09	88,0	Kil
5	Beğendik Köyü	7,72	0,05	2,31	8,28	85,8	Kil
6	Beğendik Köyü	7,88	0,05	2,36	9,46	79,2	Kil
7	Türkmen Köyü	7,83	0,07	1,29	22,07	93,5	Kil
8	Gacalın Yeri Mevkii	7,91	0,05	1,12	3,97	77,0	Kil
9	Mermer Sağı Mevkii	7,15	0,04	1,10	2,78	66,0	Killi Tın
10	Türkmen Köyü	7,46	0,09	3,53	5,52	90,2	Kil
11	Mermer Mevkii	6,97	0,04	1,21	3,17	66,0	Killi Tın
12	Ömerin Yeri Mevkii	7,15	0,05	1,33	2,28	67,1	Killi Tın
13	Avlu Altı Mevkii	7,65	0,12	2,34	5,16	115,5	Ağır Kil
14	Mercan Köyü	5,84	0,04	1,44	0,00	57,0	Killi Tın
15	Yenice Çiftlik Köyü	6,06	0,06	1,12	0,00	68,0	Killi Tın
16	Müsellim	7,36	0,14	1,50	6,47	92,0	Kil
17	Müsellim	7,42	0,16	1,35	8,09	93,0	Kil
18	Müsellim	7,31	0,16	1,77	5,66	100,0	Kil
19	Karahisar Köyü	7,40	0,18	1,64	7,38	110,0	Ağır Kil
20	Kızkapan Köyü	7,11	0,22	2,51	2,44	110,0	Ağır Kil
Min.	-	5,84	0,01	0,92	0,00	45,1	-
Maks.	-	8,10	0,22	2,91	22,07	111,1	-

Çizelge 1’den de görüldüğü gibi, Edirne ili, Keşan ilçesi topraklarının pH değerleri en düşük 5,84 ile “hafif asit”, en yüksek 8,10 ile “hafif alkalın” sınıfında olduğu görülmektedir. Toplam tuz içerikleri bakımından en düşük %0,01 ile “tuzsuz”, en yüksek %0,22 ile “hafif tuzlu” sınıfında girdiği görülmektedir. Öte yandan toplam 20 adet toprak örneğinin organik madde içerikleri en düşük %0,92 (çok az) ve en yüksek %2,91 (orta) olarak tespit edilmiştir (Lindsay ve Norwell, 1969; FAO, 1990; TOVEP, 1991; Güneş ve ark., 1996; Güneş ve ark., 2010; Bellitürk, 2013). Toprakların pH değerlerinde ve kireç içeriklerinde çok farklı değerler olduğu görülmektedir (Çizelge 1). Toprakların kireç durumu birinci derecede ana materyale bağlıdır. Yörede hem volkanik ve hem de sedimenter ana materyal üzerinde toprak oluşumu, farklı kireç içeriğine sahip toprakların oluşmasına neden olmaktadır (Gürbüz ve ark., 2019). Keşan ilçesinde yapılan bu çalışmada 5,84 ile 8,10 arasında değişen aralıklarda pH değerine sahip topraklar olduğu Çizelge 1’den açıkça görülmektedir. Bu nedenle söz konusu topraklardaki pH ve kireç miktarındaki değişkenlikler yöre topraklarının gübrenenmesinde hem gübre çeşidi ve hem de uygulama zamanı açısından dikkat edilmesi gerektiğini ortaya koymaktadır.

Organik madde bakımından yetersiz, pH bakımından dengesiz olan tarım topraklarında kullanılan kimyasal gübrelerin etkinliği oldukça düşük olup, kullanılan potasyumun en fazla %70’i, azotun %50’si ve fosforun ise %15’i topraklarda tutulmakta ve bitkilere yararlı

olabilmekte, geriye kalan NPK miktarları ise K genellikle sızarak-yıkanarak, N buharlaşarak, P ise tutularak (fikse olarak) kaybolmaktadır (Şekil 1).



Şekil 1. Bitkilerin ortalama besin element alım oranları.

Trakya Bölgesi tarım topraklarının bugün en önemli problemlerinin başında “düşük organik madde”ve “değişen, asitleşen pH” parametreleri gelmektedir. Trakya Bölgesi tarım toprakları ile ilgili olarak daha önce yapılmış olan bir çalışmada incelenen toprakların pH değerlerinin en düşük 2,97 ve en yüksek 7,74 değerinde olduğu ifade edilmiştir (Bellitürk, 2019). Toprak örneklerinin pH değerleri ile elde edilen verim arasında önemli ilişkiler mevcuttur. Bu konuda yapılan bir çalışma Çizelge 2’de açıkça görülmektedir (Halliday ve ark., 1992).

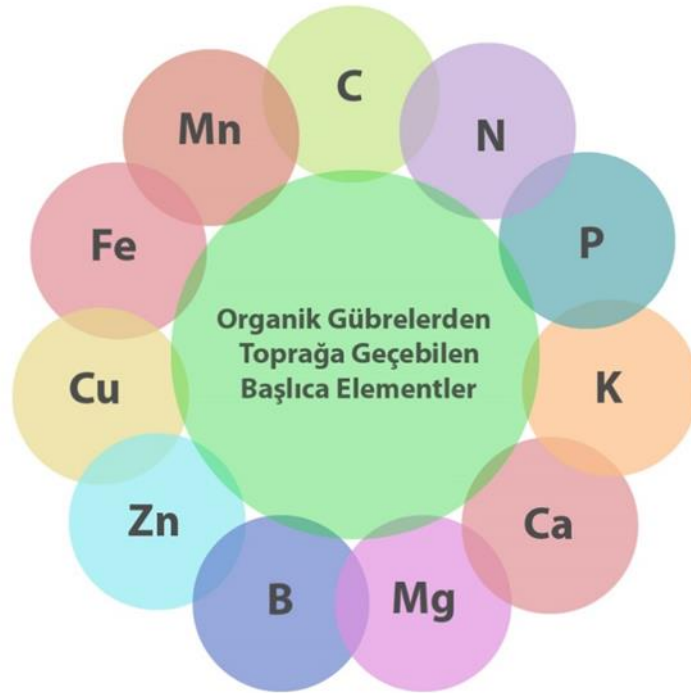
Çizelge 2. Toprak pH değeri ile verim arasındaki ilişki.

Ürün	Toprak pH Değeri				
	4,7	5,0	5,7	6,8	7,5
Ortalama Verim (En İyi 100, En Kötü 0)					
Mısır	34	73	83	100	85
Buğday	68	78	89	100	99
Arpa	0	23	80	95	100
Yonca	2	9	42	100	100

Yukarıdaki Çizelge 2'den de görüldüğü gibi, pH değerinin değişmesi ile elde edilen verim miktarlarında ürünlere göre değişkenlik olduğu ve uygun olmayan pH değerlerinde de ürün miktarlarında önemli düzeylerde kayıplar olduğu anlaşılmaktadır.

Trakya Bölgesi tarım söz konusu olduğunda verimli toprakları ve bazen de fazla kimyasal gübre kullanan bölge olması ile gündeme gelmektedir. Ancak kimyasal gübreler ile birlikte organik gübrelerin de kullanılmış olması ile hem gübrenin etkinliği artacak ve hem de sadece bitkiler değil, topraklar da iyileştirilmiş olacaktır. Organik gübrelerden vermikompost üreten firmaların bölgede fazla olması bir avantaj olup, çiftçilerin tarım ve peyzaj amacıyla giderek artan vermikompost kullanım taleplerinin olduğu konusunda çeşitli araştırmalar mevcuttur (Bellitürk, 2018; Bellitürk ve Soytürk, 2020; Çelik ve ark., 2022; Bellitürk ve ark., 2022; Bellitürk ve Çelik, 2022; Kocagöz ve ark., 2022).

Yoğun kimyasal gübre kullanımından kaynaklı olarak pH dengesi bozulmuş olan topraklara mutlaka organik gübre kullanmak gereklidir. Aksi halde, pH dengesi bozulmuş olan topraklardaki besin maddeleri, ne kadar çok kimyasal gübre kullanılırsa kullanılsın, kayıplar artacaktır. Ancak organik gübre kullanıldığında N, P, K başta olmak üzere toprakta mevcut olan besin maddeleri ve organik gübreden ilave edilen tüm besin maddelerinin bitkilere elverişliliği artacak ve gübrelemeden kaynaklanan kayıplar azalacaktır (Şekil 2).



Şekil 2. Organik gübrelerden toprağa geçen ve bitkilere elverişli olan elementler.

Düşük organik maddeden sonra Trakya Bölgesi ve dolayısıyla Keşan ilçesi tarım topraklarını en fazla tehdit eden ikinci sorun toprakların bozulan pH dengesidir. Özellikle bilinçsizce toprakları asitleştirme etkisi yüksek olan gübrelerin kullanılması neticesinde toprakların pH değerleri giderek yıldan yıla düşmekte ve tarımsal üretim değerleri de olumsuz olarak etkilenmektedir (Bellitürk, 2019). Toprak örneklerinin pH değerlerinin bilinmesi, bilimsel açıdan oldukça önemli olup, kullanılacak gübre cins ve miktarı, laboratuvarlarda özellikle elverişli fosfor analizlerinin yöntemlerinin belirlenmesi gibi birçok konu toprak pH ile yakından ilişkilidir. Kaldı ki son yıllarda artan gübre fiyatları karşısında, doğru miktarda gübre kullanılması için toprakların analiz edilmesi, analiz sonuçlarının bitki besleme uzmanlarınca değerlendirilerek doğru gübreleme programlarının oluşturulması ve uygulanmasının sağlanması hem topraklar ve hem de çevre ve ekonomi için oldukça büyük önem taşımaktadır. Toprak örneklerinin pH analizleri incelendiğinde, tekrar asit çıkanlar için “kireç ihtiyacı analizi”, alkali çıkanlar için ise “jips ihtiyacı analizi” yapılarak, ekimden, taban gübrelemesinden önce gerekli olan kireç veya jips-kükürt uygulamaları yapılmalı ve topraklar önce ıslah edilmeli, ardından ekim-dikim işlemlerine geçilmelidir. Sürdürülebilir tarım için bu şekilde toprak ıslahı mutlak bir zorunluluk olup, verim ve kaliteyi direkt olarak etkilemektedir. Tarım topraklarının pH değerlerinin düşerek asitleşmesi ile toprakların verimlilikleri arasındaki ilişki öneli olup, bu konuda daha fazla akademik çalışmaların yapılması ve sonuçlarının üreticilerle paylaşılması gerekmektedir.

KAYNAKLAR

- Bellitürk, K., 2013. Toprak Verimliliğinin Belirlenmesinde Toprak ve Bitki Analizlerinin Önemi. NKÜ. Ziraat Fakültesi, Ziraathaber, Yıl: 2, Sayı: 7, Sayfa: 10-11.
- Bellitürk, K., 2018. Some Evaluations About Use of Vermicompost in Agricultural Activity of Thrace Region, Turkey: A Review. Journal of Rice Research, 6 (2): 1000193.
- Bellitürk, K., Kır, D. ve Çelikadam, S., 2018. Toprak İslahında Organik Maddenin Önemi: Ziya Organik Tarım İşletmeleri A.Ş. Uzunköprü Örneği. Uzunköprü Ticaret Borsası 2017 Yılı Faaliyet Raporu, s: 39-45, Uzunköprü-Edirne.
- Bellitürk, K. and Vardar, Ö., 2019. Determination of Nutritional Status of Grass in Some Parks with Soil and Plant Analysis: The Case of Esenler County, Istanbul Province. Fresenius Environmental Bulletin, 28 (12): 9240-9251, Germany.
- Bellitürk, K., 2019. Asit ve Düşük Organik Madde İçeren Toprakların İslahı: Trakya Bölgesi Örneği. Kireç Dünyası, Yıl: 5, Sayı: 10, S: 19-22.
- Bellitürk, K. and Soytürk, Ö., 2020. Can Vermicompost Obtained from Eisenia foetida Fed by Nutshell and Cow Manure Mix Be an Organic Fertilizer? Fresenius Environmental Bulletin, 29 (12A): 11273-11284.
- Bellitürk, K. ve Goldmann Benardete, B., 2020. Doğanın Mucizevi Canlıları (Toprağın Bereketi ve Çevre Sağlığına Yüzyıllardır Hizmet Eden Solucanlar). İstanbul: Eco Reform Yayınları.
- Bellitürk, K. and Çelik, A., 2022. Some Assessments on the Fertilizer Need of Winter Wheat (*Triticum aestivum* L.) Widely Grown in the Thrace Region. International Conference on Global Practice of Multidisciplinary Scientific Studies, pp. 976-985, 6-8 March, Cyprus.
- Bellitürk, K., Çelik, A. and Baran, M.F., 2022. The Effect of Vermicompost Application on Soil Properties in Olive (*Olea europaea* L. cv. Memecik). Erwerbs-Obstbau, (2022) 64: 107-113.
- Çelik, A., Bellitürk, K. and Baran, M.F., 2022. The Role of Biochar in Medicinal and Aromatic Plants Production. International Conference on Global Practice of Multidisciplinary Scientific Studies, pp. 962-975, 6-8 March, Cyprus.
- F.A.O., 1990. Micronutrient Assesment at the Country Level: An International Study, FAO Soils Bulletin 63, Rome, Italy.
- Güneş, A., Aktaş, M., İnal, A. ve Alpaslan, M., 1996. Chemical and Physical Properties Konya Closed Basin Soils. Ankara University Agricultural Faculty Publication No:1453, Ankara.
- Güneş, A., Alpaslan, M. ve İnal, A., 2010. Bitki Besleme ve Gübreleme (Beşinci Baskı), Ankara Üniversitesi Ziraat Fakültesi Yayın No: 1581, Ders Kitabı No: 533, 576s. Ankara.
- Gürbüz, M.A., Kayalı, E., Bahar, E., Öz, T.A. ve Kurşun, İ., 2019. Trakya Topraklarının Veri Tabanının Oluşturulması ve Bazı Toprak Özellikleri. Toprak Bilimi ve Bitki Besleme Dergisi, 7 (1): 28-36.
- Gürbüz, S.G. and Bellitürk, K., 2021. Determination of the Nutritional Status of Agricultural Lands in Tekirdag Province Ergene District. (Agricultural Researches Resourcebook). IKSAD Publishing House. ISBN: 978-625-8007-36-7. Chapter 3:45-79, Print Date: October, 2021, Ankara.
- Halliday, D.J., Trenkel, M.E. and Whichman, W., 1992. IFA World Fertilizer Use Manual, 632 p., Germany.
- Jackson, M. L., 1958. Soil Chemical Analysis. Prentice-Hall, Inc. Englewood Cliffs, N.J.
- Kale, R. D., Mallesh, B., Kubra, B. ve Bagyaraj, D., 1992. Influence of Vermicompost Application on the Available Macronutrients and Selected Microbial Populations in a Paddy Field, Soil Biology and Biochemistry, 24 (12): 1317-1320.

- Kocagöz, Y.M., Bellitürk, K. and Hurma, H., 2022. Comparison of Organic and Chemical Fertilizer Use: The Case of Muratlı District of Tekirdağ Province. *Adyutayam*, 10 (2): 108-127.
- Lindsay, W.I. ve Norwell, W.A., 1969. Development of DTPA Micronutrient Soil Test, *Soil Science Society of America Proceedings*. 35:600-602.
- Lindsay, W. L. and Norvell, W. A., 1978. Development of a DTPA Test for Zinc, Iron, Manganese and Copper. *Soi Sci. Soc. Am. J.* 42, 421-428.
- Richards, L.A., 1954. *Diagnosis and Improvement of Saline and Alkali Soils*. United States Department of Agriculture Handbook 60, Washington D.C.
- Richardson, J.B., Görres, J.H. ve Sizmür, T., 2020. Synthesis of Earthworm Trace Metal Uptake and Bioaccumulation Data: Role of Soil Concentration, Earthworm Ecophysiology and Experimental Design. *Environmental Pollution* 262, 1-11.
- Sağlam, M.T., 2012. *Toprak ve Suyun Kimyasal Analiz Yöntemleri (Beşinci Baskı)*. Namık Kemal Üniv. Ziraat Fak. Yayın No: 2, Ders Kitabı No: 2, s: 1-184, Tekirdağ.
- Taşova, H. ve Akın, A., 2013. Marmara Bölgesi Topraklarının Bitki Besin Maddesi Kapsamlarının Belirlenmesi, Veri Tabanının Oluşturulması ve Haritalanması. *Topraksu Dergisi*, 2 (2): 83-95.
- TOVEP, 1991. *Productivity Inventory of Turkey Soils*. Republic of Turkey Ministry of Food, Agriculture and Livestock Publications, General Directorate of Rural Services, Ankara.
- Ülgen, N. ve Yurtsever, N., 1974. *Türkiye Gübre ve Gübreleme Rehberi*. Toprak ve Gübre Araştırma Enstitüsü, Teknik Yayın No:28, Ankara.

TARIM TOPRAKLARINDA ZAMANLA AZALAN VERİMLİLİK
PARAMETRELERİ: ORGANİK MADDE VE TEKİRDAĞ İLİ SÜLEYMANPAŞA
İLÇESİ ÖRNEĞİ

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ÖZET

Son yıllarda özellikle aşırı ve bilinçsiz olarak yoğun biçimde kullanılan kimyasallar nedeniyle tarım topraklarının verimlilik parametreleri olumsuz olarak etkilenmiştir. Toprakların organik madde miktarları olması gerekenin çok altına gerilemiş ve bu da tarımsal ürünlerin miktar ve kalitesinde azalmalara neden olmuştur. Bu çalışmada Tekirdağ ili, Süleymanpaşa ilçesinden temsilen alınan toplam 25 adet toprak örneği analiz edilmiş olup, toprakların organik madde içerikleri ön planda tutularak bilimsel kıstaslara göre elde edilen sonuçlar değerlendirilmiştir. İlçeyi temsilen alınan örneklerin bulunduğu alanlarda genellikle bir yıl buğday, ikinci yıl ise ayçiçeği bitkisinin ekim nöbeti olacak şekilde yoğunlukla yetiştirildiği bilinmektedir. Tekirdağ ili genelinde kimyasal gübrelerin fazla kullanıldığı tarımsal istatistiklerde yer alsa da organik ve-veya organo mineral gübre kullanım oranının günden güne arttığına ilişkin bilgiler de mevcuttur. İncelenen toprak örneklerinin ortalama organik madde miktarlarının %1,53 oranında “düşük” yani yetersiz olduğu görülmektedir. En düşük organik madde miktarı %0,29, buna karşın en yüksek organik madde miktarı ise %4,44 olarak belirlenmiştir. Toprakların tamamı tuzsuzdur. Ortalama kireç (CaCO₃) içerikleri %2,19 ile “orta düzeyde kireçli” topraklar olduğu bulunmuştur. İncelenen toprak örneklerinin 18 tanesi tın (L) ve 7 tanesi de killi tın (CL) sınıfındadır. Tekirdağ ili, Süleymanpaşa ilçesinde yoğun olarak tarımsal faaliyet yapılan söz konusu toprakların organik madde miktarı bakımından yetersiz olduğu görülmektedir. Bu nedenle sürdürülebilir tarım yapılabilmesi yanında topraklardan yüksek ve kaliteli verim alınabilmesinin sağlanması için üreticiler mutlaka toprak ve bitki analizlerini yaptırmalı ve gübreleme programlarında sadece kimyasal gübrelere değil, organik ve organo mineral gübrelere de yer vermelidirler.

Anahtar Kelimeler: Buğday, ayçiçeği, organo mineral gübre, sürdürülebilir tarım.

**PRODUCTIVITY PARAMETERS DECREASED OVER TIME IN AGRICULTURAL
SOILS: SOIL ORGANIC MATTER AND THE CASE OF SÜLEYMANPAŞA
DISTRICT OF TEKIRDAG PROVINCE**

ABSTRACT

In recent years, the productivity parameters of agricultural lands have been adversely affected, especially due to the excessive and unconscious use of chemicals. The amount of soil organic matter has decreased far below what it should be, and this has led to a decrease in the amount and quality of agricultural products. In this study, a total of 25 soil samples taken from Tekirdağ province, Süleymanpaşa district were analysed, and the results obtained according to scientific criteria were evaluated by keeping the soil organic matter content in the foreground. It is known that in the areas where the samples taken from the district are present, wheat is grown in one year and sunflower in the second year. Although it is included in the agricultural statistics that chemical fertilizers are used extensively throughout the province of Tekirdağ, there is also information that the rate of use of organic and-or organo mineral fertilizers is increasing day by day. It is seen that the average organic matter content of the examined soil samples is “low”, that is, insufficient at a rate of 1,53%. The lowest amount of organic matter was determined as 0,29%, while the highest amount of organic matter was determined as 4,44%. All soils are saltless. It was found that the average lime (CaCO₃) contents were 2,19% and “medium calcareous” soils. Eighteen of the examined soil samples are in the loam (L) class and 7 of them are in the clay loam (CL) class. It is seen that the soils in question, where intensive agricultural activities are carried out in the Süleymanpaşa district of Tekirdağ province, are insufficient in terms of soil organic matter. For this reason, producers must have soil and plant analyses done and include not only chemical fertilizers but also organic and organo mineral fertilizers in their fertilization programs in order to ensure sustainable agriculture as well as obtaining high and quality yields from the soil.

Keywords: Wheat, sunflower, organo mineral fertilizer, sustainable agriculture.

GİRİŞ

Tarım, Dünyada rekabete dayalı stratejik bir sektördür. Sürdürülebilir tarımsal üretim ile gıda güvencesini sağlamak, çiftçilerin refah düzeyini arttırmak, küresel rekabette daha fazla söz sahibi olmak, gelecek kuşaklara daha iyi bir ülke bırakmak için toprak yönetimi konusu oldukça önemlidir. Buğday ve ayçiçeği, Trakya Bölgesi'nde en fazla ekimi yapılan bir kültür bitkisi olup, değişen iklim ve toprak özelliklerinden dolayı, gübrenmesine günden güne daha fazla önem gerektiği artık bilinen bir gerçektir. Yani diğer bir deyişle, iklim ve toprak özelliklerinin günden güne farklılaşması neticesinde verim-gübreleme ilişkisi artık daha da önemli olmaya başlamıştır. Ancak son yıllarda artan kimyasal gübre fiyatlarından dolayı organik ve organo mineral gübre üretimine ve tarımsal amaçlarla kullanılmasına yönelik çalışmalar ve uygulamalar ağırlık kazanmış durumdadır.

Bitkisel üretimde verimliliği arttırmak amacıyla son yıllarda üretim girdilerinde, ciddi bir artış söz konusudur. Üretimde kullanılan kimyasal gübreler verimi arttırırken, çevre ve insan sağlığı üzerinde olumsuz etkileri olmaktadır. Son yıllarda mevcut alandan daha fazla ürün elde etmek gayesi ile bitkisel üretimde kontrolsüzce kullanılan kimyasal gübre ve ilaçların insan sağlığına olan zararlı etkileri birçok bilimsel çalışma ile ortaya koyulmuştur. Bu sebeple çevre ve insan sağlığı önemsizlenerek doğal kaynaklarımız kontrolsüzce tüketilmekte; yenilenemeyen kaynaklarımız, gelecek nesiller düşünülmeden bilinçsizce kullanılmaktadır (Bellitürk, 2012).

Nüfusun hızlı artışı ile orantılı olarak artan gıda ihtiyacı, doğru orantılı olarak toprak üzerindeki tarımsal faaliyetlerin artmasına sebebiyet vermektedir (Bellitürk ve ark., 2017). Başta tarım arazilerinin amacı dışında kullanımı olmak üzere, tarım arazilerinin bilinçsizce ve yoğun bir şekilde (fazla gübre, yoğun ilaç kullanımı, su, anız yakma vb.) kullanılması sonucunda tarım arazileri hızlı bir şekilde azalmakta ve tarım arazilerinin sürdürülebilirliği ve verimliliği sınırlanmaktadır (Sağlam ve ark., 2012). Bunun sonucunda mevcut tarım arazilerinin korunması ve topraklarımızın en iyi şekilde değerlendirilmesi gereklidir.

Marmara Bölgesi'ndeki tarım topraklarının bitki besin maddesi durumlarının belirlenmesi amacıyla yapılan bir çalışmada, toprakların %67,7'sinin organik madde kapsamının çok az, azot bakımından çok fakir ve fakir olduğu, buna karşın sadece 1752 adet topraktan %7,2'sinin ise iyi ve çok iyi düzeyde olduğu belirtilmiştir (Taşova ve Akın, 2013).

Gürbüz ve Bellitürk (2021)'ün bildirdiğine göre, Tekirdağ, ülke genelinde buğday üretiminde önemli bir paya sahiptir. Tekirdağ'da 2020 yılında buğday üretim alanı 1.966,333 da ve üretim miktarı 769,915 ton, ortalama verim ise 392 kg/da'dır (TÜİK, 2021). Türkiye'de 2019 yılında kullanılan toplam gübre miktarı 12.167,571 tondur. Bunun 8.010,324 tonu azotlu, 3.924,248 tonu fosforlu ve 233.000 tonu ise potasyumlu gübredir (TÜİK, 2021). Azot bitkilerin fazlasıyla

ihtiyacı olan fakat toprakların mineral kısmında çok az miktarda bulunan bir elementtir. Organik madde, toprakta azotun esas kaynağı olarak kabul edilmekte, toprağın fiziksel, kimyasal ve biyolojik özelliklerinin oluşmasında önemli rol oynamaktadır (Gürbüz ve Bellitürk, 2021). Ülkemizdeki, topraklarda bitki besin elementlerinin eksikliğine verilebilecek en iyi iki örnek azot ve çinko besin elementlerinin eksikliğidir. Ülkemizde topraklarımızın büyük bir çoğunluğunda organik madde az düzeydedir ve organik madde azotun esas kaynağını oluşturmaktadır. Bu nedenle gübreleme yapılmadığı takdirde nadir durumlar hariç topraklarımızda azot noksanlığının olması normal bir durumdur (Hamurcu ve Gezgın, 2006). Bellitürk (2019) tarafından bildirildiğine göre, organik maddece fakir olan topraklara uygulanan kimyasal gübreden yararlanma oranı düşük olmaktadır. Bunu önlemek için, hazırlanacak gübreleme programlarına mutlaka uygun organik gübrelerin (yosun gübresi, mikrobiyal gübreler, solucan gübresi, kompost, hümik asit, yarasa gübresi vs.) ve yeşil gübreleme uygulamasının ilave edilmesi gerekmektedir.

Bu çalışmada yoğun olarak kimyasal gübre kullanan illerden birisi olan Tekirdağ'ın Süleymanpaşa ilçesindeki tarım topraklarının özellikle organik madde açısından durumunu ortaya koymak ve sürdürülebilir tarım açısından yapılması gerekenleri değerlendirmek amaçlanmıştır.

MATERYAL VE METOT

Toprak örnekleri ekimden önce son toprak hazırlığı yapıldığında (herhangi bir gübre ve tarım ilacı uygulaması yapılmadan önce) 0-30 cm derinlikten Tekirdağ ili, Süleymanpaşa ilçesinin değişik köy ve merkeze bağlı mevkiilerinden (Çizelge 1) usulüne uygun olarak zig zag yöntemiyle alınmış ve akabinde analiz yapılacak laboratuara getirildikten sonra, havada kurutulup ardından 2 mm'lik elekten geçirilerek analize hazır hale getirilmiştir (Jackson, 1958). Toprak örneklerinin tekstür sınıfı su ile doymuşluğuna göre; toprak reaksiyonu, Uluslararası Toprak İlmi Derneğinin önerdiği üzere 1:2.5 (toprak:su) oranında toprağın sulandırılarak, cam elektrotlu pH metre ile ölçülerek; tuz içeriği ise EC-metre ile ölçülüp % birimi cinsinden belirlenmiştir (Lindsay ve Norvell 1978, Richards 1954). Kireç miktarlarının belirlenmesi Scheibler Kalsimetresi ile volümetrik olarak yapılmıştır (Ülgen ve Yurtsever 1974). Toprak örneklerindeki organik madde, Walkley-Black yöntemi ile belirlenmiştir (Sağlam, 2012).

Araştırmada kullanılan toprakların analiz sonuçlarının değerlendirilmesinde önceki çalışmalarda belirtilen standart değerler dikkate alınmıştır (Lindsay ve Norwell, 1969; FAO, 1990; TOVEP, 1991; Güneş ve ark., 1996; Güneş ve ark., 2010; Bellitürk, 2013).

Araştırmada kullanılan 25 adet toprak örneklerinin alındığı yerlere ait bilgiler Çizelge 1'de gösterilmiştir.

SONUÇLAR VE ÖNERİLER

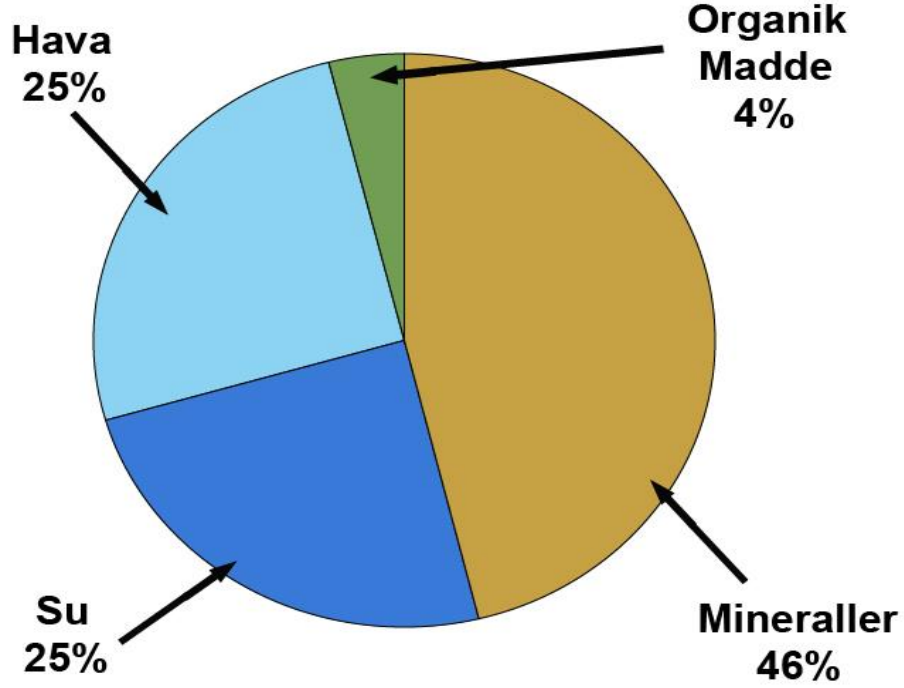
Araştırma bölgesine ait incelenen toprak örneklerinin bazı kimyasal ve fiziksel analiz sonuçları Çizelge 1’de topluca gösterilmiştir.

Çizelge 1. Toprak örneklerine ait bazı fiziksel ve kimyasal analiz sonuçları.

Örnek No	Örnek Alınan Yerlerin Köy-Mah. Adı	pH (1:2,5)	Topl. Tuz (%)	Org. Mad. (%)	Kireç (%)	Doygunluk (%)	
						(%)	Tekstür Sınıfı
1	Köseilyas Köyü	7,59	0,03	1,13	2,67	44,00	T _{in}
2	Köseilyas Köyü	7,55	0,03	1,10	2,43	44,00	T _{in}
3	Husunlu Köyü	6,60	0,01	0,58	0,00	30,80	T _{in}
4	Husunlu Köyü	7,78	0,01	0,29	1,46	37,40	T _{in}
5	Karaevli Köyü	6,54	0,03	2,50	0,00	61,60	Killi T _{in}
6	Banarlı Köyü	6,85	0,04	1,46	0,00	59,40	Killi T _{in}
7	Karadeniz Mah.	7,24	0,06	0,95	1,00	44,00	T _{in}
8	Karadeniz Mah.	6,43	0,10	1,02	0,50	56,00	Killi T _{in}
9	Karaevli Köyü	6,75	0,11	4,44	0,00	48,00	T _{in}
10	Barbaros Mah.	7,35	0,06	1,34	9,33	57,20	Killi T _{in}
11	Karaevli Köyü	7,40	0,01	1,00	1,84	50,00	T _{in}
12	Husunlu Köyü	7,13	0,02	1,16	5,63	37,00	T _{in}
13	Akçahalil Köyü	5,90	0,08	2,30	0,93	48,00	T _{in}
14	Osmanlı Köyü	7,15	0,04	0,72	1,55	43,00	T _{in}
15	Yağcı Köyü	7,79	0,05	1,43	2,21	74,80	Kil
16	Yağcı Köyü	5,84	0,01	2,24	0,00	48,40	T _{in}
17	Bıyıklı Köyü	6,77	0,04	3,75	0,00	66,00	Killi T _{in}
18	Bıyıklı Köyü	8,03	0,02	0,29	3,40	51,00	Killi T _{in}
19	Husunlu Köyü	6,78	0,01	1,16	2,45	42,00	T _{in}
20	Naip Köyü	7,62	0,04	1,40	1,31	55,00	Killi T _{in}
21	Güveçli Köyü	7,13	0,05	0,83	1,55	47,00	T _{in}
22	Karahisarlı Köyü	7,14	0,08	3,09	1,70	44,00	T _{in}
23	Karahisarlı Köyü	7,06	0,05	1,21	1,56	38,00	T _{in}
24	Taşumurca Köyü	7,02	0,09	1,44	3,87	41,00	T _{in}
25	Aşağıkılıçlı Köyü	7,54	0,02	1,53	9,44	42,00	T _{in}
Min.	-	5,84	0,01	0,29	0,00	30,80	-
Maks.	-	8,03	0,11	4,44	9,44	74,80	-

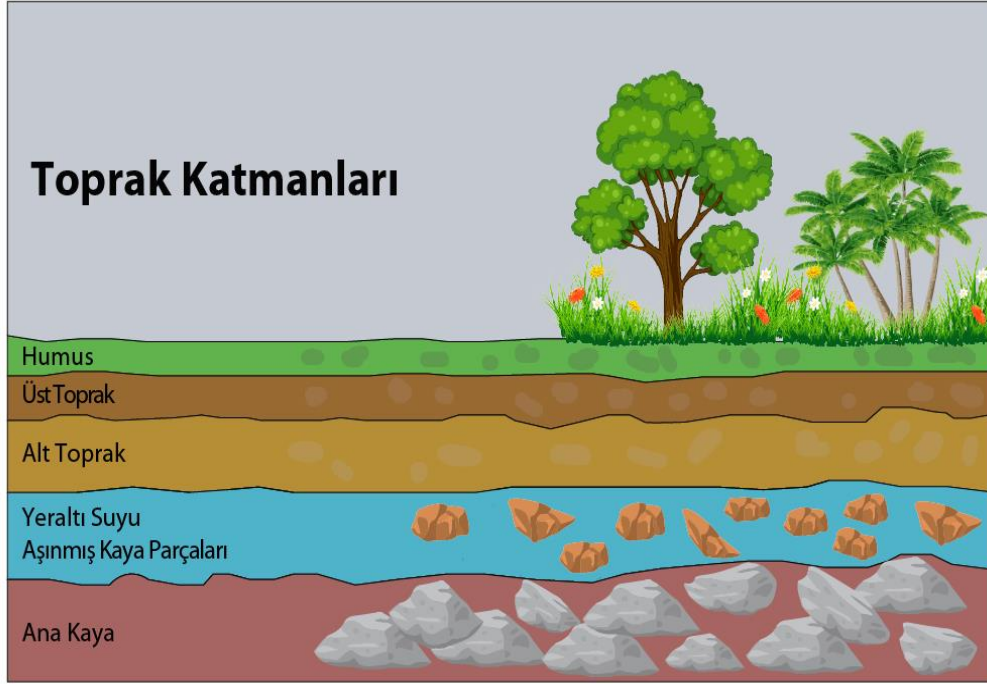
Çizelge 1’den de görüldüğü gibi, Süleymanpaşa ilçesi topraklarının organik madde içerikleri en düşük %0,29 ve en yüksek %4,44 olarak tespit edilmiştir. Aslında organik maddenin verimli topraklar için ortalama %4-5 civarında olması gerekmektedir (Şekil 1).

Toprak Bileşimi



Şekil 1. Verimli bir toprağı oluşturan faktörler.

Ancak bu ülkemiz koşullarında organik madde miktarını %4-5 civarında içeren toprakları görmek giderek zorlaşmaktadır. Üreticiler yaşadıkları verim düşüklüğünü çözmek için kimyasal gübre miktarını artırma yöntemini seçmektedirler, oysa ki, kimyasal gübrelerin toprağı değil, bitkiye faydası olduğu bilinen bir gerçektir. Bellitürk (2011) tarafından yapılan benzer bir çalışmada 66 adet toprak örneğı incelenmiş ve tüm topraklarda organik maddenin düşük olduğu belirtilmiştir. Organik maddenin yöre için düşük olduğuna yönelik birçok akademik çalışma mevcuttur (Bellitürk, 2011; Bellitürk, 2013; Açıkbaş ve Bellitürk, 2016; Bellitürk ve ark., 2018; Bellitürk, 2019; Mumcuoğlu ve Bellitürk, 2021). İlçe toprakları yerinde incelendiğinde ve analiz sonuçları değerlendirildiğinde maalesef Şekil 2’de görülen toprak katmanlarından bazıları zamanla kaybolmuştur. Bu artık bir zorunluluk olarak görülmektedir, yörede yıllara bağlı olarak sıklıkla yapılan buğday-ayçiçeğı ekim nöbeti neticesinde toprakların üst katmanlarındaki “Humus” ve verimli katman olan pulluk tabakasındaki “Üst toprak” artık kalmamış ve yöre çiftçilerinin değımiyle toprak kusmaktadır. Bu konuda 15 nolu toprak örneğı ilçenin Yağı Köyü’nden alınmış olup, üst katmanın (pulluk katmanı) durumu açık olarak gözle de görülmektedir (Şekil 2).



Şekil 1. İdeal bir toprağın katmanları.



Şekil 2. Süleymanpaşa ilçesinden alınan 15 nolu örneğe ait görüntü.

Toprak örneklerinin pH değerleri açısından en düşük 5,84 (hafif asit) ve en yüksek 8,03 (hafif alkalın) olduğu bulunmuştur (Lindsay ve Norwell, 1969; FAO, 1990; TOVEP, 1991; Güneş ve ark., 1996; Güneş ve ark., 2010; Bellitürk, 2013). Bellitürk (2011) tarafından Edirne ili Uzunköprü ilçesinde yapılan çalışma sonucuna göre toprak örneklerinin çoğunun giderek asitleştiği ve bunda da kullanılan kimyasal gübrelerin etkili olduğu belirtilmiştir. Toprak örneklerinin kireç miktarı bakımından en düşük %0,0 ve en yüksek %9,44 oranında CaCO_3 içerdiği ve toprakların genellikle killi tın (CL) ve tın (L) tekstür sınıfında olduğu ortaya çıkmıştır. Tuzluluk bakımından yöre topraklarında önemli bir sorun olmadığı görülmektedir.

Trakya Bölgesi tarım topraklarının bugün en önemli problemlerinin başında “düşük organik madde” içermesi gelmektedir. Trakya Bölgesi tarım toprakları ile ilgili olarak daha önce yapılmış olan birçok çalışmada organik maddenin yetersiz ve hatta bazı çalışmalarda toprakların %80-85’inde düşük organik madde olduğu ifade edilmiştir (Bellitürk, 2019).

Trakya Bölgesi’nin yoğun tarımsal faaliyet yapılan illerinden biri olan Tekirdağ ilinin Süleymanpaşa ilçesinden alınan 25 adet toprak örneği genel olarak organik madde içeriği bakımından fakirdir. Bu durum yaklaşık son 10 yıldır yöre açısından önemli bir sorun olarak ortaya çıkmakta olup, üreticiler genellikle kimyasal gübre kullanım oranlarını artırmak suretiyle toprakları işlemektedirler. Oysa kimyasal gübre uygulamaları, beraberinde organik ve organo mineral gübrelerce de desteklenmiş olsa hem topraklar ve hem de bitkiler açısından daha iyi sonuçlar ortaya çıkacaktır. Bu nedenle gübreleme programlarında mutlaka organik gübreler (örneğin vermikompost, kompost, leonardit vb.) de yer almalıdır (Çelik ve ark, 2022; Bellitürk ve Çelik, 2022a; Bellitürk ve Çelik, 2022b).

Yapılan toprak analizlerinin bilimsel kıstaslara göre değerlendirilmesi ve önceki çalışmaların da incelenmesi neticesinde varılan kanı; toprak analizleri yaptırmaksızın asla gübre uygulanmaması gerektiği, gübreleme programlarının mutlaka organik gübre diye adlandırılan vermikompost, kompost, yarasa gübresi, yeşil gübreleri veya son zamanların ikinci popüler gübresi olan organo mineral gübreleri de içerecek şekilde bitki besleme konusunda uzman olan kişilerce hazırlanması gerektiği ortaya çıkmaktadır. Üreticilerin tarımsal girdi kullanımı konusunda gübre söz konusu olduğunda önce geleceğini ve sonra da çevreyi düşünerek seçimler yapması gerektiği de ortaya çıkan önemli sonuçlardandır. Çünkü kimyasal gübreler hiçbir zaman topraklara yarar sağlamaz, çevreci değildir, sadece bitki ve verim artışı göz önünde tutularak üretilirler. Oysa organik gübreler çevreyle dost tekniklerle, bitkisel ve hayvansal kökenli atıkların değerlendirilmesi ile üretilir ve topraklara olduğu kadar bitkilere ve verime de olumlu katkılar sağlarlar.

KAYNAKLAR

- Açıkbaş, B. ve Bellitürk, K., 2016. Vermikompostun 5BB Üzerine Aşılı Trakya İlkeren Asma Fidanlarının Bitki Besin Elementleri İçerikleri Üzerine Etkisi. Tekirdağ Ziraat Fakültesi Dergisi (JOTAF), 13 (4): 131-138, Tekirdağ.
- Bellitürk, K., 2011. Edirne İli Uzunköprü İlçesi Tarım Topraklarının Beslenme Durumlarının Belirlenmesi. Tekirdağ Ziraat Fakültesi Dergisi (JOTAF), Tekirdağ, 8 (3): 8-15.
- Bellitürk, K., 2012. Tarım Toprakları İçin Toprak Analizleri ve Gübrelemenin Önemi. N.K.Ü. Ziraat Fakültesi El Kitabı, 20 s, Tekirdağ.
- Bellitürk, K., 2013. Toprak Verimliliğinin Belirlenmesinde Toprak ve Bitki Analizlerinin Önemi. NKÜ. Ziraat Fakültesi, Ziraathaber, Yıl: 2, Sayı: 7, Sayfa: 10-11.
- Belliturk, K., Hınısli, N. and Adiloglu, A., 2017. The Effect of Vermicompost, Sheep Manure, and Cow Manure on Nutrition Content of Curly Lettuce (*Lactuca sativa* var.). Fresenius Environmental Bulletin, 26 (1a): 1116-1120, Germany.
- Bellitürk, K., Kır, D. ve Çelikadam, S., 2018. Toprak İslahında Organik Maddenin Önemi: Ziya Organik Tarım İşletmeleri A.Ş. Uzunköprü Örneği. Uzunköprü Ticaret Borsası 2017 Yılı Faaliyet Raporu, s: 39-45, Uzunköprü-Edirne.
- Bellitürk, K., 2019. Asit ve Düşük Organik Madde İçeren Toprakların İslahı: Trakya Bölgesi Örneği. Kireç Dünyası, Yıl: 5, Sayı: 10, S: 19-22.
- Bellitürk, K. and Çelik, A., 2022a. Some Assessments on the Fertilizer Need of Winter Wheat (*Triticum aestivum* L.) Widely Grown in the Thrace Region. International Conference on Global Practice of Multidisciplinary Scientific Studies, pp. 976-985, 6-8 March, Cyprus.
- Bellitürk, K. and Çelik, A., 2022b. Is the Debate on Organic vs. Mineral Fertilization Meaningful? II-International Conference on Global Practice of Multidisciplinary Scientific Studies, July 26-28, 2022, pp. 754-762, ISBN: 978-625-8323-85-6, Batumi, Georgia.
- Çelik, A., Bellitürk, K. and Baran, M.F., 2022. The Role of Biochar in Medicinal and Aromatic Plants Production. International Conference on Global Practice of Multidisciplinary Scientific Studies, pp. 962-975, 6-8 March, Cyprus.
- F.A.O., 1990. Micronutrient Assesment at the Country Level: An International Study, FAO Soils Bulletin 63, Rome, Italy.
- Güneş, A., Aktaş, M., İnal, A. ve Alpaslan, M., 1996. Chemical and Physical Properties Konya Closed Basin Soils. Ankara University Agricultural Faculty Publication No:1453, Ankara.
- Güneş, A., Alpaslan, M. ve İnal, A., 2010. Bitki Besleme ve Gübreleme (Beşinci Baskı), Ankara Üniversitesi Ziraat Fakültesi Yayın No: 1581, Ders Kitabı No: 533, 576s. Ankara.
- Gürbüz, S.G. and Bellitürk, K., 2021. Determination of the Nutritional Status of Agricultural Lands in Tekirdag Province Ergene District. (Agricultural Researches Resourcebook). IKSAD Publishing House. ISBN: 978-625-8007-36-7. Chapter 3:45-79, Print Date: October, 2021, Ankara.
- Hamurcu, M., Gezgin, S., 2006. Bitki Beslemede Besin Elementleri Arasındaki Etkileşimin Önemi ve Bor ile Diğer Besin Elementleri Arasındaki Etkileşimler. Ziraat Fakültesi Dergisi, Konya.
- Jackson, M. L., 1958. Soil Chemical Analysis. Prentice-Hall, Inc. Englewood Cliffs, N.J.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- Lindsay, W.I. ve Norwell, W.A.,1969. Development of DTPA Micronutrient Soil Test, Soil Science Society of America Proceedings. 35:600-602.
- Lindsay, W. L. and Norvell, W. A., 1978. Development of a DTPA Test for Zinc, Iron, Manganese and Copper. Soi Sci. Soc. Am. J. 42, 421-428.
- Mumcuoğlu, A.Ç. and Bellitürk, K., 2021. Determination of Nutrition Status of Quince (*Cydonia oblonga* MILL.) Gardens by Leaf Analysis in Geyve District, Sakarya. MAS Journal of Applied Sciences, 6 (2): 312-324.
- Richards, L.A., 1954. Diagnosis and Improvement of Saline and Alkali Soils. United States Department of Agriculture Handbook 60, Washington D.C.
- Sağlam, M.T., 2012. Toprak ve Suyun Kimyasal Analiz Yöntemleri (Beşinci Baskı). Namık Kemal Üniv. Ziraat Fak. Yayın No: 2, Ders Kitabı No: 2, s: 1-184, Tekirdağ.
- Sağlam, M.T., Çullu, E.Z. ve Bellitürk, K., 2012. İki Farklı Tekstüre Sahip Toprakta Leonardit Organik Materyalinin Mısır Bitkisinin Azot Alımına Etkisi. Sakarya Üniversitesi Fen Edebiyat Dergisi, 14 (1): 383-391, Sakarya.
- Taşova, H. ve Akın, A., 2013. Marmara Bölgesi Topraklarının Bitki Besin Maddesi Kapsamlarının Belirlenmesi, Veri Tabanının Oluşturulması ve Haritalanması. Topraksu Dergisi, 2 (2): 83-95.
- TOVEP, 1991. Productivity Inventory of Turkey Soils. Republic of Turkey Ministry of Food, Agriculture and Livestock Publications, General Directorate of Rural Services, Ankara.
- TÜİK, (2021). Türkiye’de 2019 Yılında Kullanılan Gübre Miktarları, Erişim Tarihi: 14.05.2021, Erişim adresi, <https://biruni.tuik.gov.tr/medas/?locale=tr>:
- Ülgen, N. ve Yurtsever, N., 1974. Türkiye Gübre ve Gübreleme Rehberi. Toprak ve Gübre Araştırma Enstitüsü, Teknik Yayın No:28, Ankara.

**TARIM ALANLARIN BİTKİ BESLEME KAPASİTELERİNİN TOPRAK
ANALİZLERİ İLE BELİRLENMESİ: EDİRNE İLİ İPSALA İLÇESİ ÖRNEĞİ**

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ÖZET

Bu çalışma, Türkiye’de yoğun bir şekilde tarımsal üretim yapılan Edirne ilinin İpsala ilçesine bağlı farklı alanlardan alınan toplam 25 adet toprak örneğinin bazı fiziksel ve kimyasal özelliklerini incelemek ve mevcut verimlilik durumlarını ortaya çıkarmak amacıyla yapılmıştır. Toprak örnekleri, 0-30 cm derinlikten alınmıştır. Araştırma sonuçlarına göre; toprakların pH değerleri en düşük 4,85 (orta asit) ve en yüksek 8,10 (hafif alkalın) olarak bulunmuştur. Toprakların tuz içerikleri en düşük %0,01 (tuzsuz), en yüksek %0,23 (hafif tuzlu); organik madde içerikleri en düşük %0,18 (çok az), en yüksek %4,69 (yüksek); kireç (CaCO₃) içerikleri en düşük %0,00 (az kireçli), en yüksek %24,79 (fazla kireçli) ve %68’inin (17 tanesinin) “Tın (L)” tekstür sınıfına girdiği belirlenmiştir. Toprakların toplam N içerikleri en düşük %0,01 (çok az azotlu) ve en yüksek %0,23 (fazla azotlu) olarak tespit edilmiştir. Buna ilaveten en düşük-en yüksek P, K, Ca, Mg, Fe, Mn, Zn ve Cu içerikleri sırası ile 4,68-72,47; 73,93-571,74; 211,46-6346,63; 71,32-1035,40; 10,64-102,34; 16,23-139,30; 0,23-16,23 ve 0,49-7,66 ppm olarak tespit edilmiştir. Elde edilen bu çalışma sonuçlarının, Edirne ili İpsala ilçesinde tarımsal faaliyet sürdüren çiftçilere toprak analiz sonuçlarına göre yapılacak olan bilinçli gübrelemenin yararları konusunda yol göstereceği düşünülmektedir. Sürdürülebilir toprak yönetiminin sağlanması için gübreleme programlarında mutlaka organik gübrelere yer verilmesi gerektiği de elde edilen önemli sonuçlar arasındadır.

Anahtar Kelimeler: Toprak analizi, organik madde, gübreleme.

**DETERMINATION OF PLANT NUTRITION CAPACITIES OF AGRICULTURAL
AREAS BY SOIL ANALYSIS: THE CASE OF İPSALA DİSTRİCT OF EDİRNE
PROVINCE**

ABSTRACT

This study was carried out in order to examine some physical and chemical properties of 25 soil samples taken from different areas of the İpsala district of Edirne province, where intensive agricultural production is made in Turkey, and to reveal their current productivity status. Soil samples were taken from a depth of 0-30 cm. According to the research results; the lowest pH values of the soils were 4,85 (low acid) and the highest 8,10 (low alkaline). The salt content of the soils is the lowest 0,01% (saltless), the highest 0,23% (low salty); soil organic matter contents are the lowest 0,18% (very low), the highest 4,69% (high); it was determined that the lowest lime (CaCO₃) contents were 0,00% (low lime), the highest 24,79% (highly lime) and 68% (17 of them) were in the “Loam (L)” texture class. The total N contents of the soils were determined as the lowest 0,01% (too low nitrogen) and the highest 0,23% (too high nitrogen). In addition, the lowest-highest P, K, Ca, Mg, Fe, Mn, Zn and Cu contents were determined 4,68-72,47; 73,93-571,74; 211,46-6346,63; 71,32-1035,40; 10,64-102,34; 16,23-139,30; 0,23-16,23 and 0,49-7,66 ppm respectively. It is thought that the results of this study will guide the farmers, who have been carrying out agricultural activities about the benefits of conscious fertilization, which will be made according to the soil analysis results in İpsala district of Edirne province. It is also among the important results that organic fertilizers should be included in fertilization programs in order to ensure sustainable soil management.

Key words: Soil analysis, organic matter, fertilization.

GİRİŞ

Buğday ve ayçiçeği, Trakya Bölgesi için son derece yaygın olarak yetiştirilen iki ana münavebe bitkisidir. Ayçiçeği ülkemizin bitkisel yağ ihtiyacını karşılamak için bölgenin birçok yöresinde hem kuru ve hem de sulu koşullarda yetiştirilse de buğdaydan sonra kuru koşullarda en fazla yetiştirilen ana münavebe bitkisidir. Edirne ilinin Keşan ilçesinde de ağırlıklı olarak buğday, ayçiçeği ve arpa yetiştiriciliği yapılmaktadır. İlçe, iklim ve toprak yapısı bakımından tarıma son derece uygundur. Bitkisel ve hayvansal üretimde elde edilen verimlerin Türkiye ortalamasının üzerinde olduğu bilinmektedir. Ancak bölgede tarımsal açıdan önemli sorunlar arasında ise yoğun tarımsal faaliyetler nedeniyle toprak yapısının bozulması (pH değerleri bakımından asitleşme, organik maddenin düşmesi, geç tava gelmesi vb.) ve amaç dışı tarım arazilerinin kullanılması olduğu görülmektedir. Verimli bir tarım toprağında olması gereken O ve A horizonlarının (Şekil 1) artık bozulduğu ve A horizonunun (katmanının) içermesi gereken organik madde miktarının olması gereken %4-5 oranının çok altında ve hatta %0,5'den bile düşük olduğu yapılan çalışmalarda ortaya çıkmaktadır.



Şekil 1. Verimli bir toprağın katmanları.

Türkiye’de, Trakya birim alana en çok gübre kullanan yöredir. Burada birim alana kullanılan toplam gübre miktarı, yaklaşık olarak Türkiye ortalamasının iki katı kadardır. Bununla birlikte bölgede son zamanlarda bilinçsizce ve aşırı oranlarda gübre kullanıldığı da vurgulanmaktadır (Bellitürk ve ark., 2012). Çeltik üretiminde gereğinden fazla azotlu gübre kullanma eğilimi bir

tarafından milli gelir kaybına yol açarken, diğer yandan da üretimde girdi maliyetlerini yükseltmektedir. Bununla birlikte azot uygulama zamanlarının ve uygulama sayılarının çeltiğin tane ve sap verimine, ayrıca azotlu gübrelerden yararlanması üzerine önemli etkileri olduğu bilinen bir gerçektir (Korkmaz ve Bayraklı, 1987). Marmara Bölgesi'ndeki tarım topraklarının bitki besin maddesi durumlarının belirlenmesi amacıyla yapılan bir çalışmada, toplam 1752 farklı noktadan alınan toprakların pH bakımından %50,6'sının hafif alkali, %30'unun nötr, %13,8'inin hafif asit, %5,1'inin orta derecede asit, %0,3'ünün kuvvetli asit, %0,2'sinin ise kuvvetli alkali topraklar olduğu belirtilmiştir (Taşova ve Akın, 2013). Toprak ıslah programlarında organik gübrelemenin mutlaka "gübreleme programlarında" yer alması hem pH düzenleme ve hem de organik maddenin artırılması yanında tarım topraklarının su tutma kapasitelerinin de yükseltilmesi açısından oldukça önemlidir (Bellitürk ve ark. 2018; Bellitürk, 2019; Bellitürk ve Vardar, 2019). Tarımsal üretimde ana hedeflerden biri bitkisel üretimde kaliteyi diğeri ise verimin artırılmasıdır. Organik gübrelerin kalite üzerindeki etkileri önceki birçok çalışmada belirtilmiştir (Bellitürk, 2016; Bellitürk, 2017; Bellitürk ve Goldmann Benardete, 2020; Aslam ve ark., 2023).

Bu çalışmada Türkiye'de çeltik üretiminde önemli bir yere sahip olan Edirne ilinin İpsala ilçesinde, çeltik başta olmak üzere rulo çim, buğday, arpa vb. üretimleri yoğun olarak yapan üreticilerin tarlalarından alınan toplam 25 adet toprak örneğinin mevcut verimlilik durumları ortaya konulmaya çalışılmış ve doğru gübreleme ve toprak yönetimi açısından gelecekte alınması gereken önlemler üzerinde durulmuştur.

MATERYAL VE METOT

Bu çalışmada kullanılan toprak örnekleri ekimden önce son toprak hazırlığı yapıldığında (herhangi bir gübre ve tarım ilacı uygulaması yapılmadan önce) 0-30 cm derinlikten Edirne ili, İpsala ilçesinin değişik köy ve merkeze bağlı mevkilerinden ve özellikle yoğun olarak tarımsal üretim yapılan alanlardan (Çizelge 1) usulüne uygun olarak zig zag yöntemiyle alınmış ve akabinde analiz yapılacak laboratuvara getirildikten sonra, havada kurutulup ardından 2 mm'lik elekten geçirilerek analize hazır hale getirilmiştir (Jackson, 1958). Toprak örneklerinin tekstür sınıfı su ile doymuşluğuna göre; toprak reaksiyonu, Uluslararası Toprak İlmi Derneğinin önerdiği üzere 1:2.5 (toprak:su) oranında toprağın sulandırılarak, cam elektrotlu pH metre ile ölçülerek; tuz içeriği ise EC-metre ile ölçülüp % birimi cinsinden belirlenmiştir (Lindsay ve Norvell 1978, Richards 1954). Kireç miktarlarının belirlenmesi Scheibler Kalsimetresi ile volümetrik olarak yapılmıştır (Ülgen ve Yurtsever 1974). Topraklarda organik madde, Walkley-Black yöntemi ile belirlenmiştir (Sağlam, 2012). Alınabilir fosfor Spektrofotometre-Olsen metoduna göre yapılmıştır. Yarıyıllı Ca ve Mg ICP-OES (DTPA), Fe, Mn, Cu ve Zn

içerikleri ise ICP-OES yöntemi ile yapılmıştır (Linsay ve Norvell 1978). Değişebilir K ise fleymfotometrede (amonyum asetat) belirlenmiştir (Jackson 1958, Sağlam 2012). Toprak analizlerinin değerlendirilmesinde önceki çalışmalarda belirtilen standart değerler kullanılmıştır (Lindsay ve Norwell, 1969; FAO, 1990; TOVEP, 1991; Güneş ve ark., 1996; Güneş ve ark., 2010; Bellitürk, 2013).

Toprak örneklerinin alındığı yerlere ait bilgiler Çizelge 1’de gösterilmiştir.

SONUÇLAR VE ÖNERİLER

Araştırma bölgesine ait incelenen toprak örneklerinin bazı kimyasal ve fiziksel analiz sonuçları Çizelge 1’de topluca gösterilmiştir.

Çizelge 1. Toprak örneklerine ait bazı fiziksel ve kimyasal analiz sonuçları.

Örnek No	Örnek Alınan Yerlerin Köy-Mah.-Mevkii Adı	pH (1:2,5)	Topl. Tuz (%)	Org. Mad. (%)	Kireç (%)	Doymunluk (%)	
						(%)	Tekstür Sınıfı
1	Kocahıdır Köyü	7,52	0,42	0,83	0,41	39,0	Tın
2	Kocahıdır Köyü	8,03	0,41	1,25	0,40	42,0	Tın
3	Kocahıdır Köyü	7,98	0,24	0,71	0,41	38,0	Tın
4	Kocahıdır Köyü	7,88	0,25	0,62	0,42	47,0	Tın
5	Kocahıdır Köyü	8,10	0,28	0,85	0,40	39,0	Tın
6	Kocahıdır Köyü	7,93	0,22	0,89	0,45	39,0	Tın
7	Kumdere Köyü	5,37	0,03	0,68	0,00	33,0	Tın
8	Sarıcaali Köyü	5,36	0,06	1,01	0,00	38,0	Tın
9	Sarıcaali Köyü	4,95	0,05	0,97	0,00	33,0	Tın
10	Ahırköy Köyü	6,70	0,07	1,48	0,41	48,00	Tın
11	Koyuntepe Köyü	7,02	0,20	1,50	1,64	86,0	Kil
12	Koyuntepe Köyü	7,29	0,14	0,84	23,79	84,0	Kil
13	Koyuntepe Köyü	6,96	0,17	1,23	0,00	88,0	Kil
14	Koyuntepe Köyü	7,01	0,20	1,63	1,64	77,0	Kil
15	Kumdere Köyü	6,68	0,30	1,91	0,39	47,0	Tın
16	Kumdere Köyü	6,45	0,08	0,18	0,41	37,0	Tın
17	Ahırköy Köyü	7,06	0,08	1,59	0,41	67,0	Killi Tın
18	Kapucu Mah.	7,30	0,19	2,80	5,28	116,0	Ağır Kil
19	Merkez	7,00	0,10	4,69	4,04	44,0	Tın
20	Kumdere Köyü	6,65	0,24	1,64	0,39	48,0	Tın
21	Kumdere Köyü	7,02	0,29	1,48	0,39	46,0	Tın
22	Kumdere Köyü	6,86	0,15	0,83	0,39	42,0	Tın
23	Kumdere Köyü	6,71	0,18	1,97	0,40	76,0	Kil
24	Kumdere Köyü	6,87	0,21	1,17	0,36	51,0	Killi Tın
25	Kumdere Köyü	6,80	0,32	1,43	0,39	38,0	Tın
Min.	-	4,95	0,03	0,18	0,00	33,0	-
Maks.	-	8,10	0,42	4,69	23,79	116,0	-

Çizelge 1'den de görüldüğü gibi, Edirne ili, İpsala ilçesi topraklarının pH değerleri en düşük 4,95 ile “orta asit”, en yüksek 8,10 ile “hafif alkalin” sınıfında olduğu görülmektedir. Toplam tuz içerikleri bakımından en düşük %0,03 ile “tuzsuz”, en yüksek %0,42 ile “orta derecede tuzlu” sınıfında girdiği görülmektedir. Öte yandan toplam 25 adet toprak örneğinin organik madde içerikleri en düşük %0,18 (çok az) ve en yüksek %4,69 (çok fazla) olarak tespit edilmiştir (Lindsay ve Norwell, 1969; FAO, 1990; TOVEP, 1991; Güneş ve ark., 1996; Güneş ve ark., 2010; Bellitürk, 2013). Tekirdağ ilinin Ergene ilçesinde 70 adet toprak örneği üzerinde yapılan bir araştırma sonuçlarına göre; toprakların %40'ı “nötr”dür. Toprakların tamamının organik madde içerikleri ortalama bir değer olarak %1,25 olup, “çok az” ve “az” sınıfında ve organik maddece yetersiz olarak değerlendirilmektedir. Toprakların tamamı tuzsuz ve CaCO₃ içerikleri bakımından %82,61'inin “az” kireç içerdiği belirlenmiştir. İncelenen toprak örneklerinin büyük bir çoğunluğunun (%49,28) “tınlı” tekstür sınıfına girdiği görülmüştür (Gürbüz ve Bellitürk, 2021). Toprak örneklerinin bazı makro ve mikro bitki besin element durumları Çizelge 2'de gösterilmiştir.

Çizelge 2'den de görüldüğü gibi, toprakların toplam N içerikleri en düşük %0,01 ve en yüksek %0,23 olarak belirlenmiştir. Yarayışlı P içerikleri bakımından topraklarda en düşük 4,68 ppm ve en yüksek 72,47 ppm değeri ölçülmüştür. Değişebilir K, Ca ve Mg içerikleri bakımından en düşük sırasıyla 73,93; 211,46 ve 71,32 ppm olduğu tespit edilmiştir. Değişebilir K, Ca ve Mg içerikleri bakımından en yüksek sırasıyla 571,74; 6346,63 ve 105,40 ppm olduğu bulunmuştur. İlçeyi temsilen alınan toprakların yarayışlı mikro bitki besin element içeriklerinin (Fe, Mn, Zn ve Cu) en düşük-en yüksek değerleri sırasıyla 10,64-102,34; 16,23-139,30; 0,23-16,23 ve 0,49-7,66 ppm olduğu bulunmuştur. Toprak örneklerinin tamamına yakının yarayışlı Fe ve Cu bakımından yeterli olduğu görülmektedir. Yarayışlı Zn değeri az (0,2-0,7 ppm arası) olanların oranı %20 (5 adet) olup, toprakların genellikle yeterli ve fazla Zn içerdiği görülmektedir. Yarayışlı Mn içerikleri bakımından ise toprakların yeterli ve fazla sınıflarında yer aldığı görülmektedir.

Çizelge 2. Toprak örneklerine ait bazı makro ve mikro bitki besin element sonuçları

Örnek No	N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
	%	ppm							
1	0,04	30,23	177,86	743,70	259,42	26,04	43,87	1,55	1,24
2	0,06	73,17	571,74	1774,71	262,65	27,85	40,48	3,85	1,41
3	0,04	36,81	257,10	751,59	198,77	18,85	46,37	1,73	1,26
4	0,03	57,37	499,06	1074,77	352,34	11,62	20,87	3,95	0,95
5	0,04	4,68	152,17	211,46	280,48	15,42	41,66	2,51	1,27
6	0,04	32,05	224,28	1363,33	361,28	21,23	24,61	1,27	1,54
7	0,03	10,41	118,90	507,27	71,32	69,77	93,94	0,54	0,67
8	0,05	28,77	160,10	2645,00	488,20	10,64	23,83	0,76	0,49
9	0,05	30,75	109,40	757,50	174,20	45,61	139,30	0,96	0,60
10	0,07	10,06	132,47	2348,61	286,64	34,44	16,80	0,43	2,60
11	0,07	17,51	327,39	5828,34	849,43	52,20	52,62	1,06	4,38
12	0,04	7,19	188,32	5788,99	266,73	29,05	16,29	0,23	2,81
13	0,06	10,58	246,44	5936,70	548,61	34,04	24,83	0,43	2,79
14	0,08	14,04	251,18	5423,83	688,79	57,25	50,81	0,56	5,11
15	0,10	96,89	389,51	2142,79	358,01	12,05	45,77	3,02	1,62
16	0,01	21,23	200,04	1086,83	225,09	17,85	37,22	1,93	0,76
17	0,08	18,29	128,72	4283,01	599,18	29,44	16,23	16,23	2,56
18	0,14	15,89	236,37	6346,63	1035,40	102,34	39,73	0,89	7,66
19	0,23	16,63	159,31	3095,88	493,98	20,02	59,70	2,55	3,88
20	0,08	61,84	311,81	1299,13	382,89	17,81	32,95	2,33	1,27
21	0,07	56,28	304,32	1169,21	362,73	18,31	36,69	2,31	1,30
22	0,04	14,77	73,93	653,11	235,82	28,24	42,37	0,88	1,59
23	0,10	9,58	264,71	4704,48	598,54	19,19	20,68	0,76	2,15
24	0,06	11,47	141,34	1278,18	377,90	20,84	21,97	0,79	1,38
25	0,07	72,47	346,88	880,97	278,14	16,59	40,37	2,62	1,77
Min.	0,01	4,68	73,93	211,46	71,32	10,64	16,23	0,23	0,49
Maks.	0,23	72,47	571,74	6346,63	1035,40	102,34	139,30	16,23	7,66

Gürbüz ve Bellitürk (2021) tarafından Ergene ilçesinde yapılan benzer bir çalışma sonuçlarına göre incelenen 70 adet toprağın %69,57'sinde toplam azot "az", %55,07'sinde elverişli fosfor "yeterli", %49,28'de değişebilir potasyum "yeterli", %42,03'ünde değişebilir Ca "yeterli" ve %57,97'de değişebilir Mg'un "yeterli" olduğu görülmüştür. Elverişli mikro besin elementlerinden, Cu ve Mn'in "yeterli", Fe'in "fazla" ve Zn'in "az" olduğu tespit edilmiştir. Bu çalışmalardan elde edilen sonuçlar birçok yönüyle benzerlik taşımaktadır. Bellitürk ve ark. (2012) tarafından çeltik tarımı yapılan İpsala ve Meriç ilçelerinde yürütülmüş olan bir çalışmada toprak örneklerinin % N içerikleri bakımından tamamının organik maddede olduğu gibi "düşük" olduğu görülmektedir. Ortalama P, K, Ca, Mg, Fe, Mn, Zn ve Cu değerleri incelendiğinde, sırasıyla 19.25, 90.79, 1294.26, 171.32, 37.51, 38.52, 0.78 ve 1.31, ppm olduğu bulunmuştur. Buradan da açıkça görüldüğü gibi, Trakya Yöresi toprakları genel anlamda azot yönünden fakirdir. Bu durum yörede yapılan birçok çalışmada da benzer şekilde görülmüştür (Şinik, 2011; Bellitürk ve ark., 2011). Toplam N miktarının ve beraberinde topraklardaki organik maddenin artırılmasında son yıllarda Trakya Bölgesi'nde vermikompostun

kullanılmaya başlandığı görülmektedir. Vermikompost sadece topraklara değil, bitkilerin beslenmesine de olumlu katkılar sağlayan bir organik gübredir. Tarla koşullarda tesadüfi deneme desenine göre yürütülen çalışmada; farklı oranda vermikompost, inek ve koyun gübresi uygulamanın kıvırcık marulun gelişimine etkisi karşılaştırılmıştır. Vermikompostun özellikle Ca, Cu ve Zn elementlerinin kıvırcık marul bitki bünyesine alımında iyi sonuçlar verdiği ve erkencilik özelliğinde etkisinin önemli olduğu belirtilmiştir. Koyun gübresi uygulamalarının genel olarak bitki besin elementlerinin alınabilirliği açısından olumlu sonuçlar verdiği, inek gübresinin ise N alımında önemli rol oynadığı belirtilmiştir (Bellitürk, ve ark., 2017). Tarla koşullarında toprakların fiziksel ve kimyasal özelliklerini iyileştirerek buğday bitkisinin daha iyi büyümesini gözlemlemek amacıyla farklı organik materyallerden hazırlanan (inek gübresi, kâğıt atığı ve pirinç samanı) vermikompost ve inorganik gübrelerin farklı kombinasyonları kullanılarak buğday denemesi kurulmuştur. Üç farklı vermikompostun fiziko-kimyasal özellikler ve topraktaki besin mevcudiyeti üzerindeki etkisi, kimyasal gübrelerle birlikte etkinlikleri incelenmiştir. Elde edilen en iyi sonuçlar N:P:K 100:50:50 kg ha⁻¹ + 10 t ha⁻¹ inek gübresi vermikompostu uygulanan denemede görülmüştür. Bununla birlikte, toprağın hasat sonrası analizi yapılmış ve sadece vermikompost uygulanan örneklemelerin toprağın fiziko-kimyasal özelliklerini geliştirerek toprak sağlığını iyileştirdiğini ortaya çıkarmıştır. Sonuç olarak, önerilen N:P:K ile birlikte inek gübresi vermikompostu uygulaması ile sadece ürün verimi, toprak sağlığı, yaprak biti istilası değil, aynı zamanda Zn ve Fe ile zenginleştirilmiş tahıllar yetiştirilebileceği belirtilmiştir (Aslam, ve ark., 2019).

Trakya Bölgesi'nde yapılan çeltik tarımında çoğunlukla amonyum sülfat gübresi ile fosfor içeren 20-20-0 gibi kompoze gübreler tercih edilmektedir. Yanlış gübre kullanımı neticesinde hem toprakların pH değerlerinde istenmeyen düşüşler olduğu ve hem de toprakların artık bu derecede yalnızca fosfora değil potasyuma da ihtiyacı olduğu bilinmektedir. Ayrıca topraklardaki çinko eksikliği de önemsenmeli ve doğru gübre kullanımına gereken önem verilmelidir (Bellitürk ve ark., 2012). Trakya Bölgesi sınırlarında özellikle sulu tarım modeliyle çim yetiştirilen ve hatta çeltik üretimi yapılan İpsala, Meriç, gibi ilçelerde fazla kimyasal gübre kullanıldığına yönelik çok fazla araştırmalar mevcuttur. Ancak kimyasal gübreler ile birlikte organik gübrelerin de kullanılmış olması ile hem gübrelemenin etkinliği artacak ve hem de sadece bitkiler değil, topraklar da iyileştirilmiş olacaktır. Organik gübrelerden vermikompost üreten firmaların bölge genelinde çok fazla olması bir avantaj olup, çiftçilerin tarım ve peyzaj alanlarında giderek artan vermikompost kullanım alışkanlıklarının olduğu da görülmektedir (Bellitürk, 2018; Çelik ve ark, 2022; Bellitürk ve ark., 2022; Kocagöz ve ark., 2022; Aslam ve ark., 2023). Toprakları asitleştirme etkisi yüksek olan gübrelerin kullanılması neticesinde

toprakların pH deęerleri giderek yıldan yıla düşmekte ve tarımsal üretim deęerleri de olumsuz olarak etkilenmektedir (Bellitürk, 2019).

Artan üretim isteęi, iklimsel deęişiklikler, kullanılan kimyasal gübre ve tarımsal ilaçlar doğanın kendine özel yapısını bozarak, tarımsal üretimin sürdürülebilirliğini olumsuz yönde etkilemektedir. Hedeflenen ana unsur, tarımsal üretimi gerçekleştirirken yüksek düzeyde verimin yanında doğal varlıklar açısından sürdürülebilirliğin çok önemli bir kavram olmasıdır. Organik gübreler, toprak kalitesini ve verimlilięi artıran en önemli parametrelerden biridir. Bitkisel ve hayvansal atıkların kompost, vermikompost olarak deęerlendirilmesi ile, tarımsal üretimde kullanılan kimyasal gübrelere olan talebin azalması, ekonomik ve çevresel anlamda büyük faydalar sağlayacaktır. Özellikle İpsala gibi yorgun tarım topraklarına sahip ilçelerde kimyasal gübrelerin beraberinde organik gübreler ile birlikte veya uygun gübreleme programı dahilinde kullanılması hem gübrelemenin etkinlięi artıracak hem de sadece bitkiler deęil topraklar da beslenmiş olacak ve verimde yüksek-kaliteli deęerler elde edilmiş olacaktır.

KAYNAKLAR

- Aslam, Z., Bashir, S., Hassan, W., Bellitürk, K., Ahmad, N., Niazi, N.K., Assan, K., Khan, M.İ., Chen, Z. ve Matiah, M., 2019. Unveiling the Efficiency of Vermicompost Derived from Different Biowastes on Wheat (*Triticum aestivum* L.) Plant Growth and Soil Health. *Agronomy* 2019, 9(12), 791.
- Aslam, Z., Ahmad, A., Bellitürk, K., Kanwal, H., Asif, M., and Ullah, E., 2023. Integrated Use of Simple Compost, Vermicompost, Vermi-Tea and Chemical Fertilizers NP on the Morpho-Physiological, Yield and Yield Related Traits of Tomato (*Solanum lycopersicum* L.). *Journal of Innovative Sciences*, 9(1): 1-12.
- Bellitürk, K., Soytürk, Ö., Aydoğan, F., Coşkun, D., Alpaydın, E., Özel, S. ve Sivrikaya, N., 2011. Research on Relationship Between Fertilization and Environment in Agricultural Soils of Edirne-Havsa District. Edirne İli Havsa İlçesi Tarım Topraklarında Gübreleme-Çevre İlişkisinin İncelenmesi. I. Ulusal Akdeniz Orman ve Çevre Sempozyumu, 26-28 Ekim, s: 330-339, Kahramanmaraş.
- Bellitürk, K., Karakaş, Ö., Arabacı, O., Kocaman, P. ve Gür, B., 2012. Çeltik Tarımı Yapılan Toprakların Beslenme Durumlarının Belirlenmesi: İpsala ve Meriç Örneği. *Sakarya Üniversitesi Fen Edebiyat Dergisi*, 14 (1): 187-196, Sakarya.
- Bellitürk, K., 2013. Toprak Verimliliğinin Belirlenmesinde Toprak ve Bitki Analizlerinin Önemi. *NKÜ. Ziraat Fakültesi, Ziraathaber*, Yıl: 2, Sayı: 7, Sayfa: 10-11.
- Bellitürk, K., Hınıslı, N. ve Adiloğlu, A., 2017. The Effect of Vermicompost, Sheep Manure and Cow Manure on Nutrition Content of Curly Lettuce (*Lactuca sativa* var.). *Fresenius Environmental Buletin* 26(1a), 1116-1120.
- Bellitürk, K., 2016. Sürdürülebilir Tarımsal Üretimde Katı Atık Yönetimi İçin Vermikompost Teknolojisi. *Çukurova Tarım, Gıda Bil. Dergisi*, 31(3), 1-5.
- Bellitürk, K., 2017. Solucan Gübresi Üreticisinin El Kitabı. "Toprak ve Çevre İçin Solucan Gübresinin Önemi." Tekirdağ: Riverm Yayınları.
- Bellitürk, K., 2018. Some Evaluations About Use of Vermicompost in Agricultural Activity of Thrace Region, Turkey: A Review. *Journal of Rice Research*, 6 (2): 1000193.
- Bellitürk, K., Kır, D. ve Çelikadam, S., 2018. Toprak İslahında Organik Maddenin Önemi: Ziya Organik Tarım İşletmeleri A.Ş. Uzunköprü Örneği. *Uzunköprü Ticaret Borsası 2017 Yılı Faaliyet Raporu*, s: 39-45, Uzunköprü-Edirne.
- Bellitürk, K. and Vardar, Ö., 2019. Determination of Nutritional Status of Grass in Some Parks with Soil and Plant Analysis: The Case of Esenler County, Istanbul Province. *Fresenius Environmental Bulletin*, 28 (12): 9240-9251, Germany.
- Bellitürk, K., 2019. Asit ve Düşük Organik Madde İçeren Toprakların İslahı: Trakya Bölgesi Örneği. *Kireç Dünyası*, Yıl: 5, Sayı: 10, S: 19-22.
- Bellitürk, K., Goldmann Benardete, B., 2020. Doğanın Mucizevi Canlıları (Toprağın Bereketi ve Çevre Sağlığına Yüzyıllardır Hizmet Eden Solucanlar). İstanbul: Eco Reform Yayınları.
- Bellitürk, K., Çelik, A. and Baran, M.F., 2022. The Effect of Vermicompost Application on Soil Properties in Olive (*Olea europaea* L. cv. Memecik). *Erwerbs-Obstbau*, (2022) 64: 107-113.
- Çelik, A., Bellitürk, K. and Baran, M.F., 2022. The Role of Biochar in Medicinal and Aromatic Plants Production. *International Conference on Global Practice of Multidisciplinary Scientific Studies*, pp. 962-975, 6-8 March, Cyprus.
- F.A.O., 1990. Micronutrient Assesment at the Country Level: An International Study, *FAO Soils Bulletin* 63, Rome, Italy.

- Güneş, A., Aktaş, M., İnal, A. ve Alpaslan, M., 1996. Chemical and Physical Properties Konya Closed Basin Soils. Ankara University Agricultural Faculty Publication No:1453, Ankara.
- Güneş, A., Alpaslan, M. ve İnal, A., 2010. Bitki Besleme ve Gübreleme (Beşinci Baskı), Ankara Üniversitesi Ziraat Fakültesi Yayın No: 1581, Ders Kitabı No: 533, 576s. Ankara.
- Gürbüz, S.G. and Bellitürk, K., 2021. Determination of the Nutritional Status of Agricultural Lands in Tekirdag Province Ergene District. (Agricultural Researches Resourcebook). IKSAD Publishing House. ISBN: 978-625-8007-36-7. Chapter 3:45-79, Print Date: October, 2021, Ankara.
- Jackson, M. L., 1958. Soil Chemical Analysis. Prentice-Hall, Inc. Englewood Cliffs, N.J.
- Kocagöz, Y.M., Bellitürk, K. and Hurma, H., 2022. Comparison of Organic and Chemical Fertilizer Use: The Case of Muratlı District of Tekirdağ Province. *Adyutayam*, 10 (2): 108-127.
- Korkmaz, A. ve Bayraklı, F., 1987. An Investigation on Efficiency of Urea and Ammonium Nitrogen in Flooded Rice Soil. *Ondokuz Mayıs Üniv. Ziraat Fak. Dergisi* 2(1): 15-30, Samsun.
- Lindsay, W.I. ve Norwell, W.A., 1969. Development of DTPA Micronutrient Soil Test, *Soil Science Society of America Proceedings*. 35:600-602.
- Lindsay, W. L. and Norvell, W. A., 1978. Development of a DTPA Test for Zinc, Iron, Manganese and Copper. *Soi Sci. Soc. Am. J.* 42, 421-428.
- Richards, L.A., 1954. Diagnosis and Improvement of Saline and Alkali Soils. United States Department of Agriculture Handbook 60, Washington D.C.
- Sağlam, M.T., 2012. Toprak ve Suyun Kimyasal Analiz Yöntemleri (Beşinci Baskı). Namık Kemal Üniv. Ziraat Fak. Yayın No: 2, Ders Kitabı No: 2, s: 1-184, Tekirdağ.
- Şinik, E., 2011. Edirne İlinde Bulunan Asit Karakterli Toprakların Bitki Besin Elementleri ve Bazı Ağır Metal İçeriklerinin Belirlenmesi Üzerinde Bir Araştırma, N.K.Ü. Fen Bilimleri Enstitüsü Yüksek Lisans Tezi (Danışman: K. Bellitürk), Edirne.
- Taşova, H. ve Akın, A., 2013. Marmara Bölgesi Topraklarının Bitki Besin Maddesi Kapsamlarının Belirlenmesi, Veri Tabanının Oluşturulması ve Haritalanması. *Topraksu Dergisi*, 2 (2): 83-95.
- TOVEP, 1991. Productivity Inventory of Turkey Soils. Republic of Turkey Ministry of Food, Agriculture and Livestock Publications, General Directorate of Rural Services, Ankara.
- Ülgen, N. ve Yurtsever, N., 1974. Türkiye Gübre ve Gübreleme Rehberi. Toprak ve Gübre Araştırma Enstitüsü, Teknik Yayın No:28, Ankara.

**TRAKYA BÖLGESİNDE KANOLA (*Brassica napus oleifera s.p*) YETİŞTİRİLEN
TOPRAKLARIN YARAYIŞLI KÜKÜRT MİKTARININ BELİRLENMESİNDE
KULLANILABİLECEK YÖNTEMLERİN ARAŞTIRILMASI**

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ÖZET

Bu araştırmanın amacı; ülkemizde yapılan kanola (*Brassica napus oleifera s.p*) tarımında çok önemli bir paya sahip olan Trakya Bölgesinde kanola yetiştirilen toprakların yarayışlı kükürt miktarının belirlenmesinde kullanılabilecek en uygun yöntem veya yöntemleri seçmektir. Bu amaçla toprak ve bitki örneklemeleri bölgede yaygın olarak kanola (*Brassica napus oleifera s.p*) tarımı yapılmakta olan yöreleri en iyi temsil edecek şekilde (Tekirdağ, Kırklareli, İstanbul ve Çanakkale) illerinden alınmıştır. Bölge topraklarının kükürt durumu ile bu topraklara uygulanacak en uygun yöntemin seçimi için 53 adet toprak örneklerinin alındığı alanlarda yetiştirilen kanola (*Brassica napus oleifera s.p*) bitkisinin yapraklarındaki kükürt miktarları tespit edilmiştir. Bitki yapraklarında tespit edilen kükürt miktarları ile alınan 53 adet toprak örneğinin her birine uygulanan 7 farklı kükürt tayin yöntemleri (saf su, KH_2PO_4 , NaCl, NH_4OAc , CaCl_2 , $\text{Ca}(\text{H}_2\text{PO}_4)_2$, KCl) ile belirlenen kükürt içerikleri karşılaştırılmıştır. Yapılan bu çalışma ile Trakya Bölgesi toprakları için tavsiye edilebilecek en uygun yarayışlı kükürt tayin yöntemleri olarak $\text{Ca}(\text{H}_2\text{PO}_4)_2$ ve KH_2PO_4 yöntemleri önerilmiştir.

Anahtar kelimeler: toprak, yarayışlı kükürt, ekstraksiyon yöntemi, ICP.

**INVESTIGATION OF SUITABLE EXTRACTION METHODS FOR DETERMINING
THE AVAILABLE SULPHUR CONTENTS OF TRAKYA REGION SOILS WHICH
GROWING CANOLA (*Brassica Napus Oleifera S.P*)**

ABSTRACT

The aim of this research is to choose the most suitable extraction method which will be used for determining the quantity of appropriate sulphur of Trakya Region soils growing canola (*Brassica napus oleifera s.p*). Soil and plant samples directed to this aim have been taken from the province (Tekirdağ, Kırklareli, İstanbul and Çanakkale) which will symbolize the region's best where canola (*Brassica napus oleifera s.p*) grown. To select best suitable methods which will apply this soil with the sulphur state of region soils, quantity sulphur had been determined in the leaf of canola plant (*Brassica napus oleifera s.p*) which was grown on the lands taking number of fifty-three soils samples. Quantity sulphurs which were determined with seven different extraction methods (pure water, KH_2PO_4 , NaCl , NH_4OAc , CaCl_2 , $\text{Ca}(\text{H}_2\text{PO}_4)_2$, KCl) applying to each of fifty-three soil samples with quantity sulphurs which were determined from plant leaf compared with this search which was made, the most suitable sulphur extraction methods that is advised for Trakya region soils are $\text{Ca}(\text{H}_2\text{PO}_4)_2$ and KH_2PO_4 .

Keywords: Soil, available sulphur, extraction method, ICP

1.GİRİŞ

Kanola bitkisi tohumlarında bulunan % 38-50 arası yağ oranı ile önemli bir yağ bitkisi olup, 15 günde 100 kg bal ve yaklaşık 1 kg balmumu yapabilmektedir Kanola dünyada yaklaşık 27 milyon hektar ekiliş alanı ve 46 milyon ton üretimi ile soya fasulyesinden sonra ikinci sırada yer almaktadır. Avrupa Birliği ülkeleri, Dünya’da fosil yakıtlarının artması sonucu kanola üretimi için üye ülkeleri teşvik ve 2006 yılı itibariyle tüketmekte oldukları yıllık ortalama 160 milyon ton dizel yakıtı 2020 yılına kadar % 10 civarına biodizel yakıtı karıştırılması hedeflemektedir (Süzer, 2008).

Kanola ekim alanları 2006 yılında 27 bin dönüm iken 2007 yılında 50 bin dönüme çıkmıştır. Trakya Bölgesinde ekimi 2007-2008 yıllarında 200 000 da alanı geçmiştir (Hacaloğlu, 2008). 2021 yılında ise 269 148 da’lık bir alanda kanola üretimi gerçekleştirilmiştir (Anonim, 2022) <https://blog.agcurate.com/>).

Kanola ülkemiz yağ açığının kapatması yağ fabrikalarına Haziran, Temmuz, Ağustos aylarında hammadde sağlaması toprağın yapısını düzeltmesi, küspesinde % 38-40 protein bulunması ve Kanola bitkisinde kükürt, noksanlığı, bitkide dal sayısını, verimli çiçek sayısını harnupta tane sayısını ve bir tane sağrılığını olumsuz etkilemekte, bitki bodurlaşmakta ve ince gövde çalimsı bir görünüm almaktadır. Bitkide kloroz belirtisi görülmekte kök kuvvetli bir şekilde gelişmemektedir.

Kükürt noksanlığında bitkilerde/çiçeklenme polen az olduğundan arılar etkilenmemektedir. Kükürt elementi Kanola bitkisinde yağ, protein ve glukosinolat oranı üzerine etkilidir. Ayrıca kanola küspesinin protein oranı üzerinde de etkili olmaktadır. Arı ve arıcılara polen sağlaması bakımından çok önemli bir bitkidir.

İstenen kalite ve verime ulaşılabilme için kültür topraklarında yetiştirilmesi düşünülen bitkinin isteklerine cevap verebilecek miktar ve çeşitlerde bitki besin maddesi sağlanmış olması ve üretim süresince bu düzeyin korunması gerekmektedir. Bu nedenle bitki besin elementlerinin miktarlarının tespitlerinin yapıp buna göre gübre takviyesi yapılmalıdır.

Topraklarda bitkiye yarayışlı besin maddesi miktarlarının belirlenmesinde kullanılan yöntemler; laboratuvar, sera ve tarla yöntemleridir. Bu yöntemlerden sera ve tarla yöntemleri fazla zamana, işgücü ile paraya ihtiyaç duyulması sebebi ile kullanımları sınırlıdır.

Buna karşın laboratuvar yöntemleri (ekstraksiyon yöntemleri) diğer yöntemlere oranla daha avantajlı olmalarından dolayı topraklarda tespiti yapılması gereken bitkiye yararlı besin maddesi miktarının belirlenmesinde yaygın olarak kullanılan yöntemlerdir.

Günümüzde araştırmacılar bitkiye yararlı kükürdün belirlenmesi amaçlı birçok ekstraksiyon yöntemi belirlemişlerdir. Fakat her bölgenin farklı ekolojik koşullara bağlı değişik toprak oluşum öğeleri sonucu oluşan ayrı özelliklere sahip topraklarda yararlı kükürdün belirlenmesine ait tek bir ekstraksiyon yöntemi tespit edilmemiş yukarıda bahsedilen sebeplerden dolayı da tespit edilmesi mümkün değildir.

Bu araştırmada Trakya Bölgesinde yaygın olarak ekimi yapılan kanola bitkisinin yetiştirildiği topraklarda yararlı kükürt miktarının belirlenmesinde kullanılabilecek en uygun ekstraksiyon yöntemi veya yöntemleri ortaya konulmuştur.

2.MATERYAL VE YÖNTEM

2.1. Materyal

2.1.1. Toprak ve Bitki Örneklerinin Alınması ve Analize Hazırlanması

Bu araştırmada Trakya Bölgesinde yaygın olarak kanola tarımı yapılan alanları en iyi şekilde temsil eden arazilerden örnekleme yapılmasına dikkat edilmiştir. Bölgede yer alan Tekirdağ, Kırklareli, İstanbul, Çanakkale (Avrupa kesimi) illerinin kanola yetiştirilen 53 adet tarım arazisinden toprak örneği kanola ekiminden hemen önce Ekim ayı içerisinde usulüne uygun bir biçimde 2010- 2011 ve 2011- 2012 ekim ve dikim döneminde alınmıştır (Jackson, 1962). Toprak örneklerinin alındığı arazilerden Nisan ayı içerisinde de bitki örnekleri alınmıştır (Jones ve ark., 1991).

2.2. Yöntemler

2.2.1. Toprak Örneklerinde Yapılan Bazı Fiziksel ve Kimyasal Analizler

Toprak örneklerinde yapılan bazı fiziksel ve kimyasal analizler; Organik madde, kireç, toprak reaksiyonu (pH), tekstür, bitkiye yararlı fosfor, değişebilir katyonlar (K, Ca, Mg), toprak örnekleri yararlı mikro element analizi için 0.005 M DTPA+ 0.01 M CaCl₂ + 0,1 M TEA (pH 7.3) ile ekstrakte edilmiştir (Lindsay ve Norvell, 1978). Ekstrakttaki yararlı Fe, Cu, Zn ve Mn miktarları ICP-OES'de belirlenmiştir.

Topraklarda bitkilere yararlı kükürdün belirlenmesinde toprak örnekleri 7 farklı ekstraksiyon yöntemi ile ekstrakte edilmiş ve aşağıdaki çizelgede verilmiştir

Çizelge 1. Toprakların yarıyışlı kükürt miktarının belirlenmesinde kullanılan yöntemler

Ekstraksiyon çözeltisi	Toprak: çözelti oranı	Çalkalama süresi, dakika	Kaynak
Saf su	1: 5	30	Spencer ve Freney (1960)
KH ₂ PO ₄ (500 mg kg ⁻¹)	1: 5	30	Ensminger (1954)
NaCl (% 1)	1: 5	30	Williams ve Steinbergs (1959)
NH ₄ OAc (1 N)	1: 5	30	Mc Clung ve ark.(1959)
CaCl ₂ (% 0,15)	1: 6	30	Williams ve Steinbergs (1959)
Ca(H ₂ PO ₄) ₂ (500 mgkg ⁻¹)	1: 5	30	Fox ve ark. (1964)
KCl	1: 5	30	Maynard ve ark. (1987)

3. BULGULAR VE TARTIŞMA

3.1. Toprak Örneklerinin Bazı Fiziksel ve Kimyasal Özellikleri

Araştırma alanına ait toprak örneklerinin tekstür sınıfları Bouyoucos Hidrometre yöntemi ile yapılmıştır (Demiralay, 1993), çoğunlukla Tın ve Killi Tın sınıfına girmektedir kimyasal analiz sonuçlarının minimum, maksimum ve ortalama değerleri Çizelge 2’de verilmiştir.

Çizelge 2. Toprak örneklerinin bazı kimyasal özellikleri

	pH	Tuz, %	Kireç, %	Organik madde, %	Yarıyışlı P, mg kg ⁻¹	Değ. K, mg kg ⁻¹	Değ. Ca, mg kg ⁻¹	Değ. Mg, mg kg ⁻¹
Min	3,95	0,014	0,01	0,26	0,35	47	398	42
Max	8,00	0,120	44,00	3,00	73,00	735	7056	1179
Ort.	6,51	0,06	2,35	1,34	21,86	188	3470	326

Çizelge 2’ye göre toprakların pH değerleri elektrometrik olarak ölçülmüş (Sağlam, 2012) ve 3,95 ile 8,00 arasında; kireç içerikleri Scheibler Kalsimetresiyle belirlenmiş (Sağlam, 2012) ve % 0,01 ile % 44,00 arasında; organik madde içerikleri Smith-Weldon yöntemi ile tayin edilmiş (Sağlam, 2012) ve % 0,26 ile % 3,00; bitkilere yarıyışlı P içerikleri Olsen yöntemi ile ekstrakte

edildikten sonra (Sağlam, 2012), ICP-OES (Inductively Coupled Plasma Optical Emission Spectrometry) cihazında okunarak belirlenmiş ve $0,35 \text{ mg kg}^{-1}$ ile 73 mg kg^{-1} arasında; değişebilir katyonlar (K, Ca, Mg) (Sağlam, 2012)'e göre ekstrakte edilmiş ve ICP-OES ile belirlenmiştir. Değişebilir K değerleri 47 ile 735 mg kg^{-1} arasında, değişebilir Ca değerleri 398 ile 7056 mg kg^{-1} ve değişebilir Mg içerikleri ise 42 ile 1179 mg kg^{-1} arasında değişmektedir.

Toprak örnekleri yarayışlı mikro element analizi için $0.005 \text{ M DTPA} + 0.01 \text{ M CaCl}_2 + 0,1 \text{ M TEA}$ (pH 7.3) ile ekstrakte edilmiştir (Lindsay ve Norvell, 1978). Ekstrakttaki yarayışlı Fe, Cu, Zn ve Mn miktarları ICP-OES'de belirlenmiştir.

Araştırmada kullanılan Trakya Bölgesi kanola tarımı yapılan toprak örneklerinin yarayışlı bazı mikro besin elementi (Fe, Cu, Zn, Mn) içeriklerinin minimum, maksimum ve ortalama değerleri aşağıdaki Çizelge 3'de verilmiştir.

Çizelge 3. Toprak örneklerinin yarayışlı bazı mikro besin elementi içerikleri, mg kg^{-1}

	Fe	Cu	Zn	Mn
Min	3,00	0,07	eser	1,10
Max	73,00	6,00	1,99	87,64
Ort.	19,14	1,29	0,46	25,05

Toprakların Fe içerikleri yeterli düzeydedir (Lindsay ve Norwell, 1978), yarayışlı Cu içerikleri bir örnek hariç yeterlidir (Lindsay ve Norwell, 1978), yarayışlı Zn içerikleri çoğunlukla yetersiz düzeydedir (Lindsay ve Norwell, 1978), yarayışlı Mn içerikleri üç örnek hariç yeterli düzeydedir (Lindsay ve Norwell 1978).

3.2. Farklı Ekstraksiyon Yöntemleri ile Topraklarda Belirlenen Bitkilere Yarayışlı Kükürt Miktarları

Trakya Bölgesinde yaygın olarak kanola tarımı yapılmakta olan topraklarda bitkilere yarayışlı kükürt miktarlarının belirlenmesinde yedi farklı ekstraksiyon yöntemi kullanılmıştır. Söz konusu bu yöntemler göre belirlenen bitkilere yarayışlı kükürt miktarları Çizelge 4'de verilmiştir.

Çizelge 4. Trakya Bölgesinde kanola tarımı yapılan topraklarının farklı ekstraksiyon yöntemleri ile belirlenen bitkilere yarayışlı kükürt miktarları, mg kg⁻¹

	Saf su	KH ₂ PO ₄	NaCl	NH ₄ OAc	CaCl ₂	Ca(H ₂ PO ₄) ₂	KCl
Min	6,58	5,64	3,78	4,79	4,47	4,59	5,89
Max	79,44	65,15	86,22	65,57	60,66	65,26	75,41
Ort.	19,63	13,46	14,08	12,21	13,91	13,58	13,72

Çizelge 4. incelendiğinde 7 farklı ekstraksiyon yöntemi ile toprak örneklerinde belirtilen yarayışlı S miktarları birbirlerinden farklılıklar göstermektedir. Bu durumun nedeni olarak çözeltilerin ekstraksiyon güçlerinin farklı oluşu gösterilmiştir (Çelebi, 1977; Erdoğan, 2004)

3.3. Bitki Örneklerinin Kükürt İçerikleri

Araştırma alanındaki bitki örneklerinin kükürt içeriği ICP-OES ile yapılan belirlemede; % 0,24-3,97 aralığında değişmekte ve ortalama % 1,18 olarak bulunmuştur. Bitki örneklerinin kükürt içeriklerinin % 52,83'ü yeterli düzeydedir. Araştırmada ele alınan bitki örneklerinin % 47,17'nin kükürt miktarları ise yüksek düzeyde tespit edilmiştir (Jones ve ark., 1991).

3.4. Bitki Örneklerinin Kükürt İçerikleri İle Farklı Ekstraksiyon Yöntemleri ile Belirlenen Toprakların Bitkilere Yarayışlı Kükürt Miktarları Arasındaki İstatistiksel İlişkiler

Araştırma konusu için ele alınan topraklara uygulanan farklı ekstraksiyon yöntemleri ile elde edilen bitkilere yarayışlı kükürt miktarları ile bitki örneklerinin kükürt içerikleri arasında belirlenen korelasyon katsayıları aşağıdaki Çizelge 5'de verilmiştir.

Çizelge 5. Bitkilerin kükürt içerikleri ile toprakların farklı ekstraksiyon yöntemlerine göre yarayırlı kükürt içerikleri arasındaki korelasyon katsayıları, (r)

Uygulanan ekstraksiyon yöntemi	Bitki örneğinin kükürt içeriği
Saf su	0,823**
KH ₂ PO ₄	0,917**
NaCl	0,874**
NH ₄ OAc	0,880**
CaCl ₂	0,915**
Ca(H ₂ PO ₄) ₂	0,945**
KCl	0,873**

** : %1 düzeyinde önemli

Çizelge 5 incelendiğinde görüleceği üzere denemede kullanılan bütün yöntemler ile bitkilerin kükürt kapsamaları arasında istatistiksel olarak % 1 düzeyinde önemli ilişkiler elde edilmiştir.

Ancak bu yöntemler arasında Trakya Bölgesi kanola tarımı yapılan toprakların bitkilere yarayırlı kükürt miktarlarının belirlenmesinde kullanılabilir en uygun yöntemin Ca(H₂PO₄)₂ ekstraksiyon yöntemi olduğu (r: 0,945**) anlaşılmaktadır. İkinci sırada KH₂PO₄ yöntemi (r: 0,917**); üçüncü sırada CaCl₂ yöntemi (r: 0,915**); dördüncü sırada NH₄OAc yöntemi (r: 0,880**); beşinci sırada NaCl yöntemi (r: 0,874**); altıncı sırada KCl yöntemi (r: 0,873**) ve son sırada ise safsu yöntemi (r: 0,823**) izlemiştir. Bütün yöntemler ile belirlenen korelasyon katsayıları istatistiksel olarak % 1 düzeyinde önemli bulunmuştur

4. SONUÇ VE ÖNERİLER

Geniş alanlarda kanola tarımı yapılan Trakya Bölgesi topraklarında bitkilere yarayırlı kükürt miktarının tayininde kullanılabilir en uygun ekstraksiyon yönteminin belirlenmesi amacıyla 7 farklı ekstraksiyon yöntemi kullanılmıştır.

Bu araştırmada ele alınan yedi farklı ekstraksiyon yöntemi içinde yapılan istatistiksel değerlendirmeler yorumlandığında;

Yaygın olarak kanola tarımı yapılan Trakya Bölgesi topraklarında alınabilir kükürt miktarının belirlenmesinde araştırma topraklarına uygulanan yedi farklı ekstraksiyon yönteminin her biri bitkilerin kükürt içerikleri ile korelasyona tabi tutulmuş olup, en uygun yöntemin (r: 0,945**) korelasyon katsayısı ile Ca(H₂PO₄)₂ ekstraksiyon yöntemi olduğu anlaşılmaktadır. Çünkü bu

yöntem ile belirlenen toprakların bitkilere yarayışlı kükürt içerikleri ile bitkilerin kükürt içerikleri arasında en yüksek korelasyon katsayısı bulunmuştur. Bu yöntemi ($r: 0,917^{**}$) korelasyon katsayısı ile KH_2PO_4 yöntemi izlemektedir. Bütün yöntemler ile belirlenen korelasyon katsayıları istatistiksel olarak % 1 düzeyinde önemli bulunmuştur.

Bu araştırma daha önce Trakya Bölgesi toprakları için böyle bir çalışmanın yapılmamış olması ve pratikte koşullara bağımlı olarak uygulanabilirlik açısından iki farklı yöntemin tespit edilmiş olması nedenlerinden dolayı önem taşımaktadır.

Sonuç olarak bölgemizde kanola yetiştirilen toprakların yarayışlı kükürt miktarları bu iki yöntemden birisi ile belirlenip bitkinin ihtiyacı olan kükürt besin elementi kanola bitkisinde uygulanmalıdır. Aksi takdirde gereğinden fazla veya az miktarda kükürt uygulaması kanola bitkisinin verim ve kalitesini olumsuz bir şekilde etkileyecektir.

Teşekkür

Bu bildiri Serdar KADAKAL'ın Doktora tezinden hazırlanmıştır.

KAYNAKLAR

1. Anonim, (2022). <https://blog.agcurate.com/>. (erişim tarihi: 21.02.2023)
2. Çelebi, G., (1977). Antalya kıyı yöresi topraklarının kükürt durumu ve bu topraklarda, bitkiye yararlı kükürt miktarının belirlenmesinde kullanılacak yöntemler üzerine bir araştırma. A.Ü.Z.F. Bitki Besleme Kürsüsü, Doçentlik Tezi Ankara.
3. Demiralay, İ., (1993). Toprağın Fiziksel Analizleri. Atatürk Üni. Ziraat Fak. Yayınlan No: 143, Erzurum.
4. Ensminger, L. E., (1954). Some Factors affecting the adsorption of sulfate by Alabama soils. Soil Sci. Soc. Amer Proc. 18 (3): 259-264.
5. Erdoğan, S., (2004). Ege Bölgesi Pamuk Tarımı Yapılan Topraklarda Farklı Ekstraksiyon Yöntemleri ile Alınabilir Kükürt Miktarının Belirlenmesi. Yüksek Lisans Tezi, Ege Üniversitesi Fen Bilimleri Enstitüsü Toprak Anabilim Dalı, İzmir.
6. Fox, R.A., Olsen H., Rhoades, F., (1964). Evaluating the sulphur status of soils by plant and soil test. Soil Sci. Soc. AM. proc. 28: 435-439.
7. Hacaloğlu, A. H., (2008). Trakya çiftçisinin yeni umudu kanola <http://arsiv.ntvmsnbc.com/news/443854.asp>. (erişim tarihi: 01.11.2012)
8. Jackson, M.L., (1962). Soil chemical analysis Prentice-Hall.Inc.
9. Jones, J.B. Wolf Jr., B. and Mills. H. A., (1991). Plant analysis Handbook. Micro-Macro Publishing, Inc. USA.
10. Lindsay, W.L., and Norwell, W.A., (1978). Development of DTPA Soil Test Zinc, Iron, Manganese and Copper, Soil Sci. Soc. Am. J. 42: 421-428.
11. Maynard, D.G., Kalra Y.P. and Radford. F.G., (1987). Extraction and determination of sulphur in organic horizons of forest soils. Soil Sci. Soc Am. J. S1:801-806.
12. Mc Clung, A.C., Fretias L.M.M. and. Lott., W.L (1959). Analyses of several Brazilian Soils in relation to plant responses to sulfur. Soil Sci. Soc. Amer. Proc. 23: 221-224.
13. Sağlam, M.T. (2012). Toprak ve Suyun Kimyasal Analiz Yöntemleri. Namık Kemal Üniversitesi Yayınları No: 2, Ders Kitabı No: 2, Tekirdağ.
14. Spencer, K., Freney J.R., (1960). A comparison of several procedures for estimating the sulphur status of soils. Australian J. Agr. Research, 11: 948-959.
15. Süzer, S, (2008). Kanola Tarımı. Hasad Yayıncılık, İstanbul, 17-20s.
16. Williams C.H and Steinbergs, A., (1959). Soil sulphur fractions as chemical indices of available sulphur in some Australian soils. Aust. J. Agric. Res.

**EDİRNE İLİ OTOBAN KENARLARINDAKİ TARIM ALANLARINDA BAZI AĞIR
METAL KİRLİLİĞİNİN ARAŞTIRILMASI**

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ÖZET

Bu araştırma, Edirne ilinden geçen otoban kenarlarındaki topraklarda bazı ağır metallerin kirliliğinin belirlenmesi amacıyla yapılmıştır. Bunun için Edirne merkez ilçe ve Havsa ilçelerinden 56 farklı yerden toprak örneği alınmıştır. Elde edilen bulgulara göre topraklar genellikle nötr pH'da ve tuzsuz özelliktedir. Toprakların tekstürleri genellikle "Kumlu Killi Tın (SCL)" tekstür sınıfında olup, kireç kapsamları bakımından "az kireçli" sınıfına girmektedir. Toprakların organik madde kapsamları "yetersiz" düzeydedir. Toprakların yarayışlı P, değışebilir K, Ca ve Mg kapsamları ise "yeterli" düzeydedir. Toprakların bitkilere yarayışlı Fe ve Cu kapsamları "yeterli", ancak Zn ve Mn kapsamları "yetersiz" düzeydedir. Toprakların ekstrakte edilebilir Cd, Co, Cr, Ni ve Pb içerikleri sırasıyla 0.005-0.087; 0.011- 0.583; 0.044-0.182; 0.360-6.761; 1.212-5.561 mgkg⁻¹ arasında bulunmuştur. Bu sonuçlar göre, topraklarda Cd, Cr ve Ni kirliliğı saptanamamıştır. Ancak Co kirliliğı ve önemli boyutlarda da Pb kirliliğı saptanmıştır.

Anahtar kelimeler: Edirne, otoban, toprak, ağır metal, kirlilik, Cd, Co, Cr, Ni, Pb.

**AN INVESTIGATION OF SOME HEAVY METAL POLLUTION ALONG THE TEM
MOTORWAY AGRICULTURAL AREAS IN EDİRNE**

ABSTRACT

The aim of this research was to determine the heavy metal pollution of near the motorway soils in Edirne Province. For this purpose, soil samples were taken from 56 different agricultural lands near the motorway in Edirne. According to the results, the soils were generally neutral pH and saltless. The texture of soils was generally sandy-clay-loam (SCL) and less lime as classified. Organic matter amount is insufficient in soils. The contents of soils available P, exchangeable K, Ca and Mg are sufficient. Available Fe and Cu contents of soils are sufficient, but available Zn and Mn contents are insufficient. Extractable Cd, Cr, Co, Ni and Pb contents of the soil samples are between 0.005-0.087; 0.011- 0.583; 0.044-0.182; 0.360-6.761; 1.212-5.561 mgkg⁻¹, respectively. According to these results, Cd, Cr and Ni pollution were not determined in the soils. But beginning of Co pollution and important level Pb pollution were determined.

Keywords: Edirne, motorway, soil, heavy metal, pollution, Cd, Co, Cr, Ni, Pb.

1.GİRİŞ

Son yıllarda dünyadaki bu nüfus artışına paralel olarak endüstriyel faaliyetlerin yoğunlaşması sonucunda su, hava ve toprak kirlenmesi canlı yaşamını tehdit eden boyutlara ulaşmıştır. Ülkemizde hızlı sanayileşme ve nüfus artışı sonucu bu sorunlar daha sık gündeme gelmeye başlamıştır. Endüstriyel faaliyetlerle çevreye sızan ağır metaller çok önemli kirlilik unsuru olup, canlı ekosistemlere zarar vermektedirler. Doğal ve yapay yollarla ortama katılan ağır metaller kolayca birikip çevrede ve toprakta kompleks yapılar oluşturmaları nedeniyle tehlikeli kirleticiler olarak tanımlanmaktadır. Ağır metaller, çoğunlukla buldukları ortamda biyodegradasyona uğramadıklarından kolayca birikirler ve çok kompleks yapılar oluşturarak zehirlilik etkilerini de arttırabilirler. Günümüzde endüstrileşmenin artmasıyla çevrede ve toprakta ağır metal kirliliği yüksek miktarlara ulaşmıştır.

Ağır metaller periyodik tablonun 2A grubundan 6A grubuna kadar geniş bir alanda yer alan elementler olarak tanımlanmaktadır. Ağır metaller yoğunluğu 5 g/cm^3 den büyük olan metallerdir. Bu grupta Pb, Cd, Cr, Fe, Co, Cu, Ni, Hg ve Zn başta olmak üzere 60'tan fazla metal yer almaktadır. Bu elementler dünyamızda çoğunlukla karbonat, oksit, silikat ve sülfür halinde stabil bileşik veya silikatlar ile kompleks oluşturmuş şekilde bulunurlar (Haktanır ve Arcak, 1998).

Topraklarda Cd birikimi endüstriyel faaliyetler, fosforlu gübreler, lağım atıkları, yoğun trafik olan otoban kenarlarındaki tarım alanlarında motor yağları ile taşıt lastikleri yoluyla oluşmaktadır. Nitekim Brümmer ve ark. (1991) Almanya'nın Bonn şehrinde araç trafiğinin yoğun olduğu yol kenarlarından uzaklaştıkça topraktaki Cd miktarının $9,4 \text{ mgkg}^{-1}$ 'den $0,7 \text{ mgkg}^{-1}$ 'a düştüğünü belirlemiştir. Ayrıca bitki ve topraklarda Cd'un birikmesinde Cd içeren toz zerreciklerinin havadan çökmesinin de etkileri vardır. Yoğun trafik akışı gösteren yolların yakınındaki topraklarda toz çökelmeleriyle yılda metrekareye $0,2-1,0 \text{ mg Cd}$ ilave olduğu belirlenmiştir. Kirlenmeyen alanlarda ise toprağın toplam Cd kapsamı genellikle 1 mgkg^{-1} 'in altındadır (Kacar ve İnal, 2010).

Kadmiyum doğada oldukça az bulunan bir elementtir. Toprakta Cd'un toplam tolere edilebilir miktarı 3 mgkg^{-1} (Topbaş ve ark. 1998); ekstrakte edilebilir Cd'un tolere edilebilir miktarı ise $0,2 \text{ mgkg}^{-1}$ ' dir (Alloway, 1995).

Tarım alanlarındaki toplam Pb konsantrasyonu 100 mgkg^{-1} 'i, ekstrakte edilebilir Pb miktarı ise 4 mgkg^{-1} 'i aşmadığı sürece bitki ve insan sağlığı bakımından herhangi bir sorun

oluşturmamaktadır. Ancak bu rakamlar aşıldığında potansiyel olarak insan sağlığı tehlike altındadır (Chapman, 1971; Dürüst ve ark. 2004).

Toprakta bulunan Ni'in tolere edilebilir toplam miktarı 50 mgkg^{-1} (Kabata- Pendias ve Pendias, 1992); ekstrakte edilebilir miktarı ise 10 mgkg^{-1} (Gerendas ve ark., 1999) civarındadır. Topraklarda Ni'in temel kaynağı bazik kayalar içerisinde çoklukla bulunan Pentlandit (Fe, Ni)₈S₈ mineralidir. Nikel az ya da çok bütün tarım topraklarında bulunmaktadır. Ancak killi topraklarda daha fazla bulunmaktadır (Kacar ve İnal, 2010). Trafiğin yoğun olduğu yerlerde yol kenarlarından uzaklaştıkça topraktaki Ni miktarı da azalmakta ve bu durum da Ni içeren yakıtların kullanılması ile açıklanmaktadır (Tok, 1997).

Tarım topraklarında izin verilebilir toplam Cr düzeyi 100 mgkg^{-1} ve ekstrakte edilebilir Cr düzeyi ise 1 mgkg^{-1} dolayındadır. Serpantin ana maddesinden oluşan topraklar Cr yönünden zengindir. Doğada daha çok Cr-demir taşı şeklinde bulunmaktadır. Kromun topraklardaki miktarı ana materyale göre değişmekle birlikte $7- 750 \text{ mgkg}^{-1}$ arasındadır. Topraklar krom içeriklerine bakımından tekstürlerine göre değerlendirildiğinde ortalama olarak kumlu topraklarda 30 mgkg^{-1} , killi topraklarda 40 mgkg^{-1} ve kireçtaşından oluşmuş topraklarda ise 83 mgkg^{-1} bulunmaktadır. Krom toksisitesi özellikle ultrabazik kayalardan oluşan topraklarda görülmektedir (Bowen, 1966; Tok, 1997; Kacar ve İnal, 2010).

Toprakların toplam Co içeriği $1 - 40 \text{ mgkg}^{-1}$, ekstrakte edilebilir Co içeriği ise $0,03 - 0,09 \text{ mgkg}^{-1}$ arasında değişmektedir. Toprakta ekstrakte edilebilir Co'ın izin verilebilir sınır değeri $0,09 \text{ mgkg}^{-1}$ 'dir (Carrigan ve Erwin, 1951).

Bu araştırmada Edirne Merkez İlçe ve Havsa İlçesinden geçerek yurt dışı ile İstanbul'u birbirine bağlayan TEM Otoyolu güzergâhı boyunca otoban kenarlarındaki tarım arazilerinde meydana gelen karayolu taşımacılığında kaynaklanabilecek ağır metal kirliliğinin boyutlarını ortaya konulmuştur.

2.MATERYAL VE YÖNTEM

2.1. Materyal

Araştırmada kullanılan toprak örnekleri Edirne ili Havsa İlçesi ve Merkez ilçelerden geçerek Kapıkule sınır kapısı ile yurtdışına açılan TEM Otoban Yolunun Edirne İli içerisinde kalan yol kenarlarında bulunan tarım arazilerinden ve 56 farklı noktadan alınmıştır. Toprak örnekleri

otoban yolunun her iki yanından hemen otobanın bitiminde yer alan tarım arazilerinin uygun noktalarından 0-30 cm derinlikten alınmıştır (Jackson, 1967).

2.2. Yöntemler

2.2.1. Toprak Örneklerinde Yapılan Bazı Fiziksel ve Kimyasal Analizler

Toprak örneklerinde organik madde, kireç, toprak reaksiyonu (pH), tekstür, bitkiye yararışlı fosfor, değişebilir katyonlar (K, Ca, Mg) (Sağlam, 2012; Demiralay, 1993), yararışlı bazı mikro besin elementi (Fe, Cu, Zn ve Mn) analizi (Lindsay ve Norvell, 1978)'e göre yapılmıştır. Toprak örnekleri ekstrakte edilebilir bazı ağır metal analizi için 0.005 M DTPA + 0.01 M CaCl₂ + 0,1 M TEA (pH 7.3) ile ekstrakte edilmiştir (Lindsay ve Norvell, 1978). Ekstrakttaki Cd, Co, Cr, Ni, Pb miktarları ICP-OES'de belirlenmiştir.

3. BULGULAR VE TARTIŞMA

3.1. Toprak Örneklerinin Bazı Fiziksel ve Kimyasal Özellikleri

Araştırma alanına ait toprak örneklerinin tekstür sınıfları Bouyoucos Hidrometre yöntemi ile belirlenmiştir (Demiralay, 1993) ve çoğunlukla Kumlu Killi Tın (SCL) sınıfına girmektedir. Toprak örneklerinin bazı kimyasal analiz sonuçlarının minimum ve maksimum değerleri Çizelge 1'de verilmiştir.

Çizelge 1. Toprak örneklerinin bazı kimyasal özellikleri

	pH	Tuz, %	Kireç, %	Organik madde, %	Yararışlı P, mg kg ⁻¹	Değ. K, mg kg ⁻¹	Değ. Ca, mg kg ⁻¹	Değ. Mg, mg kg ⁻¹
Min	4,82	0,018	0,12	0,82	10,85	97,2	1724	140,0
Max	8,10	0,074	4,28	1,59	61,41	564,0	9197	885,6

Çizelge 1'e göre toprakların pH değerleri 4,82 ile 8,10; tuz içerikleri % 0,018 ile % 0,074; kireç içerikleri % 0,12 ile % 4,28; organik madde içerikleri % 0,82 ile % 1,59; bitkilere yararışlı P içerikleri 10,85 mg kg⁻¹ ile 61,41 mg kg⁻¹ arasında, değişebilir K içerikleri 97,2 ile 564 mg kg⁻¹; değişebilir Ca değerleri 1724 ile 9197 mg kg⁻¹ ve değişebilir Mg içerikleri ise 140 ile 885,6 mg kg⁻¹ arasında değişmektedir. Elde edilen bulgulara göre topraklar genellikle nötr pH'da ve tuzsuz özelliktedir. Topraklar kireç kapsamı bakımından "az kireçli" sınıfına girmektedir. Toprakların organik madde kapsamı "yetersiz" düzeydedir. Toprakların yararışlı P, değişebilir K, Ca ve Mg kapsamı ise "yeterli" düzeydedir.

Toprak örneklerinin bitkilere yararılı bazı mikro besin elementi (Fe, Cu, Zn, Mn) içeriklerinin minimum ve maksimum değerleri aşağıdaki Çizelge 2’de verilmiştir.

Çizelge 2. Toprak örneklerinin yararılı bazı mikro besin elementi içerikleri, mg kg⁻¹

	Fe	Cu	Zn	Mn
Min	2,84	0,22	0,08	3,48
Max	17,41	3,22	2,05	56,14

Toprakların bitkilere yararılı Fe içerikleri 2,84 ile 17,41 mg kg⁻¹ arasında ve yeterli düzeydedir (Lindsay ve Norvell, 1978), yararılı Cu içerikleri 0,22 ile 3,22 mg kg⁻¹ arasında olup, bir örnek hariç yeterlidir (Lindsay ve Norvell, 1978), yararılı Zn içerikleri 0,08 ile 2,05 mg kg⁻¹ arasında ve çoğunlukla yetersiz düzeydedir (Lindsay ve Norvell, 1978), yararılı Mn içerikleri 3,48 ile 56,14 mg kg⁻¹ arasında ve üç örnek hariç yeterli düzeydedir (Lindsay ve Norvell, 1978).

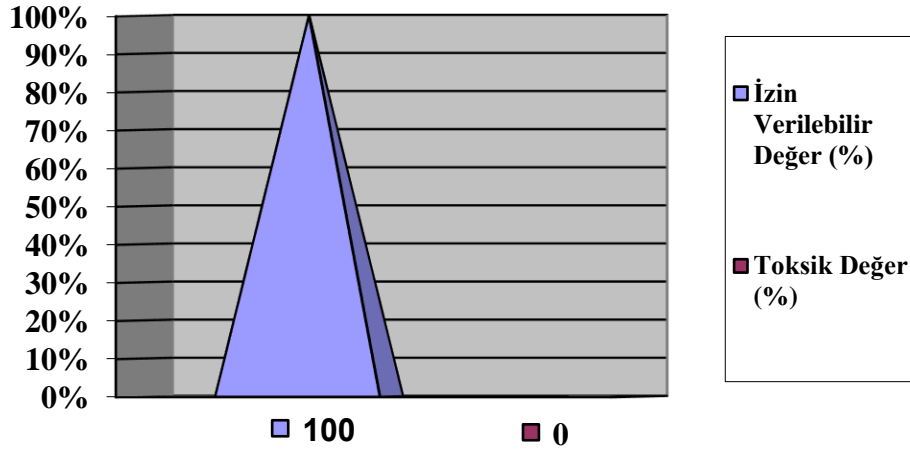
3.2. Araştırma Alanı Topraklarının Bazı Ağır Metal İçerikleri

Toprak örneklerinin ağır metal analizi sonuçlarına göre ekstrakte edilebilir kadmiyum (Cd), kobalt (Co), krom (Cr), nikel (Ni) ve kurşun (Pb) içeriklerinin minimum ve maksimum değerleri Çizelge 3.’de görülmektedir.

Çizelge 3. Toprak örneklerinin bazı ekstrakte edilebilir ağır metal içerikleri, mg kg⁻¹

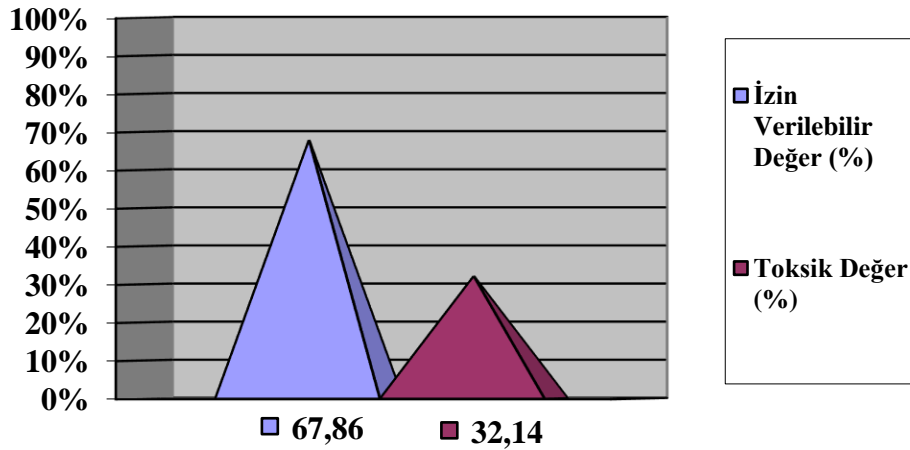
	Cd	Co	Cr	Ni	Pb
Min	0,005	0,011	0,044	0,360	1,212
Max	0,087	0,583	0,182	6,761	5,560

Araştırma alanı topraklarının ekstrakte edilebilir Cd içerikleri 0,005 mgkg⁻¹ ile 0,087 mgkg⁻¹ arasında değişmektedir. (Alloway, 1995)’ e göre yapılan değerlendirmede, toprakların % 100’ünde “izin verilebilir” düzeyde Cd bulunduğu gözlenmiştir. Bu durum Şekil 1’den de açıkça görülmektedir. Bu sonuç araştırma alanı topraklarında şimdilik bitkilere zarar verecek boyutta Cd kirliliğinin bulunmadığını göstermektedir.



Şekil 1. Araştırma alanı topraklarında belirlenen Cd kirliliği (%)

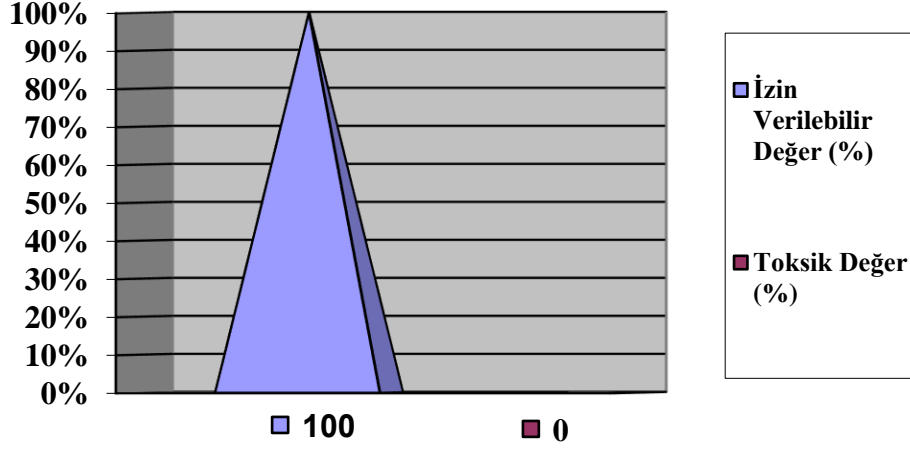
Araştırma alanı topraklarının ekstrakte edilebilir Co içerikleri $0,011 \text{ mgkg}^{-1}$ ile $0,583 \text{ mgkg}^{-1}$ arasında değişmektedir. (Carrigan ve Erwin, 1951)'e göre yapılan değerlendirmeye göre toprakların % 32,14'ünde "toksik", 67,86'sında "izin verilebilir" düzeyde Co bulunduğu gözlenmiştir. Bu sonuç ayrıca Şekil 2'den de görülmektedir. Bu bulgu araştırma alanı topraklarının 1/3'ünde bitkilere zarar verecek düzeyde Co bulunduğu belirlenmiştir. Bu durum yöredeki tarım alanlarında gerekli önlemler alınmazsa Co kirliliğinin daha da artabileceğini düşündürmektedir.



Şekil 2. Araştırma alanı topraklarında belirlenen Co kirliliği (%)

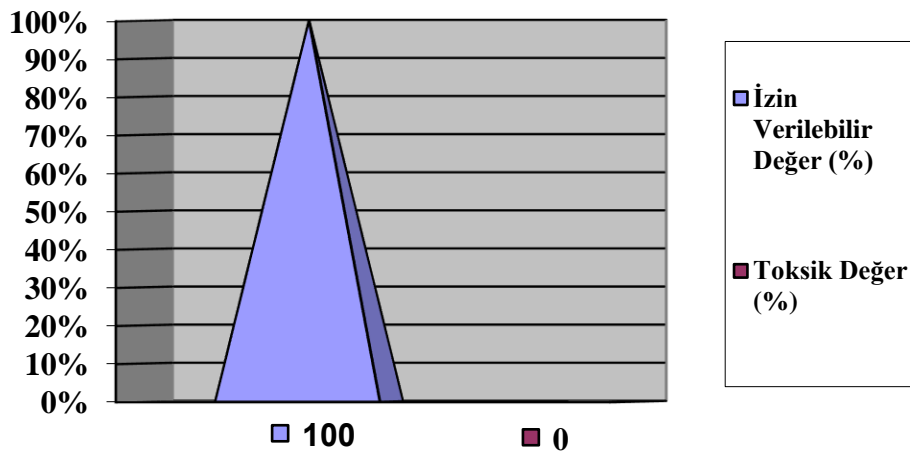
Araştırma alanı topraklarının ekstrakte edilebilir Cr içerikleri $0,044 \text{ mgkg}^{-1}$ ile $0,182 \text{ mgkg}^{-1}$ arasında değişmektedir. (Bowen, 1966)'ya göre yapılan değerlendirmede, toprakların %

100'ünde "izin verilebilir" düzeyde Cr bulunduğu gözlenmiştir (Şekil 3). Bu sonuç araştırma alanı topraklarında bitkilere zarar verecek boyutta herhangi bir Cr kirliliğinin bulunmadığını göstermektedir.



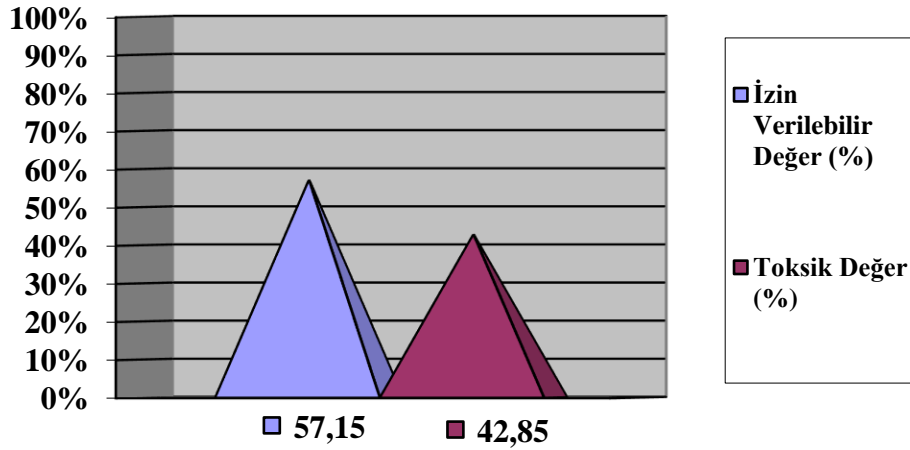
Şekil 3. Araştırma alanı topraklarında belirlenen Cr kirliliği (%)

Araştırma alanı topraklarında ekstrakte edilebilir Ni içerikleri $0,360 \text{ mgkg}^{-1}$ ile $6,761 \text{ mgkg}^{-1}$ arasında değişmektedir. (Gerendas ve ark 1999)'e göre toprakların % 100'ünde "izin verilebilir" düzeyde Ni bulunduğu gözlenmiştir. Bu durum ayrıca Şekil 4'de de görülmektedir. Bu durum araştırma alanı topraklarında şimdilik bitkilere zarar verecek boyutta Ni kirliliğinin bulunmadığını ancak gerekli önlemler alınmadığı takdirde ileriki yıllarda söz konusu tarım alanlarında Ni kirliliğinin de gündeme gelebileceğini göstermektedir. Çünkü bazı topraklarda yüksek değerlerde Ni belirlenmiştir.



Şekil 4. Araştırma alanı topraklarında belirlenen Ni kirliliği (%)

Araştırma alanı topraklarının ekstrakte edilebilir Pb içerikleri $1,212 \text{ mgkg}^{-1}$ ile $5,560 \text{ mgkg}^{-1}$ arasında değişmektedir. (Chapman, 1971)'e göre yapılan değerlendirmede toprakların % 42,85'inde "toksik", % 57,15'inde "izin verilebilir" düzeyde Pb bulunduğu gözlenmiştir (Şekil 5). Bu durum araştırma alanı topraklarının yaklaşık olarak yarıya yakınında bitkilere zarar verebilecek düzeyde Pb kirliliğinin bulunduğu belirlenmiştir.



Şekil 5. Araştırma alanı topraklarında belirlenen Pb kirliliği (%)

4. SONUÇ VE ÖNERİLER

Tarımsal üretim faaliyetinin yoğun olarak yapıldığı Edirne Merkez İlçeye bağlı Kemalköy, Yenikadın, Eskikadın ve Köşen Köyleri ile Yeniimaret, Yıldırım, Menzilahir, Şükrüpaşa ve Fatih Mahalleleri ile Havsa İlçesi Oğulpaşa, Söğütlüdere, Hasköy, Köseömer ve Bostanlı Köylerinden geçen Edirne-İstanbul TEM otoyolunun her iki kenarında yer alan tarım arazilerinden alınan toprak örneklerinde bazı analizler yapılmış ve aşağıdaki sonuçlar elde edilmiştir:

Toprak örneklerinin yarıya yakınında nötr reaksiyon tespit edilmiş olup, hafif asit ve hafif alkali reaksiyon sınıflamasına giren değerlerde de toplam oran nötr reaksiyona yakın olarak belirlenmiştir.

Araştırma alanı toprakları kireç kapsamlarına göre değerlendirildiğinde, büyük çoğunluğunun kireç içerikleri bakımından az kireçli grubuna girdiği gözlenmiş ve tarımsal üretim açısından kireç yönünden önemli bir sorunun olmadığı görülmüştür.

Araştırma alanı topraklarının tamamında organik madde miktarları yetersiz bulunmuştur. Bu sonuç, araştırma yapılan alanın tamamında çiftçilerin tarımsal üretimde organik gübrelere yeterince kullanmadıklarının bir göstergesidir.

Araştırma alanı topraklarının bitkilere yararlı fosfor miktarlarının yeterli ve yüksek düzeylerde olduğu belirlenmiştir. Çalışma yapılan arazilerde değişebilir potasyum içerikleri genelde yeterli düzeylerde tespit edilmiştir. Araştırma sahasında değişebilir Ca ve Mg miktarlarının yeterli ve yüksek düzeylerde olduğu belirlenmiştir.

Çalışma bölgesinde toprakların bitkilere yararlı Fe ve Cu miktarlarının yeterli olduğu görülmüştür. Araştırma alanı arazileri bitkilere yararlı Zn ve Mn içerikleri bakımından değerlendirildiğinde, toprakların önemli bir bölümünde bu elementlerin eksikliklerinin bulunduğu gözlenmiştir.

Araştırma bölgesinde, karayolu taşımacılığında kaynaklanan ağır metal kirlenmesi tespiti çalışmalarında yapılan analiz sonuçlarına göre Cd miktarı bakımından yapılan değerlendirmede, toprakların tamamında Cd içeriğinin henüz bitki, hayvan ve insan sağlığını tehdit edebilecek boyutlarda olmadığı belirlenmiştir.

Araştırma alanı topraklarında Co yönünden yapılan incelemede toprakların % 32,14'ünde Co kirliliği tespit edilmiştir. Mevcut Co kirliliği, Edirne şehir merkezi, Kapıkule sınır kapısının civarı ve köy yerleşimlerine yakın mevkilerden alınan toprak örneklerinde yoğunlaşmaktadır. Ayrıca araştırma alanlarında Co kirliliğinin tespit edildiği en yüksek değerin bulunduğu arazi Edirne ilinde uzun yıllardır kullanılmış bulunan şehir çöplüğüne yakın bir alandır. Bu durum mevcut Co kirliliğinin karayolu taşımacılığına ilave olarak yoğun yerleşimden ve mevcut çöplükten de kaynaklanmış olabileceğini düşündürmektedir.

Araştırma alanı toprakları Cr bakımından değerlendirildiğinde, toprakların tamamında Cr içeriğinin ekstrakte edilebilir sınır değeri olan 1 mgkg^{-1} 'in altında olduğu ve Cr kirliliğinin şimdilik söz konusu olmadığı saptanmıştır.

Araştırma sahası arazilerinin tamamında toprakların ekstrakte edilebilir Ni miktarları düşük düzeylerde tespit edilmiş ve toprakların Ni kirliliğinden şimdilik etkilenmediği gözlenmiştir. Bununla birlikte bazı topraklarda dikkate alınabilecek yüksek değerlerde Ni saptanmıştır.

Çalışma alanı toprakları Pb içeriklerine göre değerlendirildiğinde, toprakların % 42,85'inde, ekstrakte edilebilir kritik değer olan 4 mgkg^{-1} 'in üzerinde Pb tespit edilmiş olup, bu durum

karayolu taşımacılığında kaynaklanan Pb kirliliğinin mevcut olduğunu göstermektedir. Genel olarak Pb kirliliğinin yoğun olduğu araziler, TEM otoyolunun güney istikametinden yer almaktadır. Bu durum, hâkim rüzgâr yönü olan kuzey rüzgârlarının etkisiyle egzoz gazlarının güneye sürüklenerek tarım topraklarında çökme yoluyla güney tarım arazilerine Pb bulaşması sonucu Pb kirliliğinin ortaya çıkmış olabileceğini düşündürmektedir.

Sonuç olarak bu araştırmadan elde edilen bulgulara göre, Edirne İli TEM otoyolu kenarındaki tarım alanlarında Pb ve Co kirliliği mevcuttur. Topraklarda belirlenen bu ağır metal kirliliğinin bitkilere de bulaşmış olması muhtemeldir. Yörede ağır metal kirliliğinin artışının önlenmesi için gerekli yasal ve kültürel önlemler vakit geçirilmeden alınmalıdır.

Teşekkür

Bu bildiri Tuncay SARI'nın Yüksek Lisans tezinden hazırlanmıştır.

KAYNAKLAR

1. Alloway BJ (1995). Cadmium. In BJ Alloway (Ed.). Heavy metals in soils. Blackie, London.
2. Bowen HJM (1966). Trace element in Biochemistry, Academic Press, London.
3. Carrigan RA and Erwin TC (1951). Cobalt determination in soils by spectrographic analysis following chemical preconcentration. Proc. Soil Sci. Soc. Amer. 15: 145- 149.
4. Chapman HD (1971). Proc. Intern. Symp. Soil Fert. Evaln. New Delhi 1: 927- 947.
5. Demiralay, İ., (1993). Toprağın Fiziksel Analizleri. Atatürk Üni. Ziraat Fak. Yayınlan No: 143, Erzurum.
6. Dürüst N, Dürüst Y, Tuğrul D and Zengin M (2004). Heavy metal contents od pinus radiata trees of İzmit (Turkey). Asian J. of Chemistry, Vol: 16 (2): 1129- 1134.
7. Gerendas J, Polacco JC, Freyermuth SK and Sattelmacher B (1999). Significance of nickel for plant growth and metabolism. J. Plant Nutr. Soil Sci. 162: 241- 256.
8. Haktanır K ve Arcak S (1998). Çevre Kirliliği, Ankara Üniv. Zir. Fak. Yayınları, Ankara.
9. Jackson ML (1967). Soil Chemical Analysis Handbook. Micro-Macro Publishing, Inc, USA.
10. Kabata- Pendias A, Pendias H (1992). Trace Elements in Soils and Plants, 2nd Edition CRC Press, Boca Raton, Ann Arbor, London.
11. Kacar B. ve İnal A (2010). Bitki Analizleri, Nobel Yayınları No: 1241.
12. Lindsay WL and Norvell WA (1978). Development of a DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Soc. Am. J. 42:421- 428.
13. Sağlam MT (2012). Toprak ve Suyun Kimyasal Analiz Yöntemleri. Namık Kemal Üniversitesi, Yayın No: 2, Tekirdağ.
14. Tok HH (1997). Çevre Kirliliği. Anadolu Matbaacılık, İstanbul.

**FARKLI ORANLARDA SOLUCAN GÜBRESİ İÇEREN ORTAMLARDA
YETİŞTİRİLEN ÇEMEN (*Trigonella Foenum Graecum* L.) BİTKİSİNDE TUZ
STRESİNİN BİTKİ GELİŞİMİ VE RENK DEĞERLERİ ÜZERİNDEKİ ETKİSİNİN
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ÖZET

Fabaceae (Baklagiller) familyasının *Trigonella* cinsinde yer alan çemen (*Trigonella foenum graecum* L.) önemli endüstri bitkileri arasında yer almaktadır. Bitkinin tohumları ve vejetatif aksamaları hayvancılıkta yem, gıda endüstrisinde baharat ve yağı kozmetik ürünlerde kullanılmaktadır. *Trigonella foenum graecum* L. ince saplı yapısı ve toprakta iyi çözünmesinden kaynaklı yeşil gübre bitkisi olarak da kullanılma potansiyeline sahiptir. Ayrıca tıbbi olarak da tüketilen önemli bir bitki türüdür. Materyalini Geçit Kuşağı Tarımsal Araştırma Enstitüsü Müdürlüğü adına tescil edilmiş “Çiftçi” çemen çeşidinin oluşturduğu çalışma Van Yüzüncü Yıl Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü İklim Odası’nda Tesadüf Parselleri Deneme Deseni’ne göre faktöriyel düzende kurulmuştur. Üç tekerrürlü yürütülen çalışmada bitkiler 25°C sıcaklık, 8/16 saatlik karanlık/aydınlık fotoperiyotta ve % 65 neme sahip olan ortamda 500cc’lik saksılarda yetiştirilmiştir. Çalışmada faktör olarak dört farklı yetiştirme ortamı (1. Ortam: tarla toprağı + %20 perlit, 2. Ortam: %50 tarla toprağı + %30 solucan gübresi + %20 perlit, 3. Ortam: %40 tarla toprağı + %40 solucan gübresi + %20 perlit, 4. Ortam: %30 tarla toprağı + %50 solucan gübresi + %20 perlit) ve dört tuz dozu konsantrasyonu (kontrol (0), 50, 100, 150 mM NaCl) kullanılmıştır. Yürütülen çalışmanın sonucunda renk değerleri (L*, a*, b*, Chroma ve Hue), yaprak alanı ve klorofil miktarları belirlenmiştir. Tuz dozu x Ortam interaksiyonunda istatistiksel olarak yaprak alanı, klorofil miktarı, b* değeri ve Hue değeri %1 düzeyinde, a* değeri ve Chroma değeri %5 düzeyinde önemli görülürken L* değeri önemsiz görülmüştür. Çalışmanın sonucunda, günümüzde önemli bir sorun olan tuzluluğa karşı, çiftçi çemen çeşidinde organik gübre olarak kullanılan solucan gübresinin bitki gelişimi, bazı fizyolojik parametreler ve renk değerleri üzerinde olumlu etkileri olduğu belirlenmiştir.

Anahtar Kelimeler: Çemen, Renk değerleri, NaCl, Vermikompost.

**DETERMINATION OF THE EFFECT OF SALT STRESS ON PLANT GROWTH
AND COLOR VALUES IN FENUGREEK (*Trigonella Foenum Graecum* L.) GROWN
IN MEDIUM CONTAINING DIFFERENT LEVELS OF VERMICOMPOST**

ABSTRACT

Fenugreek (*Trigonella foenum graecum* L.), which is in the *Trigonella* genus of the Fabaceae (Legumes) family, is among the important industrial plants. The seeds and vegetative parts of the plant are used in animal feed, food industry, spices and cosmetic products. *Trigonella foenum graecum* L. has the potential to be used as a green manure plant due to its thin-stemmed structure and high solubility in the soil. It is an important plant species that is also consumed medicinally. Study material is the "Çiftçi" fenugreek variety registered in the name of the Transitional Zone Agricultural Research Institute. The study was established in the factorial order according to the Random Plots Trial Design in Climate Room of Van Yüzüncü Yıl University, Faculty of Agriculture, Department of Field Crops. In the study carried out with three replications, the plants were grown in 500cc pots at 25°C temperature, 8/16 hour dark/light photoperiod and 65% humidity. In the research were used four different growing media (1st medium: field soil + 20% peat, 2nd medium: 50% field soil + 30% vermicompost + 20% perlite, 3rd medium: 40% field soil + 40% vermicompost + 20% perlite, 4. Medium: 30% field soil + 50% vermicompost + 20% perlite) and four salt dose concentrations (control (0), 50, 100, 150 mM NaCl). As a result of the study were determined of color values (L*, a*, b*, Chroma and Hue), leaf area and chlorophyll amounts. In the interaction of salt dose x medium, leaf area, chlorophyll amount, b* value and Hue value were statistically significant at the 1% level, a* value and Chroma value were significant at the 5% level, while L* value was insignificant. As a result of the study, it was determined that vermicompost, which is used as an organic fertilizer in çiftçi fenugreek variety, has positive effects on plant growth, some physiological parameters and color values against salinity, which is an important problem today.

Keywords: Fenugreek, Color values, NaCl, Vermicompost.

GİRİŞ

Çemen Fabales takımının, Fabaceae (Baklagiller) familyasının, *Trigonella* cinsinde yer almaktadır. Türkiye’de yaygın olarak *Trigonella foenum graecum* L. türü yetiştirilmektedir. Çemen bitkisinin vejetatif kısmı ve tohumları çeşitli amaçlar için kullanılmaktadır. Bitkinin yeşil aksamı, kuru otu ve tohumları yüksek yem verimi ve kalitesinden dolayı yem bitkisi olarak kullanılmaktadır. Tohumları öğütülerek gıdalara lezzet vermek ve gıdaları korumak için baharat olarak kullanılmaktadır. Bunlara ilaveten bitkinin tohumlarından elde edilen boya ve yağın çeşitli kozmetik ürünlerde kullanıldığı bilinmektedir. Çemen, ince saplı yapısı ve toprakta iyi çözünmesi nedeniyle iyi bir yeşil gübre bitkisidir. Bu özelliklerinin yanında, tıbbi ve aromatik bitkiler içerisinde önemli bir yere sahiptir. Öğütülmüş tohumunun toz halinde tüketilmesi ile insan sağlığı üzerinde kan şekerini ve kolestrolü düşürücü özelliği yapılan çalışmalarla kanıtlanmıştır. Çemen tohumunun tedavi edici özelliğinin, embriyosunda bulunan, steroidal yapılu bir saponin olan diosgeninden kaynaklandığı bilinmektedir. Diosgenin kortikosteroidlerin sentezi için değerli bir maddedir. Çemen bitkisinden halk hekimliğinde ise, sindirimi kolaylaştırıcı, süt artırıcı, balgam söktürücü, ateş düşürücü, boğaz ağrısı giderici, yara iyileştirici olarak faydalanılmaktadır (Gökçe ve Efe, 2016).

Hem insan sağlığını hem de çevre güvenliğini riske atan, toprak kalitesini düşüren, patojen dayanıklılığını arttıran yoğun agro-kimyasal kullanımı doğal kaynakların güvenliği konusunda oldukça ciddi endişelere sebep olmuştur. Tüm bunlar, bilim adamlarını ve karar vericileri, biyolojik gübre ve pestisit olarak etkili organik ürünler kullanımını hedefleyen sürdürülebilir tarımsal üretim sistemlerinin geliştirilmesine yöneltmiştir. Bu alanda, her bakımdan toprak kalitesini arttıran aerobik kompost ve vermikompost ürünleri çok büyük önem kazanmıştır (Şimşek Erşahin, 2007).

Tuzluluk sorununun olduğu tarımsal üretimde etkin olarak kullanılmayan alanlarda toprak yapısını iyileştirici organik maddelerin kullanımının çözüm noktasında ön plana çıktığı görülmektedir. Tuzluluğun yanı sıra organik maddece fakir olan alanlarda verimliliği ve sürekliliği sağlama açısından da önemli bir girdi olduğu bilinmektedir. Bu noktada vermikompost, humik asit gibi organik maddelerin kullanımına yönelik çalışmalar yapılmış ve bitkilerin stres fizyolojisi üzerinde olumlu etkileri olduğu bilimsel araştırmalar ile ortaya konmuştur (Kıran, 2019; Benazzouk ve ark., 2020; Tunçtürk ve ark., 2020; García-Galindo ve ark., 2021, Şelem ve ark., 2021). Solucan gübresi ile organik materyallerin birlikte kullanılmasıyla elde edilen vermikompostun ürün verimi ve besin elementi alımı üzerine olumlu etkileri olduğu bildirilmiştir (Garg et al., 2010; Küçükyumuk ve ark., 2014).

Vermikompost içerdiği makro ve mikro yararlı elementler bakımından da toprak düzenleyicisi olarak büyük yarar sağlamaktadır (Bellitürk, 2016).

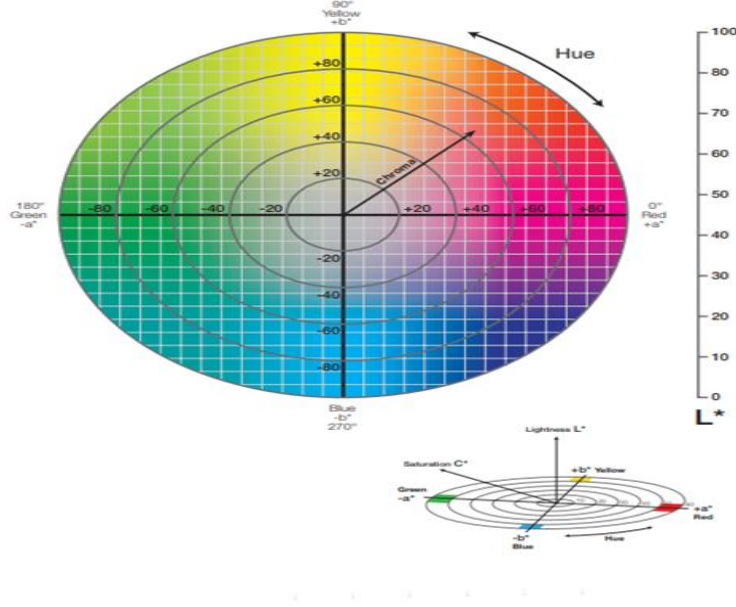
Yürütülen çalışmada farklı vermikompost oranlarının çemen bitkisinde klorofil, yaprak alanı ve renk değerleri üzerindeki etkisinin incelenmesi amaçlanmıştır.

MATERYAL VE YÖNTEM

Materyalini Geçit Kuşağı Tarımsal Araştırma Enstitüsü Müdürlüğü adına tescil edilmiş çiftçi çemen çeşidinin oluşturduğu çalışma Van Yüzüncü Yıl Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü İklim Odası' nda Tesadüf Parselleri Deneme Deseni' ne göre faktöriyel düzende kurulmuştur. Üç tekerrürlü yürütülen çalışmada bitkiler 25°C sıcaklık, 8/16 saatlik karanlık/aydınlık fotoperiyotta ve % 65 neme sahip olan ortamda 500cc'lik saksılarda yetiştirilmiştir. Çalışmada faktör olarak dört farklı yetiştirme ortamı (1. Ortam: tarla toprağı + %20 perlit, 2. Ortam: %50 tarla toprağı + %30 solucan gübresi + %20 perlit, 3. Ortam: %40 tarla toprağı + %40 solucan gübresi + %20 perlit, 4. Ortam: %30 tarla toprağı + %50 solucan gübresi + %20 perlit) ve dört tuz dozu konsantrasyonu (kontrol (0), 50, 100, 150 mM NaCl) kullanılmıştır. Tohumlar 31.08.2020 tarihinde ekilmiştir. Denemede farklı konsantrasyonlara sahip tuz (NaCl) solüsyonları bitkilerin 10-15 cm olduğu dönemde uygulanmıştır. İlk tuz dozları 14. 10. 2020 tarihinde uygulanmış ve üçer gün arayla toplamda beş uygulama olacak şekilde yapılmıştır. Çalışma 26.10.2020 tarihinde gerekli ölçüm ve gözlemler yapılmak üzere sonlandırılmıştır. Çalışmada kullanılan torfa ait özellikler; pH 6, 160-260 mg/L N, 180- 280 mg/L P₂O₅, 200- 150 mg/L K₂O₅, 80- 150 mg/L Mg, % 0.8 N, % 70 organik madde, % 35 C şeklindedir. Çalışmada kullanılan toprak killi kumlu tın tekstür yapısında, pH alkali reaksiyonlu (8.18), kireçli (% 17.9) olup organik madde (% 1.17), tuz oranı (% 0.021), yararlı fosfor içeriğı (6.70 ppm) ve azot içeriğı (0.049 me/100g) ile potasyum (488 ppm) miktarı belirlenmiştir.

Yaprak alanı Easy Leaf Area programı kullanılarak ölçülmüştür. Klorofil miktarlarının ölçümü taşınabilir özellikte olan Dualex Scientific+™ cihazı ile gerçek zamanlı ve tahribatsız olarak yapılmıştır.

Renk değerleri Minolta CR-400 (Osaka, Japan) marka renk ölçer ile L* , a* , b* C ve Hue° açı değeri olarak ifade edilmiştir. L* açıklık ((L*=0 siyah ve L*=100 beyaz), a* kırmızı/yeşil (+a* kırmızı, - a* ise yeşil), b* sarı/mavi (+b* sarı, -b* mavi), Chroma canlılık veya matlık, Hue ise algılanan renk ve rengin ismini belirleyen değerlerdir (Anonim, 2021).



Şekil 1. L*, a*, b*, Chroma ve Hue değerinin renk aralığı (Anonim, 2021).

Elde edilen verilerin hesaplanması COSTAT (6.3 versiyonu) bilgisayar analiz programı kullanılarak yapılmış olup önemli çıkan uygulamalar Duncan Çoklu Karşılaştırma Yöntemi' ne göre karşılaştırılmıştır.

BULGULAR VE TARTIŞMA

Bitki gelişimi üzerinde olumlu etkisi olduğu bilinen solucan gübresinin, farklı tuz dozlarında yetiştirilen çemen bitkisinin bazı morfolojik, fizyolojik ve renk özelliklerinde meydana getirdiği değişimler Tablo 1 ve Tablo 2' de verilmiştir.

Yaprak alanında tuz ve solucan gübresi dozları arasındaki farkın istatistiksel olarak %1 düzeyinde önemli olduğu belirlenmiştir. Yaprak alanı artan tuz stresine paralel olarak azalış göstermiş olup en yüksek değer kontrol grubundan 2.0 cm² en düşük değer ise T3 uygulamasından 1.46 cm² olarak alınmıştır. Farklı solucan gübresi miktarlarının kullanıldığı ortamlarda ise en yüksek yaprak alanı 1.98 cm² ile O2 ortamından elde edilmiştir.

Klorofil miktarında tuz ve solucan gübresi dozları arasındaki farkın istatistiksel olarak %1 düzeyinde önemli olduğu belirlenmiştir. Klorofil miktarında en yüksek değer kontrol ile aynı duncan grubunda yer alan T1 uygulamasından sırasıyla 38.43 ve 38.57 dualeks indeksi olarak alınmıştır. Farklı solucan gübresi miktarlarının kullanıldığı ortamlarda ise Klorofil miktarında en yüksek değer 40.76 dualeks indeksi ile O2 ortamından elde edilmiştir.

Tablo 1. Farklı ortam ve tuz dozlarında yetiştirilen çemen bitkisinde yaprak alanı ve klorofil miktarı.

Tuz	Ortamlar	Yaprak alanı	Klorofil
T0	O1	2.09abcd	38.25bc
	O2	2.26abc	47.60a
	O3	1.16f	36.40cd
	O4	2.49a	31.50ef
T0 Ortalama		2.00a	38.43a
T1	O1	1.52def	37.30c
	O2	2.03bcd	44.55a
	O3	1.19f	31.60ef
	O4	2.30ab	40.85b
T1 Ortalama		1.76b	38.57a
T2	O1	1.71d	33.55de
	O2	2.00cd	40.95b
	O3	1.29f	30.65f
	O4	1.36f	33.55e
T2 Ortalama		1.59c	34.67b
T3	O1	1.42f	23.30h
	O2	1.63de	29.95f
	O3	1.45ef	23.80h
	O4	1.35f	27.75g
T3 Ortalama		1.46c	26.2c
O Ortalaması	O1	1.68b	33.10b
	O2	1.98a	40.76a
	O3	1.27c	30.61c
	O4	1.87b	33.41b
VK (%)		11.71	4.65
Tuz Dozları		**	**
O		**	**
T x O Dozları		**	**

*P<0.05 düzeyinde, ** P<0.01 düzeyinde önemli olup, ortalamalar arasındaki fark Duncan çoklu karşılaştırma metoduyla P<0.05 seviyesinde değerlendirilmiştir.

Yapılan renk ölçümlerinin sonucunda tuz dozlarının tüm renk parametrelerinde istatistiksel olarak önemli olmadığı görülmüştür. Renk değerlerinden olan L* değerinin uygulamalardaki farkının istatistiksel olarak önemsiz olduğu görülmüştür. Yapılan istatistik analizinin sonucunda a* değerinin ortam ile ortam x tuz interaksyonunun %5 düzeyinde önemli olduğu belirlenmiştir. Ortamlarda en yüksek a*değeri -9.96 ile O1'den en düşük değer ise aynı duncan grubunda yer alan O2, O3 ve O4 ortamlarından elde edilmiştir. b* renk değerinde ortam ve ortam x tuz interaksyonunun %1 düzeyinde önemli olduğu görülmüştür. Farklı solucan gübresi

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Turkish Republic of Northern Cyprus, April 28-30, 2023

miktarlarının kullanıldığı ortamlarda en yüksek b* renk değeri aynı duncan grubunda yer alan O3 (17.37) ve O4 (17.78) ortamlarından alınırken, en düşük değer ise solucan gübresinin olmadığı O1 (13.80) ortamından elde edilmiştir. Chroma renk değerinin ortamlar arasındaki farkı %1 düzeyinde önemli görülürken ortam x tuz dozu uygulamaları interaksyonunda %5 düzeyinde önemli görülmüştür. Farklı ortamlarda en yüksek chroma renk değeri aynı duncan grubunda yer alan O3 (20.63) ve O4 (21.43) ortamlarından alınırken, en düşük değer ise solucan gübresinin olmadığı O1 (17.14) ortamından elde edilmiştir. Hue değerinde ortamlar arası fark istatistiksel olarak %5, ortam x tuz dozu interaksyonu ise %1 düzeyinde önemli görülmüştür. Farklı ortam uygulamalarında en yüksek değer aynı Duncan grubunda yer alan O1, O2 ve O3 uygulamalarından elde edilirken en düşük değer O4 uygulamasından elde edilmiştir.

Tablo 2. Farklı ortam ve tuz dozlarında yetiştirilen çemen bitkisinde renk değerleri.

Tuz	Ortamlar	L	a	b	C	Hue
T0	O1	40.66	-10.87a-e	15.39abc	19,02abcd	124.64bc
	O2	40.225	-11.93b-e	15.735abc	19.845abc	127.2bc
	O3	3637	-10.62a-d	16.385ab	19.695abc	122.905bc
	O4	36.665	-12.185cde	16.46ab	20.515ab	126.995bc
T0 Ortalama		38.48	-11.40	15.99	19.76	125.43
T1	O1	39.555	-9.555ab	14.37bc	17.33cd	124.63bc
	O2	36.34	-10.325abc	12.48c	16.295cd	129.235b
	O3	40.55	-13.13e	19.33a	23.455a	125.065bc
	O4	39.14	-13.36e	18.875a	23.175a	125.54bc
T1 Ortalama		38.77	-11.59	16.26	20.06	126.11
T2	O1	39.975	-9.205a	12.59c	15.765d	127.935b
	O2	39.135	-11.585b-e	15.8ab	19.645abc	126.345bc
	O3	38.315	-12.72e	17.57a	19.615abc	144.9a
	O4	40.72	-8.505a	15.48abc	18.54bcd	118.885c
T2 Ortalama		39.66	-10.50	15.36	18.39	129.51
T3	O1	38.74	-10.235ab	12.88c	16.465cd	128.575b
	O2	40.495	-12.485de	17.745a	21.78a	126.75bc
	O3	-	-	-	-	-
	O4	38.77	11.145bcde	16.225ab	19.785abc	125.16bc
T3 Ortalama		40.635	11.475bcde	20.34a	23.495a	119.05c
T3 Ortalama		39.66	-11.33	16.79	20.38	124.88
O Ortalaması	O1	39.73	-9.96a	13.80c	17.14c	126.44ab
	O2	39.04	-11.58b	15.44b	19.39b	127.38ab
	O3	38.37	-11.90b	17.37a	20.63ab	129.50a
	O4	39.29	-11.38b	17.78a	21.43a	122.61b
VK (%)		5.59	13.55	11.32	11.37	4.56
Tuz Dozları		ög	ög	ög	ög	ög
O		ög	*	**	**	*
T x O Dozları		ög	*	**	*	**

*P<0.05 düzeyinde, ** P<0.01 düzeyinde önemli olup, ortalamalar arasındaki fark Duncan çoklu karşılaştırma yöntemiyle P<0.05 seviyesinde değerlendirilmiştir.

Tuzluluk ülkemiz topraklarında karşılaşılan en önemli sorunlardan biridir. Yağış oranının az ve buharlaşmanın fazla olduğu, kurak ve yarı kurak bölgelerde tuzluluk doğal olarak bulunmakta, sulanan alanlarda ise aşırı sulamayla oluşmaktadır (Keser ve ark., 2009). Tuz stresi bitkilerde stomaların kapanması, klorofilin yapısının değişmesi ve fotosentetik mekanizmasının bozulmasına neden olarak fotosentetik aktiviteyi olumsuz etkilemektedir (Çulha ve Çakırlar, 2011). Shahid ve ark. (2011) farklı bezelye genotiplerinde NaCl stresinin bitkilerin klorofil içeriklerini azalttığını belirlemiştir. Kaymak ve Acar (2020), orman üçgölünde topraktaki tuz yoğunluğu arttıkça yapraklardaki klorofil a ve klorofil b miktarının azaldığını vurgulamıştır. Önal Aşçı ve Zambı, (2020)'de çalışmamıza benzer şekilde arta tuz stresinin klorofil miktarında düşümlere sebep olduğunu belirtmiştir. Araştırma sonuçlarımız, tuz stresine maruz kalan bitkilerde stomaların kapalı olduğu, bünyelerindeki nemi asgariye indirmek için yaprak alanlarının küçüldüğü (Yaşar, 2003), aspir ve yerfıstığı bitkilerinde tuz stresi uygulamalarında artan tuz konsantrasyonlarına bağlı olarak yaprak alanında azalmaların olduğu belirlenmiş (Kara ve ark., 2019; Yolci ve ark., 2021) ve çalışmamızla uyum içerisinde olduğu tespit edilmiştir. Araştırmacılar renk değerlerinin farklı bitkilerde ve uygulamalarda değişiklik gösterdiğini ortaya koymuştur (Dadali ve ark., 2007; Tekin ve Çavuşoğlu, 2018, Şelem ve ark., 2021). Yürütülen çalışmada yeşil renge sahip olan çemen bitkisi yapraklarının tuz uygulamalarından kaynaklı renk parametrelerinde değişimin olmadığı belirlenmiştir. Ortam uygulamalarında rengin ismini belirleyen değerin istatistiksel olarak önemli olduğu görülmüştür.

SONUÇ

Tüm dünyada önemi gün geçtikçe artan tıbbi ve aromatik bitkiler ülkemiz için de önem kazanmaktadır. Türkiye, tıbbi ve aromatik bitkiler üretimi bakımından, iklim ve zengin bitki çeşitliliği bulundurması nedeniyle önemli bir potansiyele sahiptir. Çemen bitkisi birçok kullanım alanına sahip ve ülkemiz ekolojisinde kolaylıkla yetiştirilebilecek bir bitki olmasına rağmen, ülkemizde üretimi ve ihracatı istenilen seviyelere ulaşamamıştır. Üretimin ve buna bağlı olarak da çemen ihracatının artırılması için, bu bitkinin tanıtımına önem verilmeli, kullanım alanları genişletilmeli ve halkımızın tüketim alışkanlıkları içinde daha fazla yer edinmesi sağlanmalıdır. Çemen bitkisinden elde edilen ürünlerin standartlarının iyileştirilmesi ve en iyi yetiştirme koşullarının saptanması da bu bitkinin önemini giderek artıracaktır.

KAYNAKLAR

- Anonim, 2021. <https://leventkirca.com.tr/hue-acisi-nedir-excelde-hue-acisi-nasil-hesaplanir#:~:text=Hue%20de%20C4%9Feri%2000%20ise%20renk,ise%20ye%20C5%9Fil%20C%20370%e%20mavidir.&text=Renk%20uzay%20C4%B1nda%20yer%20alan%20noktan%20C4%B1n,artt%20C4%B1k%20C3%A7a%20genel%20olarak%20renk%20parlakla%20C5%9F%20C4%B1r>. (Erişim tarihi: 19.03.2021).
- Bellitürk, K, 2016. Sürdürülebilir Tarımsal Üretimde Katı Atık Yönetimi İçin Vermikompost Teknolojisi. Çukurova Tarım ve Gıda Bilimleri Dergisi, 31(3), 1-5.
- Benazzouk, S., Dobrev, P.I., Djazouli, Z.E., Motyka, V., & Lutts, S., 2020. Positive Impact of Vermicompost Leachate on Salt Stress Resistance in Tomato (*Solanum lycopersicum* L.) at the Seedling Stage: A Phytohormonal Approach. Plant and Soil, 446(1), 145-162.
- Çulha, Ş., & Çakırlar, H. 2011. Tuzluluğun bitkiler üzerine etkileri ve tuz tolerans mekanizmaları. Afyon Kocatepe Üniversitesi Fen Bilimleri Dergisi, 11, 11-34.
- Dadali, G., Demirhan, E. & Özbek, B., 2007. Color Change Kinetics of Spinach Undergoing Microwave Drying. Drying Technology, 25(10), 1713-1723.
- García-Galindo, E., Nieto-Garibay, A., Troyo-Diéguéz, E., Lucero-Vega, G., Murillo-Amador, B., Ruiz-Espinoza, F.H., & Fraga-Palomino, H.C., 2021. Germination of *Salicornia bigelovii* (Torr.) Under Shrimp Culture Effluents and the Application of Vermicompost Leachate for Mitigating Salt Stress. Agronomy, 11, 424.
- Gökçe, Z., & Efe, L. 2016. Çemen (*Trigonella foenum-graecum* L.) bitkisinin kullanım alanları ve tıbbi önemi. Nevşehir Bilim ve Teknoloji Dergisi, 5, 355-363.
- Kaymak, G., & Acar, A. 2020. Orman üçgülü (*Bituminaria bituminosa* L.) genotiplerinin tuzluluğa dayanıklılık düzeylerinin belirlenmesi. Anadolu Tarım Bilimleri Dergisi, 35(1), 51-58.
- Keser, Ö., Çolak, G., & Caner, N. 2009. Tuza toleransı farklı iki kültür bitkisinde bazı fizyolojik ve makromorfolojik parametreler üzerine Na₂CO₃ tipi tuz stresi etkileri. Balıkesir Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 11(2), 64-80.
- Kıran S, 2019. Vermikompost Uygulamalarının Kuraklık Stresi Altındaki Kıvırcık Salatının (*Lactuca sativa* var. *crispa*) Mineral İçerikleri Üzerine Etkisi. Kahramanmaraş Sütçü İmam Üniversitesi Tarım ve Doğa Dergisi, 22, 133-140.
- Küçükyumuk, Z., Gültekin, M., Erdal, İ., 2014. Vermikompost ve Mikorizanın Biber Bitkisinin Gelişimi ile Mineral Beslenmesi Üzerine Etkisi. Ziraat Fakültesi Dergisi, 9(1), 51-58.
- Önal Aşçı, Ö. & Zambı, H. 2020. NaCl Stresinin Yem Bezelyesinin Klorofil ve Mineral İçeriğine Etkisi . Uluslararası Tarım ve Yaban Hayatı Bilimleri Dergisi , 6 (3) , 562-569 . DOI: 10.24180/ijaws.757855
- Shahid, M. A., Pervez, M. A., Balal, R. M., Ayyub, C. M., Ghazanfar, U., Abbas, T., Rashid, A., Garcia-Sanchez, F., Mattson, N. S., & Akram, A. 2011. Effect of salt stress on growth, gas Exchange attributes and chlorophyll contents of pea (*Pisum sativum*). African Journal of Agricultural Research, 6(27), 5808-5816.
- Şelem, E., Nohutçu, L., Tunçtürk, R., & Tunçtürk, M. 2021. Vermikompostlu Ortamda Yetiştirilen *Calendula officinalis* L. Bitkisinde Tuz Stresinin Morfolojik ve Anatomik Gelişim Parametreleri Üzerindeki Etkisi. Journal of the Institute of Science and Technology, 11(4), 3222-3231.
- Şimşek Erşahin, Y. 2007. Vermikompost Ürünlerinin Eldesi ve Tarımsal Üretimde Kullanım Alternatifleri. GOÜ. Ziraat Fakültesi Dergisi, 2007, 24 (2), 99-107.
- Tekin O, & Çavuşoğlu, Ş, 2018. The Effects of Different Postharvest Applications on Some Physicochemical Properties in 'Rubygem' and 'Sabrina' Strawberry (*Fragaria*× *Ananassa* Duch.) Cultivars. Applied Ecology and Environmental Research, 16(4), 5299-5310.

- Tunçtürk M, Tunçtürk R, Oral E, & Baran İ, 2020. Humik Asitin Baklada (*Vicia faba* L.) Tuz (NaCl) Stresinin Azaltılması Üzerine Etkisi. İğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 10(3), 2168-2179.
- Yolci, M. S. , Tunçtürk, R. & Tunçtürk, M. 2021. Yerfıstığı (*Arachis hypogea* L.) Çeşitlerinin Bazı Büyüme ve Fizyolojik Parametreleri Üzerine Tuz Stresinin Etkisi . Yuzuncu Yıl University Journal of Agricultural Sciences, 31 (1) , 228-236. DOI: 10.29133/yyutbd.768736

VAN YÖRESİNDEKİ *Colchicum szovitsii* FİSCH. ET MEY. VE *Colchicum kurdicum* (BORNM.) STEF. ÜZERİNDE MORFO-ANATOMİK GÖZLEMLER

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ÖZET

Yürütülen bu çalışmada doğal olarak yetişen *Colchicum szovitsii* Fisch. Et Mey. ve *Colchicum kurdicum* (Bornm.) Stef. türlerinin morfo-anatomik özellikleri belirlenmiştir. Van ilinde yapılan flora çalışmasından elde edilen örnekler morfo-anatomik olarak karşılaştırılmıştır. Materyalini *Colchicum szovitsii* ve *Colchicum kurdicum* türlerinin oluşturduğu çalışmada bitki yaprak boyu, yaprak eni, stoma boyu, stoma eni, stoma orta açıklığı ve stoma yoğunluğu belirlenmiştir. Stoma ölçüm ve sayımları yaprağın üst ve alt yüzeyinden ayrı ayrı yapılmış ve alt yüzeydeki değerlerin üst yüzeyden daha yüksek olduğu görülmüştür. Stoma boyu, *Colchicum kurdicum* türünde alt yüzeyde $59.35 \pm 3.54 \mu\text{m}$ üst yüzeyde $48.25 \pm 0.88 \mu\text{m}$ iken *Colchicum szovitsii* türünde sırasıyla $48.84 \pm 2.10 \mu\text{m}$ ile $40.12 \pm 1.82 \mu\text{m}$ olarak tespit edilmiştir. *Colchicum kurdicum* ile *Colchicum szovitsii* türlerinde alt yüzeydeki orta açıklık ve stoma yoğunluğunun üst yüzeydekinden daha yüksek çıktığı belirlenmiştir. Stoma eninin ise iki türde de üst yüzeyde daha yüksek olduğu saptanmıştır. Yaprak boyunun *Colchicum kurdicum* ve *Colchicum szovitsii* türlerinde sırasıyla $6.33 \pm 1.75 \text{ cm}$ ve $2.90 \pm 0.26 \text{ cm}$ olduğu belirlenmiştir. Yaprak eninin ise *Colchicum kurdicum* türünün (5.5 ± 1.73) *Colchicum szovitsii* (0.76 ± 0.25) türünden daha yüksek değere sahip olduğu ortaya konmuştur.

Anahtar Kelimeler: Geofit, Acı çiğdem, Stoma, Van.

MORPHO-ANATOMICAL OBSERVATIONS ON *Colchicum Szovitsii* Fisch. Et Mey.
And *Colchicum Kurdicum* (Bornm.) STEF. IN VAN REGION

ABSTRACT

In this study, the morpho-anatomical properties of *Colchicum szovitsii* Fisch. Et Mey and *Colchicum kurdicum* (Bornm.) Stef. species were determined. Samples obtained from the flora study in Van region were compared morpho-anatomically. In the study, which used of *Colchicum szovitsii* and *Colchicum kurdicum* species, determined plant leaf height, leaf width, stomatal length, stomatal width, stomatal opening and stomatal density. Stoma measurements and counts were made separately from the upper and lower surfaces of the leaf, and it was observed that the values on the lower surface were higher than the upper surface. Stoma length was determined as $59.35 \pm 3.54 \mu\text{m}$ on the lower surface and $48.25 \pm 0.88 \mu\text{m}$ on the upper surface in *Colchicum kurdicum* species, while it was $48.84 \pm 2.10 \mu\text{m}$ and $40.12 \pm 1.82 \mu\text{m}$ in *Colchicum szovitsii* species. In *Colchicum kurdicum* and *Colchicum szovitsii* species, it was determined that the middle opening and stoma density on the lower surface were higher than those on the upper surface. Stoma width was found to be higher on the upper surface in both species. Leaf length was determined as $6.33 \pm 1.75 \text{ cm}$ and $2.90 \pm 0.26 \text{ cm}$ in *Colchicum kurdicum* and *Colchicum szovitsii* species, respectively. Leaf width was found to be higher in *Colchicum kurdicum* (5.5 ± 1.73) than *Colchicum szovitsii* (0.76 ± 0.25).

Keywords: Geophyte, Bitter crocus, Stoma, Van.

GİRİŞ

Acı çiğdem, Zambakgiller (Liliaceae) familyasına ait otsu ve kormlu yapıda olan çok yıllık bitkilerdir. Son yıllarda yapılan çalışmalarda tüm dünyada 99 civarında türün doğal yayılış gösterdiği ve bununla birlikte 49 tür ile Türkiye florasının ana gen merkezi olduğu kabul edilmektedir (Kaya, 2011). Türkiye’de doğal olarak yayılış gösteren yaklaşık 50 adet acı çiğdem türünün 22 tanesi endemiktir (Güner ve ark., 2002). Cinsine ait türlerin bir kısmı ilkbaharda çiçek açarken bir kısmı da son baharda çiçek açmaktadır. Çalışma materyalini oluşturan türlerin ilkbaharda çiçek açtığı bilinmektedir (Kulaksız-Pişkin, 2022). Colchicum türleri zehirli alkaloidler içermelerinden dolayı insan ve hayvan sağlığı açısından çok tehlikeli bitkilerdir (Yaldız ve ark., 2010). Acı çiğdem türlerinin içerdiği en önemli alkaloid kolşisin (colchicine, C₂₂H₂₂NO₆)’dir. Liliaceae familyasındaki Colchicum cinsine ait bitkilerin tedavi edici etkileri yüzyıllar öncesine dayanmakta olup Dioscorides, Galen ve Tralesli İskender gibi birçok Yunan hekiminin tedavide kullandıkları kaydedilmiştir (Suhail ve ark. 2017).

Antik çağlardan beri bilinen biyolojik aktif bileşenlerden biri olan kolşisin Colchicum türlerinde doğal olarak bulunmaktadır (Ebadi 2006). Kolşisin ilk kez 1820’de Colchicum autumnale L. türünden Pelletier ve Caventou tarafından izole edilmiştir (Pandey ve Banik 2012; Kavita 2021). Kolşisin, bitki ve hayvanlarda hücre bölünmesi üzerine güçlü inhibitör etki göstermektedir. Metafaz evresinin durdurulmasıyla hücre bölünmesi tamamlanamamakta ve antikanser etki ortaya çıkmaktadır (Akhtar ve ark. 2018; Molkova ve ark. 2022). Kolşisin’in antimitotik ve antiinflamatuvar aktivite göstermesinden dolayı, kolşisin terapötik olarak gut artriti, ailevi Akdeniz ateşi, Behçet hastalığı, osteoartrit, çeşitli kardiyovasküler hastalıklar ve farklı kanser türlerinde kullanılmaktadır Türkiye’de preparatları olarak kolşisin ve türevlerinden hazırlanan ColchicumDispert®, Kolsin®, MuscoRil®, Muscoflex®, Adeleks®, Thiospa® bulunmaktadır (Kayaalp 2002; Kavalalı 2014; Ergül ve Bakar-Ateş 2021). İzole edilen Colchicum alkaloidleri *C. szovitsii* türü için Kolşisin ve 2-demetilkolşisin (Rocchetti ve ark. 2019) iken *C. kurdicum* türü için Kolşisin, Kolşikozit 2-demetilkolşikozit, 2-demetilkolşisin, Kolşifolin, Demekolsin, N-deasetil-N-formilkolşisin ve 3-demetilkolşisin’dir (Azadbakht ve ark. 2020a, b). Ülkemizde yetişen Colchicum türleri üzerinde yapılan aktivite çalışmalarında *C. szovitsii* türünün analjezik aktivite, antimikrobiyal aktivite ve aitotoksik aktivite (Heidari ve ark. 2005; Türker ve Usta 2008)gösterdiği, *C. kurdicum* türünün ise antiinflamatuvar aktivite, antioksidan aktivite, sitotoksik aktivite ve hemolitik aktivite gösterdiği ortaya konmuştur (Azadbakht ve ark. 2020a, b).

Bitkilerdeki içsel su düzeninin kurulmasında yapraklarda bulunan stomalar önemli rol oynamaktadır. Stomalar, bitkilerin daha çok yaprak epidermisinde bulunan çok ufak

gözenekciklerdir. Stomaların büyüklükleri ve yoğunluklarının, bitkilerin tür ve çeşidi ile yetiştirme koşullarına göre farklılık gösterdiği yapılan çalışmalarla ortaya konulmuştur (Yanmaz ve Eriş, 1984; Eriş, 1998; Çağlar ve ark., 2004; Ilgın ve Çağlar, 2009). Araştırmacılar stomaların sayısı ve biyometrik özelliklerinin, tür ve çeşitlerin kuraklığa direncinin artırılmasında kullanılabileceğine dikkat çekmektedir (Scienza ve Boselli, 1981; Forlani ve ark., 1983). Benzer şekilde kültür bitkilerinde çeşitlere ve yetiştirme koşullarına göre bitki-su dengesinin kontrolü açısından stoma yoğunluğu ve yapılarının saptanmasının önemli bir konu olarak görülmektedir (Çağlar ve ark. 2004). Farklı bitki tür ve çeşitlerinin stoma yoğunluk ve büyüklükleri ile ilgili dünyada ve ülkemizde çeşitli araştırmalar yapılmıştır (Hassan ve ark. 2008; Gokbayrak ve ark. 2008; Aslantaş ve Karakurt 2009; Kurt ve Doğan, 2020; Şelem ve ark., 2020a,b).

Dünyada giderek artan su açığı özellikle kurak ve yarıkurak bölgelerde bitkisel üretimde fotosentez ve üretkenliği sınırlayıcı en önemli faktör olarak karşımıza çıkmaktadır. Bütün bitkilerde olduğu gibi geofitlerde de su stresine karşı geliştirilmiş kuraklık dirençli hat ve çeşitlerin kullanılması üreticiler tarafından arzu edilmektedir. Araştırmacılar kurağa dayanıklılık bakımından stoma yoğunluğu ve stoma boyutlarının seleksiyon kriteri olarak değerlendirilebileceğini bildirmişlerdir (Venora ve Calcagno, 1991; Maghsoudi ve Maghsoudi, 2008; Mehri ve ark., 2009). Bu çalışma ile Türkiye florasında doğal olarak yetişen ve ilkbaharda çiçeklenen *Colchicum szovitsii* Fisch. Et Mey. ve *Colchicum kurdicum* (Bornm.) Stef. türlerinin morfo-anatomik özelliklerinin belirlenmesi amaçlanmıştır.

MATERYAL VE YÖNTEM

Van ilinde yapılan flora çalışmasından elde edilen örnekler morfo-anatomik olarak karşılaştırılmıştır. Materyalini *Colchicum szovitsii* ve *Colchicum kurdicum* türleri oluşturmaktadır.

Bitkilerden alınan çiçek ve yaprak örnekleri analizlerin için Tarla bitkileri bölümüne ait Fizyoloji ve Sitoloji laboratuvarlarına taşınmıştır. Bitkilerden alınan yaprak örnekleri stoma analizleri için Tarla Bitkileri Bölümü'ne ait Fizyoloji ve Sitoloji Laboratuvarları'na taşınmıştır. Polen Leica DM500 ışık mikroskobu, mikroskoba bağlı Leica ICC50 HD kamera ile Leica LAS EZ (versiyon 3.0) yazılımı kullanılmıştır. Alana düşen stoma sayısı mm² 'lik alana düşen sayı olarak belirlenirken stoma boyu, stoma eni ve stoma orta açıklığı µm olarak belirlenmiştir.

BULGULAR VE TARTIŞMA

Çalışmada kullanılan *Colchicum* türlerine ait yaprak boyu ve eni farklılıklar göstermiş olup bu değerler sırasıyla *C. szovitsii* türünde 2.9 cm ve 0.76 cm, *C. kurdicum* türünde 6.33 ve 5.5 cm olarak tespit edilmiştir (Tablo 1.).

Tablo 1. *Colchicum kurdicum* ve *Colchicum szovitsii* türlerinin yaprak boyu ve eni.

	Yaprak boyu (cm)	Yaprak eni (cm)
<i>Colchicum kurdicum</i>	6.33±1.75	5.5±7.73
<i>Colchicum szovitsii</i>	2.9±0.26	0.76±0.25

Yapraktan alt ve üst yüzeyli olarak yapılan stoma ölçüm ve sayımlarının her iki türde de farklılar gösterdiği belirlenmiştir. *Colchicum kurdicum* türünde yaprak alt ve üst yüzeyli stoma ölçümlerinde tüm parametreler açısından yaprak alt yüzeyinin daha yüksek değerlere sahip olduğu görülmüştür. Stoma boyu, eni, orta açıklığı ve yoğunluğunun *Colchicum kurdicum* türünde alt ve üst yüzeylerinin sırasıyla 59.35-48.25 µm, 31.50-43.55 µm, 9.97-7.27 µm ve 127.33-94.00 adet/mm² olduğu tespit edilmiştir.

Tablo 2. *Colchicum kurdicum* türünde yaprak alt ve üst yüzeyli stoma ölçüm ve sayımları

	Stoma boyu (µm)	Stoma eni (µm)	Orta açıklık (µm)	Yoğunluk (adet/mm ²)
Alt yüzey	59.35±3.54	31.50±0.85	9.97±0.39	127.33±2.51
Üst yüzey	48.25±0.88	43.55±1.09	7.27±0.91	94.00±4.58

Colchicum szovitsii türünde ise stoma boyu, orta açıklık ve stoma yoğunluğu alt yüzeyde daha yüksek iken stoma eninin üst yüzeyde daha yüksek olduğu belirlenmiştir. Yaprak alt yüzeyinde stoma boyu, stoma eni, orta açıklık ve yoğunluk sırasıyla 48.84 µm, 29.28 µm, 3.96 µm ve 102.66 adet/mm² iken üst yüzeyde 40.12 µm, 36.18 µm, 3.04 µm ve 96.66 adet/mm² olarak tespit edilmiştir.

Tablo 3. *Colchicum szovitsii* türünde yaprak alt ve üst yüzeyli stoma ölçüm ve sayımları

	Stoma boyu (µm)	Stoma eni (µm)	Orta açıklık (µm)	Yoğunluk (adet/mm ²)
Alt yüzey	48.84±2.10	29.28±2.23	3.96±0.15	102.66±2.98
Üst yüzey	40.12±1.82	36.18±2.00	3.04±0.33	96.66±5.50

Yapılan çalışmalarda; stoma yoğunluğunun kuraklıktan etkilendiği, miktarında düşüşlerin olduğu, aynı zamanda stoma yoğunluğundaki azalmaların kuraklık direncini artırabileceği ve fotosentetik kapasiteyi etkileyebileceği bildirilmiştir (Franks ve ark., 2015; Yang ve ark., 2017). Bazı araştırmacılar, stoma sayısı ve boyutlarının yaprağın alınma konumu(güneş/gölge), sulama, çevre koşulları ve gübreleme gibi uygulamalardan kaynaklı farklılık gösterdiğini belirtmişlerdir (Eriş ve Soylu, 1990, Marasalı ve Aktekin,2003, Doğan ve ark., 2020). Pektaş (2007) yaptığı çalışmada stomaların adaptasyon açısından önemli olduğunu ve geofitlerdeki aynı cinsteki türlerinde stoma boyutlarının farklılıklar gösterdiğini vurgulamıştır. 2x ve 4x kromozom sayısına sahip genotiplerde ploidi ilgili yapılan çalışmalarla stoma boyutları belirlenmiş ve

tetraploid bitkilerin stoma boyutlarında artışla birlikte birim alandaki stoma sayısında azalma meydana geldiğini bildirmişlerdir. stoma boyutlarındaki artışa bağlı olarak yoğunluğunda azalışlar kaydedilmiştir. (Sinski ve ark. 2014; Kara ve Yazar, 2020).

SONUÇ

Stoma ölçüm ve sayımları yaprağın üst ve alt yüzeyinden ayrı ayrı yapılmış ve alt yüzeydeki değerlerin üst yüzeyden daha yüksek olduğu görülmüştür. Stoma boyu, *Colchicum kurdicum* türünde alt yüzeyde $59.35 \pm 3,54 \mu\text{m}$ üst yüzeyde $48.25 \pm 0.88 \mu\text{m}$ iken *Colchicum szovitsii* türünde sırasıyla $48.84 \pm 2.10 \mu\text{m}$ ile $40.12 \pm 1.82 \mu\text{m}$ olarak tespit edilmiştir. *Colchicum kurdicum* ile *Colchicum szovitsii* türlerinde alt yüzeydeki orta açıklık ve stoma yoğunluğunun üst yüzeydekenden daha yüksek çıktığı belirlenmiştir. Stoma eninin ise iki türde de üst yüzeyde daha yüksek olduğu saptanmıştır. Yaprak boyunun *Colchicum kurdicum* ve *Colchicum szovitsii* türlerinde sırasıyla $6,33 \pm 1.75 \text{ cm}$ ve $2,90 \pm 0.26 \text{ cm}$ olduğu belirlenmiştir. Yaprak eninin ise *Colchicum kurdicum* türünün ($5,5 \pm 1.73$) *Colchicum szovitsii* ($0,76 \pm 0.25$) türünden daha yüksek değere sahip olduğu ortaya konmuştur.

KAYNAKLAR

- Akhtar, S. ve Siddiqui, M. Z. 2018. Suranjan shirin (*Colchicum autumnale*): A review of an anti-arthritic Unani drug. *The Pharma Innovation*, 7(12), 09-12.
- Aslantaş, R., Karakurt, H. 2009. The effects of altitude on stomata number and some vegetative growth parameters of some apple cultivars. *Journal of Agricultural and Biological Science* 5(5): 853- 857
- Azadbakht, M., Davoodi, A., Hosseinimehr, S. J., Emami, S., Azadbakht, M., Mirzaee, F. ve ark. 2020a. Phytochemical, physicochemical and biological evaluation of *Colchicum kurdicum* (Bornm.) Stef: a study on materia medica of Persian medicine. *Journal of Medicinal Plants*, 19(76), 36-45.
- Azadbakht, M., Davoodi, A., Hosseinimehr, S. J., Keighobadi, M., Fakhar, M., Valadan, R. ve ark. 2020b. Tropolone alkaloids from *Colchicum kurdicum* (Bornm.) Stef. (Colchicaceae) as the potent novel antileishmanial compounds; purification, structure elucidation, antileishmanial activities and molecular docking studies. *Experimental Parasitology*, 213, 107902.
- Çağlar, S., Sütyemez, M., Bayazıt, S., 2004. Seçilmiş bazı ceviz (*Juglans regia*) tiplerinin stoma yoğunlukları. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi*, 17(2): 169-174
- Ebadi, M. 2006. Pharmacodynamic basis of herbal medicine. Florida: CRC Press.
- Ergül, M. ve Bakar-Ates, F. 2021. Investigation of molecular mechanisms underlying the antiproliferative effects of colchicine against PC3 prostate cancer cells. *Toxicology in Vitro*, 73, 105138.
- Eriş, A., 1998. Bahçe Bitkileri Fizyolojisi. Uludağ Üniversitesi, Ziraat Fakültesi Ders Notları, No:11, IV.Baskı, Bursa. 152 s.
- Eriş, A., & Soyulu, A. 1990. Stomatal density in various Turkish grape cultivars. *Vitis*, 382-389
- Forlani, M., Pasquarella, C., Coppola, V. 1983. Relation between stomatal density and vigour of grapevine rootstocks. *Rivista di Viticoltura e di Enologia Conegliano* 36: 117-125.
- Franks, P. J., W. Doheny-Adams, T., Britton-Harper, Z. J., & Gray, J. E. 2015. Increasing water-use efficiency directly through genetic manipulation of stomatal density. *New Phytologist*, 207(1), 188-195.
- Gokbayrak, Z., Dardeniz, A., Bal, M. 2008. Stomatal density adaptation of grapevine to windy conditions. *Trakia Journal of Sciences* 6(1): 18- 22.
- Güner, A., Özhatay, N., Ekim, T. and Başer, K., 2002. Flora of turkey and east Aegean islands. XI volumes, ISBN:1-55297-673-4. USA. 224.
- İlgin, M., Çağlar, S., 2009. Comparison of leaf stomatal features in some local and foreign apricot (*Prunus armeniaca* L.) genotypes. *African Journal of Biotechnology* Vol. 8 (6):1074-1077.
- Hassan, S.E., Kalig, I., Khan, A.S. 2008. Genetic mechanism of some physiological traits in spring wheat at two plant population regimes. *Journal Agricultural Research* 46(4): 315-323
- Heidari, M. R., Vahedian, M., Moamenzadeh, S. ve HayatbakhshAbbasi, M. M. 2005. The Analgesic Effect and Possible Mechanism of *Colchicum szovitsii* Methanolic Extract in Mouse. *Journal of Rafsanjan University of Medical Sciences*, 4(1), 25-33.
- Kara, Z. & Yazar, K. 2020. Bazı üzüm çeşitlerinde in vitro poliploidi uyarımı. *Anadolu Tarım Bilimleri Dergisi*, 35(3), 410-418.
- Kavalalı, G. 2014. Bitkisel Aktif Madde Olan Kolşisin'in Etnofarmakolojik Yönden Değerlendirilmesi. *Mersin Üniversitesi Tıp Fakültesi Lokman Hekim Tıp Tarihi ve Folklorik Tıp Dergisi*, 4(1) 16-18.
- Kayaalp, O.S. 2002. Farmakolojiye Giriş, Rasyonel Tedavi Yönünden Tıbbi Farmakoloji. 10th ed. Ankara: Hacettepe-Taş Kitapçılık

- Kaya, E., 2011. Türkiye'nin doğal süs bitkileri kataloğu. Atatürk Bahçe Kùltürleri Merkez Arařtırma Enstitüsü Yayınları, Yayın No:91, s:272.
- Kukalsız Piřkin, B. 2022. *Colchicum variegatum* L. Üzerinde Farmakognozik Arařtırmalar. İstanbul Üniversitesi Saęlık Bilimleri Enstitüsü.
- Kurt, H. & Doęan, A. 2020. Farklı ekolojilerde yetiřen fındık (*Corylus avellana* L.) çeřit ve genotiplerinin stoma yoęunluk ve daęılımlarının belirlenmesi. Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi, 30(3), 544-552.
- Maghsoudi, K., Maghsoudi, A. 2008. Analysis of the effects of stomatal frequency and size on transpiration and yield of wheat (*Triticum aestivum* L.). American Eurasian Journal of Agriculture and Environmental Sciences 3(6): 865-872.
- Marasalı, B., & Aktekin, A. 2003. Sulanan ve sulanmayan baę kořullarında yetiřtirilen üzüm çeřitlerinde stoma sayısının karřılařtırılması. Tarım Bilimleri Dergisi, 9 (3), 370-372.
- Mehri, N., Fotovat, R., Saba, J., Jabbari, F. 2009. Variation of stomata dimensions and densities in tolerant and susceptible wheat cultivars under drought stress. Journal of Food Agriculture & Environment 7(1): 167-170.
- Molkova, E. A., Shchegravina, E. S., Otvagin, V. F., Kuzmina, N. S., Malysheva, Y. B., Svirshchevskaya, E. V. ve ark. 2022. Synthesis and biological evaluation of colchicine and thicolchicine derivatives bearing a Michael acceptor moiety in ring A. Russian Chemical Bulletin, 71(3), 564-571.
- Pandey, D. K. ve Banik, R. M. 2012. Optimization of extraction conditions for colchicine from *Gloriosa superba* tubers using response surface methodology. Journal of Agricultural Technology, 8(4), 1301-1315.
- Pektař, A. 2007. Tuz Gölü (Cihanbeyli-Konya) *Allium* L.(Liliaceae) taksonlarının morfolojik, anatomik ve ekolojik özellikleri. (PhD), Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, Konya, Türkiye
- Rocchetti, G., Senizza, B., Zengin, G., Okur, M. A., Montesano, D., Yildiztugay, E. ve ark. 2019. Chemical Profiling and Biological Properties of Extracts from Different Parts of *Colchicum szovitsii* subsp. *szovitsii*. Antioxidants, 8(12), 632.
- Sinski, I., Dal Bosco, D., Pierozzi, N., Maia, J., Ritschel, P., Quecini, V., 2014. Improving in vitro induction of autopolyploidy in grapevine seedless cultivars. Euphytica, 196 (2), 299-311. <https://doi.org/10.1007/s10681-013-1034-8>
- Suhail, S., Shakir Jamil, S. ve Jilani, S. 2017. Phytochemical and Pharmacological Review of Suranjan Shireen (*Colchicum autumnale*). Indo American Journal of Pharmaceutical Res, 7(4), 8492-6.
- Scienza A, Boselli M 1981. Frequency and biometrical characteristics of stomata in different stock-vine varieties. Vitis 20: 281-292.
- řelem, E., Nohutçu, L., Tunçtürk, R., & Tunçtürk, M. 2020a. Determination of morphological measurements, stoma and pollen characteristics with pollen viability of some allium species Bazı allium türlerinin morfolojik ölçümleri, stoma ve polen özellikleri ile polen canlılığının belirlenmesi. Yuzuncu Yıl University Journal of Agricultural Sciences, 30(Additional issue).
- řelem, E., Nohutçu, L., Tunçtürk, R., & Tunçtürk, M. 2020b. Bazı Allium Türlerinin Morfolojik Ölçümleri, Stoma ve Polen Özellikleri ile Polen Canlılığının Belirlenmesi. Yuzuncu Yıl University Journal of Agricultural Sciences, 30(Ek sayı (Additional issue), 882-889.
- Turker, A. U. ve Usta, C. 2008. Biological screening of some Turkish medicinal plant extracts for antimicrobial and toxicity activities. Natural Product Research, 22(2), 136-146.

- Verona, C., Calcagno, F. 1991. Study of stomatal parameters for selection of drought resistant varieties in *Triticum durum* DESF. *Euphytica* 57(3): 275-283.
- Yaldız, G., Yüksek, T. ve Şekeroğlu, N., 2010. Rize ili florasında bulunan tıbbi ve aromatik bitkiler ve kullanım alanları. 3. Ulusal Karadeniz Ormancılık Kongresi 20– 22 Mayıs 2010, Artvin, s:1100–1114.
- Yang, L., Liu, Q., Wang, Y., & Liu, L. 2017. Identification and characterization of a glossy mutant in Welsh onion (*Allium fistulosum* L.). *Scientia Horticulturae*, 225, 122-127.
- Yanmaz, R., Eriş, A., 1984. Bazı sebze türlerinin yapraklarındaki stoma sayıları. Number of stomata of some vegetables leaves) *Ank. Üniv. Zir. Fak.Yıllığı* 1983 (1-2-3-4), 94-102.

**MORİNGA OLİEİFERA’NIN YUMURTA TAVUKLARININ BESLENMESİNDE
KULLANILMASI**

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ÖZET

Yoğun üretim sisteminin benimsendiği kanatlı hayvan sektöründe uzun yıllar boyunca antibiyotikler yem katkı maddesi olarak kullanılmıştır. Antibiyotiklerin insan sağlığı üzerine olan zararlı etkilerin anlaşılması ve tüketicilerin satın alma davranışlarındaki farklılaşma sebebiyle alternatif yem katkı maddesi arayışları başlamıştır. Alternatif yem katkı maddelerinden birisi de tıbbi aromatik bitkilerdir. Moringa oleifera üzerinde durulan tıbbi aromatik bitkilerden birisi olup; içerdiği biyoaktif bileşenler dışında protein bakımından zengindir. Moringa steroller, terpenoidler, flavonoidler, fitokimyasallar açısından zengin olmakla birlikte, tanen ve diğer antibesleme faktörlerini çok az miktarda içermesi sebebiyle de kanatlı hayvan sektörü için alternatif bir yem katkı maddesidir. Bu derlemede Moringa oleifera'nın yumurta tavuklarının beslenmesinde kullanımı ile ilgili araştırmalar incelenmiştir.

Anahtar Kelimeler: Moringa oleifera, Besleme, Yumurta tavuğu

THE USE OF MORINGA OLIEIFERA IN THE NUTRITION OF LAYING HENS

ABSTRACT

Antibiotics have been used as feed additives for many years in the poultry sector, where intensive production system has been adopted. Due to the understanding of the harmful effects of antibiotics on human health and the differentiation in the purchasing behavior of consumers, the search for alternative feed additives has begun. One of the alternative feed additives is medicinal aromatic plants. Moringa oleifera is one of the medicinal aromatic plants focused on. The bioactive components contained in moringa are rich in other proteins and crude cellulose. Moringa sterols, terpenoids, flavonoids, phytochemicals, although Rich in tannins and other factors antibesleme contain a very small amount of a feed additive in poultry industry due to the alternative. In this review, the researches related to the use of Moringa oleifera in the nutrition of laying hens were examined.

Keywords: Moringa oleifera, Feeding, Laying hens

GİRİŞ

Son yıllarda yem katkı maddesi olarak hayvan beslemede antibiyotiklerin yasaklanması üzerine, onların yerine ikame edilecek yeni inovatif yem katkıları arayışları başlamıştır. Fitojenik yem katkıları, fitobiyotikler, tıbbi ve aromatik bitkiler, bitki ekstraktları, eterik yağlar bu gruba girmekte olup, çiftlik hayvanlarının verim performanslarını iyileştirmede öncülük edebilecek sonuçlar elde edilmiştir. (Moreno-Mendoza ve ark., 2021). Bunlar içerdikleri fitokimyasallar ile antioksidan, antiinflamatuvar, antimikrobiyal, antibakteriyel, antelmintik, koksidiyostatik, antiviral ve immünomodülatör gibi özellik göstermektedirler (Kikusato, 2021; Ullah ve ark., 2022). Son yıllarda üzerinde durulan bitkilerden bir tanesi de *M. Oleifera*'dır.

M. oleifera, Moringaceae familyasından olup yaygın isimleri arasında moringa, baget ağacı, yaban turpu ağacı, ben yağı ağacı, benzoil ağacı veya mucize ağacı diye adlandırılmaktadır. *M. oleifera* ağacı Güney Asya'ya, özellikle Hindistan, Sri Lanka, Pakistan, Bangladeş, Afganistan'a özgüdür. *M. oleifera*'nın tohumu ve yaprakları gıda endüstrisinde yaygın olarak kullanılmaktadır. *M. oleifera*'nın, yapraklarının besleyici değerinin yüksek olduğu için hayvanların beslenmesinde kullanılmaktadır. *M. oleifera*'nın yaprakları, diğer temel besinlerin yanı sıra önemli bir vitamin B kompleksi, C vitamini, beta-karoten olarak A vitamini, K vitamini, manganez ve protein kaynağı olan en besleyici kısmıdır. Yaprakları antimikrobiyal özelliklere sahiptir ve yağ, protein, vitamin ve mineraller açısından zengindir. *M. oleifera*'nın yapraklarından elde edilen ekstraktlar, kan lipid metabolizması üzerinde etkileri olabilecek düşük miktarda polifenol içerir. *M. oleifera*, kümes hayvanlarında bir mikro besin kaynağı ve besin takviyesi olarak kullanılabilir. Ek olarak, *M. oleifera* yaprak tozu, yapraklarda farklı fitokimyasalların (quercetin, kaempferol vb.) varlığından dolayı antimikrobiyal, antifungal, bağışıklık güçlendirici, anti tümör ve karaciğer koruyucu olarak kullanılmaktadır (Mahfuz ve Piao, 2019).

M. oleifera'nın tıbbi kullanımını dışında hayvanlar için yem materyali olması, tohumundan yağ elde edilmesi, lif kaynağı gibi sayısız kullanımı, biyolojik ve ekonomik olasılıkları, özellikle de içerdiği biyoaktif bileşenler üzerinde daha fazla araştırmayı gerektirmektedir

Bu derlemede, yumurtacı kanatlıların beslenmesinde kullanılan moringa bitkisi ve ondan elde edilen ürünlerin söz konusu hayvanlar üzerindeki etkileri ele alınmıştır.

Moringa Yapraklarının Besin Madde Kompozisyonu

M. oleifera birçok tropikal ve subtropikal ülkede yaygın olarak yetişen küçük boylu bir ağaçtır. Tohumu, yaprakları, yağı, ekstraktı, ağaç kabuğu, kökleri ve çiçekler geleneksel tıpta yaygın olarak kullanılmaktadır. Moringa yapraklarının vitaminler, mineraller, amino asitler ve yağ

asitleri içeren arzu edilen bir besin dengesi içermesi ile karakterize edilmiştir (Stohs ve Hartman, 2015)

M. oleifera yapraklarının besin bileşimi söz konusu olduğunda; kuru maddesi yaklaşık %93,63-95,0; ham proteini %17,01-22,23, karbonhidrat %63,11-69,40, selüloz %6,77-21,09, ham yağ %2,11, yağ asidi de %1,69-2,31 arasında değişmektedir (Mahfuz ve Piao, 2019).

M. oleifera yapraklarının besin madde içeriği Çizelge 1 verilmiştir. Çizelge 1 incelendiğinde moringanın yapraklarında protein içeriğinin yüksek olduğu görülmüştür.

Moringa bitkisinin yaprakları yüksek düzeyde kalsiyum ve fosfor içermektedir. Yeterli düzeyde de çinko içermektedir. Vitaminler bakımından da iyi bir kaynaktır. Moringa zeatin, quercetin, kaempferom fenolik bileşikler bakımından zengindir (Patel ve ark., 2014).

Çizelge 1. Moringa yapraklarını besin madde içeriği (Mahfuz ve Piao, 2014)

Besin Madde İçeriği	Taze Yaprak	Kuru Yaprak	Yaprak (Toz form)
Protein (g)	6,7-17,1	29,4-40,0	25,4-27,1
Yağ (g)	1,7-2,11	5,2-6,5	2,3
Karbonhidrat (g)	6,3-12,5	38,0-41,2	34,3-38,2
Ham selüloz (g)	0,9-7,09	12,5-21,09	19,2
Mineraller			
Fosfor (mg)	30,15-70	204-252	204
Kalsiyum (mg)	440	2185-3050	2003
Bakır (mg)	0,07	0,08-0,49	0,57
Demir (mg)	0,85-10,7	25,6-49,0	28,2
Çinko (mg)	6,7	3,25-13,03	-
Magnezyum (mg)	42-82	86-448	368
Vitaminler			
Vitamin A	0,9-11,05	16,3-18,90	-
Vitamin C	220	15,8-17,3	173
Vitamin E	448	10,8-77,0	113

Moringa oleifera yapraklarında bulunan antibesinsel maddeler Çizelge 2’de verilmiştir.

Çizelge 2. Moringa oleifera yapraklarında bulunan antibesinsel maddeler (% KM)

Anti besinsel faktörler	Balami ve ark., (2018)	Teixeira ve ark., (2014)
Taninler	2.19	2.06
Saponinler	1.06	-
Fitat	2.57	-
Oksalat	0.45	1.05
Tripsin inhibitör	-	1.45 TUI/g
Siyanid	0.1	-

Moringa yaprakları 12 gr/kg tanen, 80 gr/kg saponin içermektedir. Saponinin sahip olduğu keskin ve tahriş edici tat ve yüksek konsantrasyonda yem alımını ve dolayısıyla vücut büyümesini azaltabilir (Amad ve ark., 2022). Farklı çalışmalarda rakamlar arasında görülen farklılıkların sebebi genetik, yaş, büyüme ve çevre koşullarında görülen farklılıklardır. Moringa yapraklarının oksalat içeriği çözünmez olup, ispanaktakinin (822 mg) altındadır ve tavuklar için zararlı değildir. Tripsin inhibitörleri ile ilgili olarak, nispeten düşük seviyede bulunmuştur.

Moringa Oleifera Yapraklarının Yumurta Tavuklarında Beslenmesinde Kullanımı

Son yıllarda yumurta tavuklarında M.oleifera yaprak ekstratının kullanıldığı birçok çalışma yürütülmüş olup çalışmaların sonuçları farklılık arz etmektedir. Yumurtacı tavuklarla olan çalışmalar incelendiğinde performans, yumurta kalitesi ile kan parametreleri ile ilgili çalışmalara rastlanılmıştır.

Lohman tavukları üzerinde yürütülen bir çalışmada Abdel-Azeem ve ark. (2017), karma yeme %0.5, %1.0, %1.5 ve %2.0 seviyesinde M. oleifera yaprak tozu ilave etmişlerdir. Araştırmacılar %2.0 seviyesinde M. oleifera yaprak tozunun yem katkı maddesi olarak kullanılabileceğini bildirmişlerdir.

Vanaraja yumurta tavuklarının karma yemlerine 0.5, 1.0, 1.5 ve 2.0 kg seviyelerinde M. oleifera yaprak tozu ilavesinin rasyon maliyetini azalttığı, yumurta üretimini ve yemden yararlanma oranını iyileştirdiği ifade edilmiştir (Swain ve ark., 2017).

Yumurta tavukları üzerinde yürütülen bir çalışmada karma yeme %2, %4 ve %6 seviyesinde M. oleifera yaprak tozu ilave edilmiştir. Çalışma sonucunda karma yeme %4-6 seviyesinde toz formu ilavesinin yumurta tavuklarında yem sindirilebilirliğini ve yumurtalarda dış kaliteyi artırdığını bildirmişlerdir (Siti ve ark., 2019).

Yumurta tavuğu karma yemlerine %2, %4 %6 seviyesinde M. oleifera yaprak tozu ilavesinin performans, yumurta sarısı kolesterol ve mineral içeriği üzerine etkilerinin araştırıldığı başka bir çalışmada karma yeme %4-6 seviyesinde M. oleifera yaprak tozu ilavesi ile yumurta veriminin, yumurta kitlesinin, yemden yararlanma oranının, yumurta sarısı beta karoten, Ca ve Mg içeriğinin arttığını, kolesterol seviyesinin azaldığı görülmüştür (Bidura ve ark., 2020).

Gayathri ve ark., (2020), %1 düzeyinde M. oleifera yaprak tozu ilavesinin performans ve yumurta kabuğu kalite özellikleri üzerine olumlu etkisinin olduğunu bildirmiştir.

Abdel-Wareth ve Lohakare (2021), M. oleifera yaprak tozunun 64-72. haftalık yaşlar arasındaki yumurtacı tavuklara %0-0.3-0.6 ve 0.9 düzeyinde verilmesinin, yumurta performansı söz konusu olduğunda, yumurta ağırlığı, yumurta verimi ve yemden yararlanma oranını istatistiki olarak artırdığını, buna karşılık yem tüketimini etkilemediğini bildirirken; yumurta kalitesi söz

konusu olduğunda Haugh birimi ve kabuk kalınlığının istatistiki olarak arttığı, buna karşılık albumen ve sarı üzerine etkisinin olmadığını ifade etmiştir. Sharmin ve ark., (2021) ise *M. oleifera* yaprak tozunun 26-42 haftalık yaşlar arasındaki yumurtacı tavuklara %0-0.5 ve 1 düzeyinde verilmesinin canlı ağırlık, yem tüketimi, yumurta ağırlığı, verimi, yumurta şekil indeksi, Haugh birimi, kabuk kalınlığının uygulamalardan etkilenmediğini, sadece sarı renginin istatistiki olarak etkilendiğini tespit etmiştir.

Rajesh ve ark., (2021), *M. oleifera* yaprak tozunun 34-49 haftalık yaşlar arasındaki yumurtacı tavuklara %0-5-7.5 ve 10 düzeyinde verilmesinin kolesterol düzeyinde önemli bir azalmaya yol açtığını bildirmiştir. Konu ile ilgili yapılan bir başka çalışmada ise Shen ve ark. (2022), 37 haftalık yumurta tavukları karma yemlerine %2.5, %5.0, %7.5 ve %10.0 seviyesinde *M. oleifera* yaprak tozu katılmasının etkilerini araştırmışlardır. Çalışma sonucunda karma yeme %2.5 seviyesinde *M. oleifera* yaprak tozu ilavesinin hormon sentezi ve gen regülasyonu açısından üreme fiziolojisi üzerinde potansiyel etkilerinin olduğunu bildirmişlerdir.

Sonuç olarak *M.oleifera* yaprak tozunun içerdiği besin maddeleri göz önüne alındığında yumurta tavuklarında potansiyel bir yem katkı maddesi olarak kullanılabileceği bununla birlikte farklı parametreler üzerindeki etkilerinin araştırıldığı çalışmalara ihtiyaç olduğu söylenebilir.

KAYNAKÇA

- Abd El-Hack, M. E., Alqhtani, A. H., Swelum, A. A., El-Saadony, M. T., Salem, H. M., Babalghith, A. O., ... & El-Tarabily, K. A. (2022). Pharmacological, nutritional and antimicrobial uses of *Moringa oleifera* Lam. leaves in poultry nutrition: an updated knowledge. *Poultry Science*, 102031.
- Abdel-Wareth, A., Lohakare, J. (2021). *Moringa oleifera* leaves as eco-friendly feed additive in diets of hy-line brown hens during the late laying period. *Animals*, 11(4), 1116. <https://doi.org/10.3390/ani11041116>
- Amad, A. A., Zentek, J., Dhamar, Y. (2022). *Moringa* (*M. oleifera*) Leaf Meal in Diets for Broilers and Laying Hens: A Review. *Journal of Agricultural Science*, 14(10): 12-33.
- Balami, A. G., Ndahi, J. J., Gadzama, J. J., Enam, S. J., Chiroma, M. A., Abdu, P. A., ... Oladele, S. B. (2018). Effect of *Moringa oleifera* feed supplementation on the serum biochemical profile of broilers challenged with very virulent infectious bursal disease virus. *Journal of Advanced Veterinary and Animal Research*, 5(2), 155-165. <https://doi.org/10.5455/javar.2018.e260>
- Bidura, I. G. N. G., Partama, I. B. G., Utami, I. A. P., Candrawati, D. P. M. A., Puspani, E., Suasta, I. M., ... & Siti, N. W. (2020). Effect of *Moringa oleifera* leaf powder in diets on laying hens performance, β -carotene, cholesterol, and minerals contents in egg yolk. In *IOP Conference Series: Materials Science and Engineering* (Vol. 823, No. 1, p. 012006). IOP Publishing.
- Gayathri, S. L., L. K. Babu, and A. K. Panda. "Effect of dietary supplementation of *Moringa oleifera* leaf meal on production performance and egg quality of Vanaraja laying hens." *Animal Nutrition and Feed Technology* 20.2 (2020): 279-287.
- Kikusato, M. (2021) Phytobiotics to improve health and production of broiler chickens: Functions beyond the antioxidant activity. *Anim. Biosci.* 34, 345–353.
- Mahfuz, S., Piao, X. S. (2019). Application of *Moringa* (*Moringa oleifera*) as natural feed supplement in poultry diets. *Animals*, 9(7), 431.
- Mbikay, M. 2012. Therapeutic potential of *Moringa oleifera* leaves in chronic hyperglycemia and dyslipidemia: A Review. *Front Pharmacol*, 3, 1-12.
- Moreno-Mendoza, Y., López-Villarreal, K.D., Hernández-Martínez, C.A., Rodríguez-Tovar, L.E., Hernández-Coronado, A.C., Soto-Domínguez, A., Hume, M.E., Méndez-Zamora, G. (2021). Effect of *Moringa* leaf powder and agave inulin on performance, intestinal morphology, and meat yield of broiler chickens. *Poult. Sci.* 100, 738–745.
- Onu, P. N, Aniebo, A. O. (2011). Influence of *Moringa oleifera* leaf meal on the performance and blood chemistry of starter broilers, Nigeria. *Int J Food Agric and Vet Sci*, 1(1): 38-44.
- Patel, P., Patel, N., Patel, D., Desai, S., Meshram, D. (2014). Phytochemical analysis and antifungal activity of *Moringa oleifera*. *International Journal of Pharmacy and Pharmaceutical Sciences*, 6(5), 144-147.
- Rajesh, P., Kumari, N. N., Nagalakshmi, D., Rao, M. H., & Gurram, S. (2021). *Moringa oleifera* leaf meal (MOLM) with cocktail enzyme supplementation on immunity, serum biochemical and antioxidant activity of layers. *Indian Journal of Animal Nutrition*, 38(3), 310-316.
- Sharmin, F., Sarker, M. S. K., Sarker, N. R., & Faruque, S. (2021). Dietary effect of *Moringa oleifera* on native laying hens' egg quality, cholesterol and fatty-acid profile. *Italian Journal of Animal Science*, 20(1), 1544-1553.
- Shen, M., Li, T., Lu, J., Qu, L., Wang, K., Hou, Q., Wu, P. (2022). Effects of Supplementation of *Moringa Oleifera* Leaf Powder on Some Reproductive Performance in Laying Hens. *Brazilian Journal of Poultry Science*, 24 (2), 1-8.

- Siti, N. W., Bidura, I. G. N. G., Mayuni, S. N., Utami, I. A. (2019). Effect of Moringa oleifera leaf powder in diets on feed digestibility and external egg quality characteristics in laying hens. *J. Biol. Chem. Res*, 36, 80-87.
- Stohs, S. J., Hartman, M. J. (2015). Review of the safety and efficacy of Moringa oleifera. *Phytotherapy Research*, 29(6), 796-804.
- Swain, B. K., Naik, P. K., Chakurkar, E. B., & Singh, N. P. (2017). Effect of supplementation of Moringa oleifera leaf meal (MOLM) on the performance of Vanaraja laying hens. *Indian Journal of Animal Sciences*, 87(3), 353-355.
- Teixeira, E. M. B., Carvalho, M. R. B., Neves, V. A., Silva, M. A., & Arantes-Pereira, L. (2014). Chemical characteristics and fractionation of proteins from Moringa oleifera Lam. leaves. *Food Chemistry*, 147, 51-54. <https://doi.org/10.1016/j.foodchem.2013.09.135>
- Ullah, F., Muhammad T., Shabana, N., Nazir, A. K., Khan, R.U. (2022) In-vitro efficacy and ameliorating effect of Moringa oleifera on growth, carcass, stress and digestibility of nutrients in Escherichiacoli-infected broilers, *Journal of Applied Animal Research*, 50:1, 118-124.

ACİL SERVİSLERİN UYGUNSUZ KULLANIMI

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Özet

Acil servisler akut gelişen durumlarda değerlendirme, tanımlama, stabilizasyon ve tedavi uygulamalarının gerçekleştirildiği özel birimlerdir. Herhangi bir nedenle başka birimde hizmet alınamadığında hizmet istemi çoğu zaman acil servislere yönelmektedir. Asıl amacı acil durumlarda kritik sağlık bakımına ihtiyacı olanlara hizmet etmek olan acil servislerin, sağlık durumu acil olmayan ve birinci basamak bir sağlık kuruluşunda tedavi olabilecek bireyler tarafından kullanımı olan “Acil servislerin uygunsuz kullanımı”, küresel bir sorundur. Bu derleme acil servislerin kullanımını etkileyen faktörler, acil servislerin uygunsuz kullanım nedenleri ve sonuçlarına ilişkin bilgi sunmaktadır.

Anahtar Kelimeler: Acil Servis; Uygunsuz Kullanım; Sağlık hizmetleri

IMPROPER USE OF EMERGENCY SERVICES

Abstract

Emergency services are special units where evaluation, identification, stabilization and treatment applications are carried out in cases such as an acute health problem. When service cannot be received in another unit due to some reason, most of the time the service request is directed to the emergency services. The use of emergency services, whose main purpose is to serve people in need of critical health care in emergencies, by individuals whose health condition is not urgent and can be treated in a primary health care institution, named as "Inappropriate use of emergency services" is a global problem. This review provides information on the factors affecting the use of emergency services, the reasons for inappropriate use of emergency services and their consequences.

Keywords: Emergency room; Improper Use; Health Service

1. GİRİŞ

Acil servisler sağlık sorunu veya ani yaralanma gibi durumlarda değerlendirme, teşhis, stabilizasyon ve tedavinin uygulandığı özel birimlerdir (Edirne, Edirne, Atmaca, & Keskin, 2008; Şimşek & Gürsoy, 2015). Acil servislerdeki sağlık hizmetleri, kurtarma ve hayatta kalmayı sağlamaya yönelik olup sakatlık ve ölüm risklerinin kontrolünde kesintisiz hizmet verilmesini hedeflemektedir.(Ersel et al., 2006). Sunulan hizmetin önceliğin en acil vakaya verilmesi ve zamanında tedavi yapılması gibi temel ilkeleri bulunmaktadır.

Sağlanan bakım ve tedavinin kalitesi acil servisleri tıbbi bakım için özel bir seçenek haline getirmiştir. Semptomların ortaya çıkması veya sağlık sisteminin yoğunluğu nedeniyle başka bir birimden hizmet alınamadığında hizmet istemi acil servislere yönelmektedir. Bu nedenle günümüzde acil servis hizmetleri modern sağlık sisteminin giriş kapısı ve yapı taşlarından biridir (Carret, Fassa, & Domingues, 2009). Birincil amacı acil durumlarda kritik tıbbi bakıma muhtaç olan kişilere hizmet etmek olan acil servislerin, sağlık durumu acil olmayan ve birinci basamak bir sağlık kuruluşunda tedavi olabilecek bireyler tarafından kullanımı küresel çapta bir sorundur (Uğrak, Cihangiroğlu, Uzuntarla, & Teke, 2016).

2. ACİL SERVİSLERİN KULLANIMINI ETKİLEYEN UNSURLAR

Son yıllarda dünya nüfusunun artmasıyla birlikte dünya çapında acil sağlık hizmetlerine yönelik talep artmıştır (Pines, Pilgrim, Schneider, Siegel, & Viccellio, 2011). Gelir durumu, eğitim durumu ve sosyal destek sistemleri gibi sosyodemografik özellikler de acil servislerin kullanımını etkileyen önemli faktörlerdendir (He, Hou, Toloo, Patrick, & Gerald, 2011). Yaşam tarzının da acil servislere başvuruları önemli oranda etkilediği dikkat çekmektedir. Yaşam tarzı özellikleri acil servislerin sık kullanılmasına neden olan kronik hastalıklar, alkol ve madde bağımlılığı düzeyi ile de ilişkilidir (Johar, Jones, & Savage, 2013).

Acil servislerin kullanımını etkileyen bir diğer unsur da kişinin yaşadığı sağlık sorununun aciliyet algısıdır. Yürütülmekte olan pek çok çalışma bu algıyı etkilemekte ve bu durumda dolaylı olarak acil servislerin kullanımını etkilemektedir. Ülkelerin sağlık sistemleri ve sağlık politikaları da acil servislerin kullanımını önemli ölçüde etkilemektedir (Callen, Blundell, & Prgomet, 2008).

3. ACİL SERVİSLERİN UYGUNSUZ KULLANIMI

Kaza veya yaralanma olmadan gelişen, acil servis hizmeti gerektirmeyen ve birinci basamak sağlık kuruluşlarında güvenle tedavi edilebilecek sağlık sorunları için acil servislerin kullanılması uygunsuz kullanım olarak kabul edilmektedir (McHale et al., 2013). Uygunsuz kullanım kavramının öznel olması ve aciliyet kavramının nicel bir ölçüsü olmaması gibi nedenlerle, bilim dünyası bu kavram için net bir fikir birliğine ulaşmamaktadır (Schull, Kiss,

& Szalai, 2007). Bilim dünyası başvuruların aciliyet düzeyi ile uygunluğu arasındaki ilişki üzerinde de durmaktadır. Birkaç saat bekletildiğinde herhangi bir olumsuz sonuç gelişme riski bulunmayan sağlık sorunlarına yönelik acil servis başvuruları “acil olmayan başvurular” şeklinde tanımlanmaktadır (Durand et al., 2011). Acil olmayan başvurular, sağlık sorunlarının ciddiyetini yansıtan bir ifade olarak ele alınmaktadır. Uygunsuz kullanım ise sağlık sorununun ciddiyet düzeyi, olası hizmet birimlerinin ulaşılabilirlik ve hastaların acil servisi tercih etme nedenleri gibi sosyal ve psikolojik boyutları olan bir kavram olarak kabul edilmektedir (Bullard et al., 2014). Çeşitli çalışmalarda uygunsuz kullanım tanımı, farklı kriterlere dayandırılmakta ve kriterlerin belirlenmesinde genellikle Kanada Triyaj Skalası (CTAS) ve Hastane Aciliyet Uygunluğu Protokolü (HUAP) kullanılmaktadır (Durand et al., 2011).

Sıklıkla kullanılan uygunsuz kullanım ölçütleri; hastanın hiçbir olumsuz sonuç gelişme olasılığı olmadan tıbbi bakım alıncaya kadar bekleyebileceği süre, ölüm riski ya da organ hasarı varlığı, acil tedavi ve gözlem gereksinimi, tıbbi bakım için acil servis kaynaklarının gerekliliği, özel tanı yöntemlerinin gerekliliği, tedavi için başka bir hizmet biriminin uygunluğu, yakınmaların akut olarak gelişip gelişmediği, sağlık sisteminin bir başka basamağından sevk edilme durumu olarak açıklanmıştır (Durand et al., 2011).

4. ACİL SERVİSLERİN UYGUNSUZ KULLANIM NEDENLERİ

Yapılan çalışmalar incelendiğinde uygunsuz kullanıma neden olan birçok faktörün olduğu görülmektedir. Birinci basamak sağlık hizmetlerine erişim, acil serviste verilen hizmetin özellikleri ve kişinin yaşadığı sağlık sorununa ilişkin problemler, acil servisleri sağlık hizmetinin ön planına yerleştirmekte ve bu durumda acil servislerin uygunsuz kullanımına neden olmaktadır (Edirne et al., 2008). Bu nedenler;

- Acil servislerin yer ve işlev olarak zamandan kazanım sağlaması (Lega & Mengoni, 2008),
Sigorta açısından sıkıntı yaşayan bireylerin diğer birimlerden yararlanamaması nedeniyle acil servisleri tek adres olarak kullanmalarındır (Harris, Patel, & Bowen, 2011),
- Halkın birinci basamak sağlık kuruluşlarının işlevlerine dair bilgi düzeyinin düşük olması (Breen & McCann, 2013),
- Bireylerin soruna yönelik aciliyet algısı (Yürütülmekte olan çeşitli sağlık kampanyaları ve sağlıkla ilişkili yapılan programlar aciliyet algısının şekillenmesinde rol almakta ve bu durumda acil servislerin kullanımı üzerinde etkili olmaktadır),
- Basit sağlık sorunlarında bakım alma konusunda sağlık çalışanları ya da hasta yakınlarının acil servislere başvuru yönündeki önerileri,

- Barınmada sorun yaşayan kişilerin açlık, güvenlik gibi ihtiyaçlarını karşılama düşünceleri (Şimşek & Gürsoy, 2015) şeklinde sıralanabilir.

5. ACİL SERVİSLERİN UYGUNSUZ KULLANIM SONUÇLARI

Uygun kullanım acil tıbbi bakıma gereksinimi olan bireylerin acil servis kaynaklarından yararlanmasını engelleyerek, değerlendirme ve teşhis sürecinde gecikmelere, tedavi sürecinin aksamasına, verilen hizmetin kalitesinin ve yaşamsal risklerin kontrol altına alınması için zamana karşı verilen mücadelenin başarısını etkilemektedir (Ersel et al., 2006; Şimşek & Gürsoy, 2015). Uygun kullanım sebebiyle başvuran hasta sayısındaki artış;

- iş yükünün artmasına, çalışan memnuniyetinin azalmasına,
- çalışanlar arasındaki iletişimi etkileyerek tıbbi hata yapılmasına,
- hasta muayenesinde aceleci davranılmasına
- hastaların bekleme sürelerinin uzamasına,
- hasta memnuniyetinin azalmasına neden olmaktadır (Şimşek & Gürsoy, 2015).

Acil müdahale gerektiren durumlar dışında acil servislerin kullanılmasıyla bilimsel temelden uzaklaşmakta ve bu durum acil servislerde çalışan bireylerin psikolojilerinde de bozulmalara neden olmaktadır (Durand et al., 2011).

Acil servislerin kronik hastalıkların takibi için kullanılması, bu hastalıkların gerektirdiği özel, önleyici ve sürekli bakıma yönelik hizmetlerden mahrum kalınmasına yol açmaktadır (McWilliams, Tapp, Barker, & Dulin, 2011). Uygun kullanımın sağlık bakım maliyetlerini de arttırdığı görülmektedir. Birinci basamak sağlık kuruluşunda verilen hizmetlerin yeterli olduğu durumlarda acil servisler kullanılmayarak sağlık bakım maliyetlerinde %69-%86 oranında tasarruf sağlanabileceği yapılan çalışmalar sonucunda ortaya konmuştur. (McWilliams et al., 2011). Uygun kullanım verilen hizmetin kalitesini düşürüp, maliyetini arttırmanın yanısıra kalabalıklaşmaya sebep olarak servis hizmetlerinin sağlanmasını güçleştirmektedir (Olshaker, 2009).

6. SONUÇ

- Acil servislerde sunulan hizmetin kalitesini arttırmak için etkili bir triyaj uygulaması yapılmalıdır. Acil servislerde triyajın önemi ve bu kapsamda yeşil alana başvuru yapan hastaların bekletilebileceği konusunda halk bilgilendirilmelidir

- Aile hekimliklerinin ileri tetkik ve tedavi gerektirmeyen durumlar ve sađlık eđitimi/yařam tarzı deđiřiklikleriyle kontrolü sađlanabilecek sađlık sorunlarına ynelik verdiđi hizmetler konusunda halk eđitimi yapılmalıdır (Brim, 2008).
- Medya tarafından yayınlanan sađlık bilgilerinin aciliyet algısı üzerinde etkili olduđu bilinmektedir. Bu yzden yayınlanan sađlık bilgilerinin dođruluđu yetkililer tarafından kontrol edilmelidir (Cantrk, Eřiyok, Polat, Korkusuz, & Akduman, 2005).
- Sađlık sorunlarının tedavi ve kontrolnde bařarı,maliyetinde etkinlik ve acil servis hizmetlerinde kalite sađlanması iin uygun bakımın uygun birimlerden alınmasına ynelik alıřmalar planlanmalıdır. Bu ama dođrultusunda mesai saatleri dıřında acil olmayan hastalar iin hizmet birimlerinin oluřturulması konusu ncelikli olarak ele alınmalıdır (McWilliams, Tapp, Barker, & Dulin, 2011).

KAYNAKÇA

- Breen, B. M., & McCann, M. (2013). Healthcare providers attitudes and perceptions of 'inappropriate attendance' in the Emergency Department. *International Emergency Nursing, 21*(3), 180-185.
- Brim, C. (2008). A descriptive analysis of the non-urgent use of emergency departments. *Nurse Researcher, 15*(3).
- review of prevalence and associated factors. *Cadernos de saude publica, 25*, 7-28.
- Bullard, M. J., Chan, T., Brayman, C., Warren, D., Musgrave, E., Unger, B., & Group, C. N. W. (2014). Revisions to the Canadian emergency department triage and acuity scale (CTAS) guidelines. *Canadian Journal of Emergency Medicine, 16*(6), 485-489.
- Callen, J. L., Blundell, L., & Prgomet, M. (2008). Emergency department use in a rural Australian setting: are the factors prompting attendance appropriate? *Australian Health Review, 32*(4), 710-720.
- Cantürk, G., Eşiyok, B., Polat, O., Korkusuz, İ., & Akduman, B. (2005). Ankara Üniversitesi Tıp Fakültesi İbn-İ Sina Hastanesi acil servisine 2002 yılında başvuran zehirlenme olguları. *Adli Bilimler Dergisi, 4*(1), 39-45.
- Carret, M. L. V., Fassa, A. C. G., & Domingues, M. R. (2009). Inappropriate use of emergency services: a systematic Durand, A.-C., Gentile, S., Devictor, B., Palazzolo, S., Vignally, P., Gerbeaux, P., & Sambuc, R. (2011). ED patients: how nonurgent are they? Systematic review of the emergency medicine literature. *The American journal of emergency medicine, 29*(3), 333-345.
- Edirne, T., Edirne, Y., Atmaca, B., & Keskin, S. (2008). Yüzüncü yıl üniversitesi tıp fakültesi acil servis hastalarının özellikleri. *Van Tıp Dergisi, 15*(4), 107-111.
- Ersel, M., Karcioğlu, Ö., Yanturalı, S., Yürüktümen, A., Sever, M., & Tunç, M. A. (2006). Bir acil servisin kullanım özellikleri ve başvuran hastaların aciliyetinin hekim ve hasta açısından değerlendirilmesi. *Türkiye Acil Tıp Dergisi, 6*(1), 25-35.
- Harris, M. J., Patel, B., & Bowen, S. (2011). Primary care access and its relationship with emergency department utilisation: an observational, cross-sectional, ecological study. *British Journal of General Practice, 61*(593), e787-e793.
- He, J., Hou, X.-y., Toloo, S., Patrick, J. R., & Gerald, G. F. (2011). Demand for hospital emergency departments: a conceptual understanding. *World journal of emergency medicine, 2*(4), 253.
- Lega, F., & Mengoni, A. (2008). Why non-urgent patients choose emergency over primary care services? Empirical evidence and managerial implications. *Health policy, 88*(2-3), 326-338.
- Johar, M., Jones, G., & Savage, E. (2013). The effect of lifestyle choices on emergency department use in Australia. *Health policy, 110*(2-3), 280-290.
- McHale, P., Wood, S., Hughes, K., Bellis, M. A., Demnitz, U., & Wyke, S. (2013). Who uses emergency departments inappropriately and when-a national cross-sectional study using a monitoring data system. *BMC medicine, 11*(1), 1-9.
- McWilliams, A., Tapp, H., Barker, J., & Dulin, M. (2011). Cost analysis of the use of emergency departments for primary care services in Charlotte, North Carolina. *North Carolina medical journal, 72*(4), 265-271.
- Olshaker, J. S. (2009). Managing emergency department overcrowding. *Emergency Medicine Clinics, 27*(4), 593-603.
- Pines, J. M., Pilgrim, R. L., Schneider, S. M., Siegel, B., & Viccellio, P. (2011). Practical implications of implementing emergency department crowding interventions: summary of a moderated panel. *Academic Emergency Medicine, 18*(12), 1278-1282.

- Schull, M. J., Kiss, A., & Szalai, J.-P. (2007). The effect of low-complexity patients on emergency department waiting times. *Annals of emergency medicine*, 49(3), 257-264. e251.
- Şimşek, P. (2015). *Acil servis sağlık çalışanlarının acil servislerin uygunsuz kullanımına ilişkin görüşleri*. Sağlık Bilimleri Enstitüsü,
- Şimşek, P., & Gürsoy, A. (2015). Acil Servislerin Acil Sorunu: Uygunsuz Kullanım. *Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi*, 18(4), 312-317.
- Uğrak, U., Cihangiroğlu, N., Uzuntarla, Y., & Teke, A. (2016). Hastaların sürekli kaygı düzeyleri ile acil sağlık hizmetlerini kullanma eğilimlerinin analizi. *Bartın Üniversitesi İİ BF Dergisi*, 7(13), 208-225.

**THE EFFECT OF TEAM COMMUNICATION ON PATIENT SAFETY IN THE
OPERATING ROOMS: SYSTEMATIC REVIEW**

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ABSTRACT

It is estimated that more than half of the complications that occur in the hospital setting are related to surgical procedures. In areas where safety is important, such as the operating room, most errors are due to poor communication and poor teamwork. Operating theaters are complex spaces by nature. Team communication is extremely important here. The purpose of this exercise is to systematically examine the impact of team communication on patient safety in the operating room. The keywords "operating room", "team communication" and "patient safety" were searched in Pubmed, Science Direct and Cochrane databases between 2000-2022. Of the 498 studies reached, 4 studies that met the inclusion criteria were included in the study. Team members who work together and communicate well can detect mistakes quickly and prevent them more easily. The use of briefing and handover checklists in the operating room can increase team communication, which can directly positively affect patient safety. In addition, with the decrease in the operation time and the time to start the operation, the efficiency of the surgical process may increase. Studies have shown that the satisfaction of the surgical team and the perception of operating room safety will also increase.

Keywords: Operating room, team communication, patient safety

**AMELİYATHANEDE EKİP İLETİŞİMİNİN HASTA GÜVENLİĞİNE ETKİSİ:
SİSTEMATİK DERLEME**

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ÖZET

Hastane ortamında meydana gelen komplikasyonların yarısından fazlasının cerrahi prosedürlerle ilişkili olduğu tahmin edilmektedir. Ameliyathane gibi güvenliğin önemli olduğu alanlarda çoğu hata yetersiz iletişim ve zayıf ekip çalışmasından kaynaklanmaktadır. Ameliyathaneler doğası gereği karmaşık alanlardır. Buradaki ekip iletişimi son derece önemlidir. Bu çalışmanın amacı ameliyathanede ekip iletiminin hasta güvenliğine etkisini sistematik olarak incelemektir. 2000-2022 yılları arasında Pubmed, Science Direct ve Cochrane veri tabanlarında “operating room”, “team communication” ve “patient safety” anahtar kelimeleri taranmıştır. Ulaşılan 498 araştırmadan dahil edilme kriterlerine uyan 4 araştırma çalışmaya dahil edilmiştir. Birlikte çalışan ve iyi iletişim kuran ekip üyeleri, hataları hızla algılayabilir ve daha kolay önleyebilir. Ameliyathanede brifing ve devir teslim kontrol listelerinin kullanımı ile ekip iletişimi artabilir, bu da hasta güvenliğini doğrudan olumlu yönde etkileyebilir. Ayrıca ameliyat süresinde ve ameliyata başlama zamanında azalma ile cerrahi süreç verimlilik artış meydana gelebilir. Cerrahi ekibin memnuniyeti ve ameliyathane güvenlik algısının da artacağı yapılan çalışmalarla gösterilmiştir.

Anahtar Kelimeler: Ameliyathane, ekip iletişimi, hasta güvenliği

GİRİŞ

Ameliyathanede güvenlik önemli bir sorundur. Ek olarak hastane ortamında meydana gelen komplikasyonların yarısından fazlasının cerrahi prosedürlerle ilişkili olduğu tahmin edilmektedir. Her ameliyatın, doğru bir şekilde gerçekleştirilebilmesi için birçok adımı ve aşaması vardır. Hatalar, hasta güvenliğini tehdit etme potansiyeline sahip herhangi bir adımda meydana gelebilir (Pugel ve ark., 2015). Ameliyathane gibi güvenliğin önemli olduğu alanlarda çoğu hata yetersiz iletişim ve zayıf ekip çalışmasından kaynaklanmaktadır. Ameliyathaneler doğası gereği karmaşık alanlardır. Buradaki ekip iletişimi son derece önemlidir. Ameliyathanede hataları azaltma ve ekip iletişimi artırma stratejileri olarak eğitim verilmesi, güvenli cerrahi kontrol listeleri kullanılması, brifingler gibi yöntemler kullanılabilir. Bu yöntemler ile ekibin iletişimi, iş birliği, motivasyonu ve hasta güvenliği sonuçları olumlu yönde gelişebilir (Fudickar ve ark., 2012; van Dalen ve ark., 2022).

Cerrahi süreçte hasta bakımında cerrahlar, hemşireler, anestezi uzmanları başta olmak üzere birçok sağlık profesyoneli etkin rol almaktadır. Bu ekip içerisindeki herkesin anahtar bir rolü bulunmaktadır. Herhangi bir ekip üyesinden kaynaklanan aksaklıklar ciddi sonuçlara yol açabilir. Bu aksaklıkların giderilmesinde ekip iletişimi doğrudan etkilidir (Einav ve ark., 2010; ElBardissi ve Sundt, 2012).

GEREÇ VE YÖNTEM

Çalışmanın amacı ameliyathanede ekip iletişiminin hasta güvenliğine etkisini sistematik olarak incelemektir. 2000-2022 yılları arasında Pubmed, Science Direct ve Cochrane veri tabanlarında “operating room”, “team communication” ve “patient safety” anahtar kelimeleri taranmıştır. Ulaşılan 498 araştırmadan dahil edilme kriterlerine uyan 4 araştırma çalışmaya dahil edilmiştir. Dahil edilen çalışmalar Tablo 1’de özetlenmiştir.

BULGULAR

Weld ve ark. tarafından TeamSTEPPS’in ameliyathane verimliliği ve hasta güvenliği üzerindeki etkisini değerlendirmek amacıyla bir çalışma yapılmıştır. TeamSTEPPS, o gün için planlanan her bir vakaya özgü konuları tartışmak üzere ilgili ameliyathaneye atanan tüm sağlık personelinin katıldığı brifinglerden oluşmaktadır. Bu çalışmada üroloji ameliyathanesinde gerçekleştirilen ameliyatlara; ameliyatlara başlama süreleri, ameliyata zamanında başlama süreleri ve hasta güvenliği ile ilgili sorunlar açısından bir önceki yıllarla karşılaştırılmıştır. Çalışmanın sonunda TeamSTEPPS ile ortalama ameliyat süreleri 12.7 dakika daha kısa ve ameliyata

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zamanında başlama oranı %21 oranında daha iyi olarak belirlenmiştir. Ayrıca hasta güvenliği ile ilgili sorunlar %16'dan %6'ya düşerek hasta güvenliğinde artış bulunmuştur (Weld ve ark., 2016).

Araştırmayı Yapan Kişiler	Araştırma Tipi	Sonuç
Weld ve ark., 2016	Performans Geliştirme Projesi	Çalışmanın sonunda TeamSTEPPS ile ortalama ameliyat süreleri 12.7 dakika daha kısa ve ameliyata zamanında başlama oranı %21 oranında daha iyiydi. Ayrıca hasta güvenliği ile ilgili sorunlar %16'dan %6'ya düşerek hasta güvenliğinde artış bulunmuştur.
Leong ve ark., 2017	Prospektif Çalışma	Cerrahi ekibin ekip ikliminin anlamlı derecede arttığı; bilgilendirme ve brifinglerin olumlu etki yarattığı; ameliyat süresinin çalışma öncesinden daha kısa sürdüğü; hem cerrahi verimliliğinin hem de hasta güvenliğinin arttığı sonucuna ulaşılmıştır.
Defontes ve Surbida, 2004	Brifing Projesi	Çalışmanın sonunda yanlış alan cerrahisinin yılda 3'ten 0'a (%300) düştüğü; ekibin memnuniyetinin %19 arttığı, hemşirelerin değişim hızının %16 azaldığı ve ameliyathanedeki güvenlik iklimi algısının "iyi"den "mükemmel"e yükseldiği sonucuna ulaşılmıştır.
Nasiri ve ark., 2021	Randomize Kontrollü Çalışma	Kontrol listesi kullanan grupta bilgi eksikliği oranı steril ekipte %19,5'ten %12,1'e; sirküle ekipte %16,8'den %14,1'e düştü. Steril ekipte devir teslim süreci kalitesi uygulama sonrası ($7 \pm 1,5$), uygulama öncesine ($6,5 \pm 0,9$) göre anlamlı derecede yüksek bulunmuştur. Kontrol listesi kullanımı ile shiftler arası geçiş süresi hem steril ekipte hem de sirküle ekipte arttı. Ekibin kontrol listesi kullanımıyla devir teslimden memnuniyeti %67,5'tan %85,5'a yükselmiştir.

Leong ve ark. tarafından cerrahi ekip üyeleri arasında optimal bir iş birliğine odaklanan perioperatif brifing ve bilgilendirmenin getirilmesiyle ameliyathanede hasta güvenliğini artırmaya yönelik bir çalışma yapılmıştır. Bu çalışmanın başlamasından yaklaşık 2.5 yıl sonra

cerrahi ekibin ekip ikliminin anlamlı derecede arttığı; bilgilendirme ve brifinglerin olumlu etki yarattığı; ameliyat süresinin çalışma öncesinden daha kısa sürdüğü; hem cerrahi verimliliğinin hem de hasta güvenliğinin arttığı sonucuna ulaşılmıştır (Leong ve ark., 2017).

Defontes ve Surbida tarafından perioperatif dönemde hasta güvenliğini artırmak için cerrahi ekibin iletişimini, iş birliğini, durumsal farkındalığı ve ekip çalışmasını artırmak için brifing projesi uygulanmıştır. Çalışmanın sonunda yanlış alan cerrahisinin yılda 3'ten 0'a (%300) düştüğü; ekibin memnuniyetinin %19 arttığı, hemşirelerin değişim hızının %16 azaldığı ve ameliyathanedeki güvenlik iklimi algısının "iyi"den "mükemmel"e yükseldiği sonucuna ulaşılmıştır (Defontes ve Surbida, 2004).

Nasiri ve ark. tarafından ameliyathanede shift değişimlerinde yapılandırılmış bir devir teslim kontrol listesinin etkili iletişim, ameliyathane ekibi memnuniyeti ve hasta güvenliği üzerindeki etkisini incelemek amacıyla randomize kontrollü bir çalışma yapılmıştır. Kontrol listesi kullanan grupta bilgi eksikliği oranı steril ekipte %19,5'ten %12,1'e; sirküle ekipte %16,8'den %14,1'e düşerek istatistiksel olarak anlamlı bir düşüş bulunmuştur. Steril ekipte devir teslim süreci kalitesi uygulama sonrası ($7 \pm 1,5$, uygulama öncesine ($6,5 \pm 0,9$) göre anlamlı derecede yüksek bulunmuştur. Kontrol listesi kullanımı ile shiftler arası geçiş süresi hem steril ekipte hem de sirküle ekipte artmıştır. Ekibin kontrol listesi kullanımıyla devir teslimden memnuniyeti %67,5'ten %85,5'a yükselmiştir (Naziri ve ark., 2021).

SONUÇ

Birlikte çalışan ve iyi iletişim kuran ekip üyeleri, hataları hızla algılayabilir ve daha kolay önleyebilir. Cerrahi ekibin hasta güvenliğini bir öncelik olarak algılaması gerekmektedir. Ameliyathanede brifing ve devir teslim kontrol listelerinin kullanımı ile ekip iletişimi artabilir, bu da hasta güvenliğini doğrudan olumlu yönde etkileyebilir.

KAYNAKÇA

- Defontes, J., & Surbida, S. (2004). Preoperative Safety Briefing Project. *The Permanente journal*, 8(2), 21–27. <https://doi.org/10.7812/TPP/04.968>
- Einav, Y., Gopher, D., Kara, I., Ben-Yosef, O., Lawn, M., Laufer, N., Liebergall, M., & Donchin, Y. (2010). Preoperative briefing in the operating room: shared cognition, teamwork, and patient safety. *Chest*, 137(2), 443–449. <https://doi.org/10.1378/chest.08-1732>
- ElBardissi, A. W., & Sundt, T. M. (2012). Human factors and operating room safety. *The Surgical clinics of North America*, 92(1), 21–35. <https://doi.org/10.1016/j.suc.2011.11.007>
- Fudickar, A., Hörle, K., Wiltfang, J., & Bein, B. (2012). The effect of the WHO Surgical Safety Checklist on complication rate and communication. *Deutsches Arzteblatt international*, 109(42), 695–701. <https://doi.org/10.3238/arztebl.2012.0695>
- Leong, K. B. M. S. L., Hanskamp-Sebregts, M., van der Wal, R. A., & Wolff, A. P. (2017). Effects of perioperative briefing and debriefing on patient safety: a prospective intervention study. *BMJ open*, 7(12), e018367. <https://doi.org/10.1136/bmjopen-2017-018367>
- Nasiri, E., Lotfi, M., Mahdavinoo, S. M. M., & Rafiei, M. H. (2021). The impact of a structured handover checklist for intraoperative staff shift changes on effective communication, OR team satisfaction, and patient safety: a pilot study. *Patient safety in surgery*, 15(1), 25. <https://doi.org/10.1186/s13037-021-00299-1>
- Pugel, A. E., Simianu, V. V., Flum, D. R., & Patchen Dellinger, E. (2015). Use of the surgical safety checklist to improve communication and reduce complications. *Journal of infection and public health*, 8(3), 219–225. <https://doi.org/10.1016/j.jiph.2015.01.001>
- van Dalen, A. S. H., Swinkels, J. A., Coolen, S., Hackett, R., & Schijven, M. P. (2022). Improving teamwork and communication in the operating room by introducing the theatre cap challenge. *Journal of perioperative practice*, 32(1-2), 4–9. <https://doi.org/10.1177/17504589211046723>
- Weld, L. R., Stringer, M. T., Ebertowski, J. S., Baumgartner, T. S., Kasprenski, M. C., Kelley, J. C., Cho, D. S., Tieva, E. A., & Novak, T. E. (2016). TeamSTEPPS Improves Operating Room Efficiency and Patient Safety. *American journal of medical quality : the official journal of the American College of Medical Quality*, 31(5), 408–414. <https://doi.org/10.1177/1062860615583671>

**CİNSEL İSTİSMAR MAĞDURLARINDA TRAVMATİK HAFIZA AÇISINDAN
DEĞERLENDİRME**

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ÖZET

Otobiyografik bellek (OB) (kişisel olarak deneyimlenen geçmiş olayların anımsanmasıyla ilgili belleği yönü) günlük durumlarda uyumsal işleyişin önemli bir parçasıdır. Benlik duygusuna katkıda bulunur, sosyal davranışa ve problem çözmeye rehberlik eder ve gelecekteki etkinlikleri tasavvur etme ve bağlamsallaştırma becerisini kolaylaştırır. Belirli psikiyatrik tanıları olan bireyler en belirgin şekilde majör depresif bozukluk ve travma sonrası stres bozukluğu sağlıklı yetişkinlerin deneyimlediğinden farklı bir otobiyografik bellek kalitesi yaşarlar. Bu hastalarda otobiyografik anılar aşırı genel olma eğilimindedir; yani psikiyatrik hastaların otobiyografik anılarından daha az özel ayrıntı içerirler. Aşırı genel otobiyografik bellek, savaş gazileri, fiziksel ve cinsel saldırı mağdurları, kanser teşhisi konan hastalar ve doğal afetler yaşamış kişiler dahil olmak üzere birçok travma mağdurunun özelliğidir. Bu bilişsel işleme biçimi genel bir travmayla ilişkili yapısal anormallik ve işlevsel düzensizlik modeline uyar; özellikle, travmatik anı izlerinin geri alınması sırasında yukarıdan aşağıya bilişsel kontrolde yer alan beyin bölgelerinin (örn. Prefrontal korteks) azalmış aktivasyonu ile ilişki görünmektedir. Psikolojik travma, kortizolün bozulmuş salgılanmasıyla, özellikle glukokortikoid bozulmuş salınımı ile beyne zarar verebilir. Travmaya maruz kalan bireylerde otobiyografik bellek aşırı genel ve olumsuz önyargılı olma eğilimindedir. Çocukluk çağı travması, körelmiş bazal kortizol salgılanması, beyin değişiklikleri ve otobiyografik bellek eksiklikleri ile ilişkilidir. Çocukluk çağı travması, bazal kortizol sekresyonunu ve prefrontal-hipokampal-extrastriat bölgelerin bağlantısını değiştirerek otobiyografik bellekte görsel-algısal bağlamsal ayrıntıların yokluğuna yol açabilir. Bu nedenle mevcut bulgular, bir olayın belirli bağlamsal ayrıntılarının travma deneyimi olan bireylerde işlevsel kaçınma ve daha zayıf yürütme kontrolü nedeniyle kaybolabileceğini göstermektedir. Cromheeke ve ark. (2014) çocuklukta istismar öyküsü olan kadınlarda özellikle olumlu duygular için işleyen bellek kapasitelerinin bozulduğunu bildirmiştir; bu, çocukluk istismarının duygu işleme üzerinde kalıcı bir etkiye sahip olduğunu ve bunun da hafıza performansını etkilediğini göstermektedir. Hastalar ayrıca aşırı uyarılma, duygusal düzensizlik, aşırı uyanıklık ve uyku problemlerinden muzdariptir ve travmatik olayı

hatırlamayı tetikleyen her şeyden aşırı derecede kaçınma eğilimindedir. TSSB, amigdala ve insula gibi limbik bölgeler üzerindeki prefrontal kontrolün kaybı nedeni ile travmatik anılar zayıf bir şekilde bağlamsallaştırılır, parçalanmış anılara neden olur (Fenster ve diğerleri, 2018). Özellikle çocukluk çağı cinsel istismarlarına bağlı travmalarda otobiyografik hafıza kaybı yaşanır. Bu durum sıklıkla ihanet, disosiyasyon, istismar süresi ve dissosiyatif amnezi, istismarın başlangıç yaşı ile doğrudan ilişkili bulunmuştur. Travma geçirmiş birey, gerçek bir hatıra olarak kabul edilemeyecek fiziksel ve psişik, parçalı ve rahatsız edici izlerin sürekli dönüşünden dolayı bedeninde acı çeker. Travmatik bir deneyimin anısı ve bundan doğabilecek bellek çalışması, öznenin deneyimindeki radikal bir boşluğu dolduran bir anının ayrıntılandırılması sorununu ortaya koyar: doğrudan hatırlanamayan bir olay. Otobiyografik bellek eksikliklerinin altında yatan nörobiyolojik mekanizmaları anlamak, travmayla ilişkili ruhsal bozuklukların önlenmesi ve tedavisi için önemli sonuçlar sağlayacaktır.

Anahtar Kelimeler: travma, travmatik hafıza, istismar, cinsel, mental

GİRİŞ

Çocukluk çağındaki cinsel istismar (CÇCİ), uzun süreli olumsuz etkileri ve bununla ilişkili yüksek yıllık maliyetleri olan endemik bir halk sağlığı ve sosyal sorunudur. Dünya Sağlık Örgütü'ne (WHO) göre, CÇCİ, “çocuğun tam olarak anlamadığı, bilgilendirilmiş rıza veremeyeceği veya gelişimsel olarak hazır olmadığı ve rıza gösteremeyeceği, toplumun yasalarını veya sosyal tabularını aykırı cinsel aktiviteye dâhil edilmesi” olarak tanımlanmaktadır (WHO, 1999; Gewirtz-Meydan, Godbout, 2023). CÇCİ yaşayan bireyler, travma semptomları ve diğer olumsuz sonuçlar yaşama riski altındadır. Çocukluk döneminde travmaya maruz kalmak, yetişkinlikte kötü sağlık sonuçları riskinin artmasına neden olabilir. Psikolojik travmaya maruz kalmanın, glukokortikoid (insanlarda kortizol) salgılanmasını bozarak nöronal hücre ölümüne neden olduğu bilinmektedir. Aslında, travma sonrası stres bozukluğu (TSSB) olan hastalarda kortizol salgılanmasında bozulma ve beyinlerinde gri madde hacminde azalma görülmektedir. TSSB’de travmatik anılar, patolojik olmayan travmatik anılardan farklı olarak çok daha rahatsız edicidir ve travma hatırlatıcıları tarafından kolayca tetiklenir. Unutamama ve korku tepkisinin aşırı genelleştirilmesi, geçmişe dönüş, kabuslar, aşırı uyarılma ve travmayla ilişkili uyaranlardan kaçınma gibi çeşitli TSSB semptomlarının temelini oluşturur.

Psikolojik travma, kortizolün bozulmuş salgılanması yoluyla, özellikle glukokortikoid reseptörlerinin ifade edildiği alanlarda beyne zarar verebilir. Çocukluk çağı travması, körelmiş bazal kortizol salgılanması, beyin değişiklikleri ve aşırı genel otobiyografik bellek (OB) olarak adlandırılan otobiyografik bellek eksiklikleri ile ilişkilidir. Otobiyografik bellek (yani, "kişisel olarak deneyimlenen geçmiş olayların anımsanmasıyla ilgili belleğin yönü), günlük durumlarda uyumsal işleyişin önemli bir parçasıdır. Benlik duygusuna katkıda bulunur, sosyal davranışa ve problem çözmeye rehberlik eder ve gelecekteki faaliyetleri tasavvur etme ve bağlamsallaştırma becerisini kolaylaştırır. Travmatik bireylerde otobiyografik anılar aşırı genel olma eğilimindedir ve sağlıklı kontrollerin otobiyografik anılarından daha az spesifik ayrıntı içerirler. Çocukluk çağı travması, bazal kortizol sekresyonunu ve prefrontal-hipokampal-extrastriat bölgelerin bağlantısını değiştirerek otobiyografik bellekte görsel-algısal bağlamsal ayrıntıların yokluğuna yol açabilir.

Erken yaşam stresi, yaşamın ilerleyen dönemlerinde psikopatoloji ve bilişsel gerileme riskini artırır. Erken yaşam stresinden etkilenen nörobiyolojik substratlar (yani, biliş, nöroplastisite ve nöroinflamasyon) da yaşlanma süreci üzerinde olumsuz etkiye sahiptir. Yaşlanan beyin, hem temel hem de zorlu koşullar altında mikroglia proinflamatuvar bir duruma geçerken nöroimmün

düzensizliği ile karakterize edilir. Çocukluk travmasının hızlanan yaşlanma ile ilişkili olduğu, beyinde hızlandırılmış telomer kısalmasına yol açtığı belirlenmiştir. Bir çalışmada 5 ila 10 yaşları arasında çeşitli şiddet türlerine maruz kalan çocukların akranlarına göre önemli ölçüde daha fazla telomer erozyonu (yani 10 yaşına kadar) yaşadıkları belirlenmiştir (Drury et al., 2012). Özellikle hızlı yaşlanmayla birlikte nesne tanıma belleğinde bozulmalar görülür. Yoğunlaştırılmış prefrontal-extrastriate bağlantı, bellek alımındaki anlamsal içeriği güçlendirerek OGM oluşumuna katkıda bulunabilir. Bununla birlikte, yakın tarihli bir meta-analiz, travmaya maruz kalmanın, ancak depresif semptomalojinin değil, OB'nin büyüklüğünü tahmin ettiğini bulmuştur. Daha da önemlisi, OB aynı zamanda travmaya maruz kalan sağlıklı bireylerde ve çocukluk çağı travması ve depresyon öyküsü olanlarda da gözlemlenmiştir, ancak yalnızca depresyon öyküsü olanlarda görülmemektedir. Bu bulgular, travmatik deneyimin kendisinin, psikiyatrik semptomatolojiden bağımsız olarak beyin değişikliklerini olduğu kadar OB'yi de etkileyebileceğini göstermektedir. OB şu üç şekilde ortaya çıkabilir: 1) yakalama ve ruminasyon, 2) işlevsel kaçınma ve 3) daha zayıf yürütme kontrolü. Kendilik hakkındaki olumsuz düşüncelerin yakalanması ve ayrıntılı düşünülmesi, travmatik hafızadaki acı verici bir yönün sınırlı bir şekilde hatırlanmasını sağlayabilir ve diğer acı verici olmayan bağlamsal bilgileri göz ardı edebilir. Bununla birlikte, aynı zamanda, kişi travmayı anlamsal olarak onlarla ilişkilendirdiği için travmatik olmayan anıların kendisini hatırlamaktan da kaçınılabilir. Ayrıca, yürütücü kontrolden ödün verilmiş kişiler, travma ile semantik olarak ilişkili olan potansiyel tetikleyiciyi engelleyemedikleri için, belirli bağlamsal bilgileri almada genellikle zorluk gösterirler.

Teorik olarak, işlevsel kaçınma ve daha zayıf yürütme kontrolü, travma-OB ilişkisinin altında yatan temel bir faktör olabilecek anlamsal ilişkilendirmeyi içerir. Bu, depresyonu olmayan bu klinik olmayan popülasyonda semantik-ilişkili belleğin neden özel olarak travma ile ilişkili olduğunu açıklayabilir. Bu nedenle mevcut bulgular, bir olayın belirli bağlamsal ayrıntılarının, travma deneyimi olan bireylerde işlevsel kaçınma ve daha zayıf yürütme kontrolü nedeniyle (veya en azından bilişsel işlevlerinin bozulmamış olması koşuluyla işlevsel kaçınma nedeniyle) kaybolabileceğini göstermektedir.

Daha fazla olumsuz ve daha az olumlu bilgiyi hatırlama eğilimi sıklıkla depresyona genetik yakınlıkla ilişkilendirilmiştir. Bu bellek önyargısı, özellikle stresli çocukluk olayları yaşayan kişilerde depresyon aday genleri ile ilişkili olabilir. Depresif bireyler, olumlu bilgiler yerine olumsuz bilgileri tercihli olarak işleme eğilimindedirler. Bu yanlı işleme algı, dikkat ve hafızada mevcuttur ancak bellek yanlılığındaki bulgular özellikle sağlamdır. Olumsuz önyargılı bellek,

olumsuz bilginin hakim olmasına izin verecek ve farklı bilişsel alanlardaki önyargılar birbirleriyle ilişkili olduğundan, daha fazla olumsuz işlemeyi teşvik edecektir. Ayrıca, olumsuz önyargılı bellek, depresyon ve depresyon savunmasızlığının önemli bir özelliği olan ruminasyon ile ilişkilendirilmiştir. Önyargılı bellek işleme, depresyondan kurtulduktan sonra da devam eder ve istikrarlı bir depresyon özelliği olarak kabul edilir. Bu nedenle, tercihen olumsuz materyali hatırlama ve olumlu bilgiyi daha az hatırlama eğilimi, yalnızca depresyonun bir belirtisi değil, aynı zamanda önemli bir depresyon savunmasızlığı faktörü olarak kabul edilir. Travmatik olayların kişiler arası ilişkilerin doğasından kaynaklı olabilir, kasıtlı olarak çocuğa yönelik travmatik olaylar -özellikle de bir başkası tarafından uygulandığında güvenliği sağlama gereken bakıcı- olumsuz temel varsayımların oluşmasını teşvik edebilir ve dolayısıyla depresyonun seyri ve şiddeti üzerinde travmatik olmayan olumsuz olaylardan daha güçlü bir etkiye sahip olabilir.

Çocukluk ve ergenlik sıkıntıları, psikoz gelişimi için önemli risk faktörleridir. Fiziksel, cinsel ve duygusal istismar gibi çocukluk çağı travması; tümünün potansiyel risk faktörleri olduğu bulunmuştur. Bir failin dahil olduğu travma, yani çocukluk dönemindeki kişiler arası travmanın, ayrışmayı tetikleyebileceği nedeniyle özellikle zarar verici olduğu düşünülmektedir bu da daha sonraki psikozla bağlantılıdır. Travmatik anıların TSSB'nin gelişimi ve sürdürülmesinde merkezi olduğu iddia edilmektedir ve ayrıca bazı insanların psikoz deneyimlerinde rol oynadığı öne sürülmektedir. Bu hastalarda müdahaleci epizodik anılar, olumsuz geçmiş olaylarla ilgili duygusal olarak yoğun, istemsiz düşüncelere neden olur. Epizodik anıların kendine gönderme yapan, şimdiye odaklı anlamlara göre kategorize edildiği bilinmektedir. Günlük yaşam sırasında epizodik anıların geri çağrılmasını ve ardından belleğin bir kişinin işleyişi ve refahı üzerindeki etkisini etkiler. Örneğin, bir kişi "Ben kötüyüm" diye düşünürse, bu inançla tutarlı anıları hatırlaması muhtemeldir. Bu hafıza geri kazanımı daha sonra bilişsel süreçleri, duyguları ve davranışı etkileyerek kişinin kendisini 'kötü' bir insan olarak algılamasını güçlendirecek ve bu travmatik anının güçlenmesini ve psikotik süreci destekleyecektir (Clarke et al, 2022).

Çocukların duygusal ihmalinin, işlevsel olmayan veya bozulmuş duygu düzenlemesi ve ayrıca azalmış bilişsel kapasitelerle bağlantılı olduğunu gösteren kanıtlar vardır: örneğin, Gouid ve ark. çocuklara kötü muameleyle ilgili olarak nöropsikolojik işleyiş kalıplarını araştırmış ve duygusal işlemede ve çocuk ihmaliyle ilgili işleme hızında belirgin eksiklikler bulmuştur. (Frewen, et al, 2008; Gouid ve ark. 2012) İstismarın kendini ifşa etmesi, gizli ve isimsiz bir kişisel bildirim ortamında, yüzyüze görüşmeye göre daha kolay olabilir, çünkü çoğu kişi

genellikle utanır, kendini suçlar veya inanılmamaktan korkar (özellikle yakın kişiler arası travma durumlarında) Şiddetli yakın kişiler arası travma durumlarında, kişi çözülme nedeniyle travmatik olayları kısmen ya da tamamen unutmuş olabilir. Bununla birlikte, bu tür travmanın doğası, travmaya özgü amnezi nedeniyle eksik bildirim neden olabilir. Ayrıca, kişiler arası travmada faille yakın ilişkisi olanlar ifşayı daha çok geciktirme eğilimi gösterir.

Çocukluk çağı travması, çocuklarda (Macfie, Cicchetti ve Toth, 2001) ve yetişkinlerde çözülme (dissosiasyon) ile ilişkilidir. Dissosiasyonun olumsuz ve dayanılmaz duygulara karşı düzenleyici bir stratejiyi temsil ettiği kavramı göz önüne alındığında ve dissosiasyonu düşük hafıza performansı da dahil olmak üzere farklı bilişsel eksikliklerle ilişkilendirildiği belirlenmiştir (Terock ve diğerleri, 2016).

SONUÇ

Otobiyografik bellek, düzgün çalıştığında, insanların tutarlı bir benlik duygusunu sürdürmelerine, duygularını uygun şekilde düzenlemelerine ve sorunları verimli bir şekilde çözmelerine olanak tanır. Travmatik durumla karşılaşıldığında çalışması bozulur ve dikkate değer bilişsel ve duygusal olumsuz sonuçlar ortaya çıkar. Özellikle çocukluk çağı cinsel istismarları önemli ruhsal sorunlara yol açan travmalardır. Bu bireylerdir ruhsal sorunların ortaya çıkmasında etkin rol oynayabilen travmatik hafızasının değerlendirilmesi ve travmaya ilişkin hafıza sorunlarını hedefleyen psikoterapötik tekniklerden faydalanılabilmektedir.

Kaynaklar

1. Clarke, R., Kelly, R., & Hardy, A. (2022). A randomised multiple baseline case series of a novel imagery rescripting protocol for intrusive trauma memories in people with psychosis. *Journal of behavior therapy and experimental psychiatry*, 75, 101699. <https://doi.org/10.1016/j.jbtep.2021.101699>
2. Chiasson, C., Moorman, J., Romano, E., Vezarov, M., Cameron, A., & Smith, A. (2021). The influence of emotion on working memory: Exploratory fMRI findings among men with histories of childhood sexual abuse. *Child abuse & neglect*, 122, 105340. <https://doi.org/10.1016/j.chiabu.2021.105340>.
3. Drury, S. S., Theall, K., Gleason, M. M., Smyke, A. T., De Vivo, I., Wong, J. Y., Fox, N. A., Zeanah, C. H., & Nelson, C. A. (2012). Telomere length and early severe social deprivation: linking early adversity and cellular aging. *Molecular psychiatry*, 17(7), 719–727. <https://doi.org/10.1038/mp.2011.53>
4. Geraerts E., Smeets E., Jelicic M., Merckelbach H., Heerden J V., Retrieval inhibition of trauma-related words in women reporting repressed or recovered memories of childhood sexual abuse. (2006). *Behaviour Research and Therapy*, 44, Pages 1129-1136. <https://doi.org/10.1016/j.brat.2005.09.001>.
5. Gewirtz-Meydan, A., & Godbout, N. (2023). Between pleasure, guilt, and dissociation: How trauma unfolds in the sexuality of childhood sexual abuse survivors. *Child abuse & neglect*, 141, 106195. Advance online publication. <https://doi.org/10.1016/j.chiabu.2023.106195>
6. Hagens M., Minnen A. V., Cees A.L. Hoogduin, Verbraak M. (2009). A transdiagnostic comparison of trauma and panic memories in PTSD, panic disorder, and healthy controls, *Journal of Behavior Therapy and Experimental Psychiatry*, 40, Pages 412-422. <https://doi.org/10.1016/j.jbtep.2009.04.001>
7. Hakamata Y., Mizukami S., Izawa S., Moriguchi Y., Hori H., Matsumoto N., Hanakawa T., Inoue Y., HiTagaya H.. (2021). Childhood trauma affects autobiographical memory deficits through basal cortisol and prefrontal-extrastriate functional connectivity, *Psychoneuroendocrinology*, 127, 105172. <https://doi.org/10.1016/j.psyneuen.2021.105172>.
8. Kotah JM, Hoesijmakers L, Nutma E, Lucassen PJ, Korosi A.(2021).Early-life stress does not alter spatial memory performance, hippocampal neurogenesis, neuroinflammation, or telomere length in 20-month-old male mice, *Neurobiology of Stress*, 15, 100379, <https://doi.org/10.1016/j.ynstr.2021.100379>.
9. Molly R. Wolf, Thomas H. Nochajski, Black Holes' in memory: Childhood autobiographical memory loss in adult survivors of child sexual abuse. (2022). *European Journal of Trauma & Dissociation*, 100234. <https://doi.org/10.1016/j.ejtd.2021.100234>.
10. Patiño-Lakatos G. (2019) Trace and Memory of Trauma: From Bodily Memory to Symbolic Memory, *L'Évolution Psychiatrique*, 84, Pages e45-e58. <https://doi.org/10.1016/j.evopsy.2019.05.002>.
11. Raut S. B., Canales J. J., Ravindran M., Eri R., Benedek D. M., Ursano R. J., Johnson L. R.. (2022). Effects of propranolol on the modification of trauma memory reconsolidation in PTSD patients: A systematic review and meta-analysis, *Journal of Psychiatric Research*, 150, Pages 246-256. <https://doi.org/10.1016/j.jpsychires.2022.03.045>
12. Schie K. V., Veen S. C., Hagens M. A.. (2019). The effects of dual-tasks on intrusive memories following analogue trauma, *Behaviour Research and Therapy*, 120, 103448. <https://doi.org/10.1016/j.brat.2019.103448>

13. Schaug J. P., Storebø O. J., Austin S. F., Trauelsen A. M., Pedersen M. B., Haahr U. H., Simonsen E.. (2023). The convergent validity of the childhood trauma questionnaire (short-form) and the brief betrayal trauma survey in a first-episode psychosis sample, *Psychiatry Research Communications*, 3, 100112. <https://doi.org/10.1016/j.psychom.2023.100112>.
14. Terock J., Auwera S. V., Janowitz D., Wittfeld K., Frenzel S., Klinger-König J., Grabe H. J. (2020). Childhood trauma and adult declarative memory performance in the general population: The mediating effect of alexithymia, *Child Abuse & Neglect*, 101, 104311. <https://doi.org/10.1016/j.chiabu.2019.104311>
15. Thomas K. G., Bradley H., Chen A., Lipinska G.. (2021). Trauma survivors with disrupted sleep generate less specific and less emotional autobiographical memories, *Journal of Affective Disorders Reports*, 6, 100196. <https://doi.org/10.1016/j.jadr.2021.100196>.
16. World Health Organization (1999). World Health Organization Report of the consultation on child abuse prevention, 29–31 March. <https://apps.who.int/iris/handle/10665/65900> (1999)
17. Vrijzen J. N., Tendolkar I., Arias-Vásquez A., Franke B., Schene A. H., Fernández G., Oostrom I. V.. (2015). Interaction of the 5-HTTLPR and childhood trauma influences memory bias in healthy individuals. *Journal of Affective Disorders*, 186, Pages 83-89. <https://doi.org/10.1016/j.jad.2015.06.008>.

İNSAN SAĞLIĞI VE SOSYAL HİZMETLER SEKTÖRÜNDE FAALİYET (DEVİR HIZI) RASYOLARININ ÖNEM DÜZEYİNİN BELİRLENMESİ: SD – CRITIC VE LOPCOW TABANLI COPELAND YÖNTEMİYLE AMPİRİK BİR ANALİZ

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ÖZET

Günümüzde hizmet sektörü oldukça değer kazanmaya başlamaktadır. Hem gerçekleşen deprem, sel, salgın hastalıklar gibi öngörülemeyen olaylar hem de insanların hizmet gereksinimi sektörün önemini arttırmaktadır. Hizmet sektörü denildiğinde akla ilk gelen sağlık hizmetidir. Sağlık; insanların hayatta kalabilmeleri ve hayatını iyi geçirebilmeleri için temel göstergelerdendir. Sağlıkın ne derece önemli olduğu özellikle pandemi döneminde açıkça ortaya çıkmıştır. Bu çalışmada Türkiye Cumhuriyeti Merkez Bankası'na kayıtlı sektörlerden olan insan sağlığı ve sosyal hizmetler sektörü ele alınmıştır. Bu sektörün 2009-2021 yılları arası 13 yıllık verileri yardımıyla faaliyet oranları diğer bir ifadeyle devir hızı rasyolarının ağırlığı ölçülmüştür. Devir hızı rasyoları olarak; stok devir hızı, alacak devir hızı, çalışma sermayesi devir hızı, net çalışma sermayesi devir hızı, maddi duran varlık devir hızı, borç devir hızı ve aktif devir hızı kullanılmıştır. Bu rasyoların yüksek olması işletmenin alacak, borç vb. tahsillerini yapabildiğini göstermektedir. Dolayısıyla sağlık sektörü için devir hızlarının artması sektörün hizmet kalitesinin iyi olduğu konusunda da fikir vermektedir. Çalışmada faaliyet oranlarının ağırlığını bulabilmek için 3 farklı çok kriterli karar verme tekniği kullanılmıştır. Amaç; farklı yöntemler aracılığıyla faaliyet oranlarının önem düzeyini belirleyerek daha sağlıklı sonuçlara ulaşabilmektir. Ardından ise Copeland yöntemiyle bu sonuçlar tek bir sıralamaya dönüştürülmüş ve belirlenen zaman diliminde hangi devir hızı rasyosunun daha çok önem arz ettiği saptanmıştır.

Anahtar Kelimeler: Faaliyet (devir hızı) rasyoları, SD, Critic, LOPCOW ve Copeland yöntemi

DETERMINING THE SIGNIFICANCE LEVEL OF ACTIVITY (TURNOVER) RATIOS IN THE HUMAN HEALTH AND SOCIAL SERVICES INDUSTRY: AN EMPIRICAL ANALYSIS WITH THE COPELAND METHOD BASED ON SD – CRITIC AND LOPCOW

ABSTRACT

Today, the service sector is starting to gain a lot of value. Both unpredictable events such as earthquakes, floods, epidemics, and the need for service of people increase the importance of the sector. When the service sector is mentioned, the first thing that comes to mind is health service. Health is one of the basic indicators for people to survive and have a good life. The importance of health has been clearly revealed especially during the pandemic period. In this study, the human health and social services sector, which is one of the sectors registered with the Central Bank of the Republic of Turkey, is discussed. With the help of the 13-year data of this sector between the years 2009-2021, the activity rates, in other words, the weight of the turnover ratios were measured. As turnover ratios; inventory turnover, receivables turnover, working capital turnover, net working capital turnover, tangible asset turnover, debt turnover and asset turnover were used. If these ratios are high, the company's receivables, debts, etc. demonstrates that he is able to complete his studies. Therefore, the increase in turnover rates for the health sector also gives an idea that the service quality of the sector is good. In the study, 3 different multi-criteria decision making techniques were used to find the weight of the activity rates. The aim is to reach healthier results by determining the level of importance of activity rates through different methods. Then, with the Copeland method, these results were converted into a single order and it was determined which rotation rate ratio was more important in the specified time period.

Keywords: Turnover ratios, SD, Critic, LOPCOW and Copeland methods

1. GİRİŞ

Günümüzde gelişen teknolojik yapılarla birlikte hizmet sektörünün önemi giderek artmaya başlamıştır. Hizmet sektörüne verilen önem aynı zamanda verilen hizmetin kalitesini arttırmak için yapılan uygulamaların geçerli, uygulanabilir ve geleceğe yönelik iz bırakabilmesini sağlayacak düzeyde olmasını hedeflemektedir. Dolayısıyla hedeflerin gerçekleşmesiyle birlikte doğrudan hizmet sektörü daha kaliteli hâle gelmektedir.

Hizmet denildiğinde ise akla ilk gelen sağlık sektörüdür. Çünkü sağlık; insan hayatı için vazgeçilmez olan ve insanların toplumda huzur içinde yaşayabilmeleri için ilk önce değinilmesi gereken kavramlardandır.

Sağlık sektöründe dünyada birçok ülke, özel veya kamu olmak üzere birçok hastanenin yönetimi konusunda ekonomik ve finansal açıdan baskılar yaşayabilmektedir. Bu sorunu ortadan kaldırmak için ise sağlık yönetimindeki üst düzey yöneticilerin etkin, geçerli, doğru ve uygulanabilir politikalar belirmeleri oldukça önem arz etmektedir (Avcı, 2014). Bu politikaları belirleme kısmında ise finansal veya mali analizler devreye girmektedir. Hastaneler için uyguladıkları politikayla uyumlu bir finansal analiz yapmak; hem faydalı hem de finansal performansı arttıran kilit uygulamaların başında gelmektedir (Li vd., 2002).

Tüm işletmelerdeki gibi özel veya kamu olmak üzere hastanelerde finansal performans ölçümü; geleceğe yönelik tahminler yapmak ve hedef belirlemek açısından oldukça önem arz etmektedir. Ayrıca özel sektörün sağlıkta varlığı hastaneler arası rekabeti arttırdığı için performans ölçümü gitgide önem kazanmıştır. Hastanelerin türüne göre finansal performans ölçümünde amaç değişse de her işletmenin getiri sağlaması gerekmektedir (Doğru, 2010). Kamu hastanelerinde her ne kadar sosyal sorumluluk bilinci ağır bassa da varlıklarını sürdürebilmeleri için onların da kaynağa ihtiyaçları bulunmaktadır ve bu kaynakları özel hastanelerdekine benzer biçimde etkin ve verimli kullanılıp kullanılmadığını saptayabilmek için finansal performans ölçümlerinin yapılması gereklidir (Çil Koçyiğit, 2011).

Finansal performans ölçümleri yapıldıktan sonra başarılı bir performansı bulunan hastaneler, mevcut kaynaklarını doğru kullanıp finansal sürdürülebilirliği sağlamakta ayrıca borç-öz kaynak dengesini de kurabilmektedir (Özgülbaş, 2005).

Finansal performans ölçümü yapabilmek için ise sayısal verilerden oluşan finansal göstergeler kullanılmaktadır. Bu ölçüm hastaneler için; varlıklarını ve kaynaklarını ne derece etkin kullandıklarını, mevcut finansal durumlarını, risk durumunu ve yatırım kararlarını

değerlendiren bir dizi süreçten oluşmaktadır. Geçmiş ve şu anki durumu birlikte incelediği için hastanelerin gelecek planlamalarında yol gösterici nitelik taşımaktadır (Ekinci ve Bakır, 2021).

Mâli ya da finansal analiz; bir işletmenin finansal durumunun yeterliliğini belirleyen, finansal tablo kalemlerindeki değişiklikleri, kalemler arasındaki ilişkileri inceleyen ve sektördeki firmalarla sonuçları karşılaştıran bir kavramdır (Akgüç, 2013). Finansal analizde geleceğe yönelik tahminlerde bulunabilmek için mevcut ve geçmişteki veriler yardımıyla durum değerlendirmesi yapılmaktadır (Özer, 2012). Finansal analiz; yatay analiz, dikey analiz, trend analizi ve karşılaştırmalı tablolar analizi olmak üzere 4 şekilde yapılmaktadır (Palamutçu, 2013).

Bu çalışmada finansal analiz tekniklerinden oran analizi yardımıyla verilere erişim sağlanmıştır. Oran analizi türlerinden ise faaliyet oranları veya diğer bir deyişle devir hızı rasyoları hesaplanmıştır.

Faaliyet oranları; işletmelerin aktif kullanım etkinliğini ölçerek firmaların varlıklarını ne düzeyde verimli kullandığını tespit etmektedir. Bu nedenle faaliyet oranlarının yüksek olması varlıkların verimli kullanıldığına işaret etmektedir (Demir ve Tuncay, 2012).

Yapılan çalışmada kullanılan faaliyet oranları; stok devir hızı, alacak devir hızı, çalışma sermayesi devir hızı, net çalışma sermayesi devir hızı, maddi duran varlık devir hızı, borç devir hızı ve aktif devir hızıdır.

Stok devir hızı (SDH); firmanın stoklarını yılda kaç kere yenilediğini ve satışlara dönüştürdüğünü göstermekte olup, satılan malın maliyeti / ortalama stoklar formülüyle hesaplanmaktadır. SDH'nin düşük olması; işletmelerin satış politikalarındaki yanlışlardan, emniyet stoğu yüksekliğinden ve stok düzeyindeki dengesizliklerden kaynaklanmaktadır. Yüksek SDH ise doğru stok politikaları, üretim-stok dengesi ve siparişle üretim yapılması gibi gerekçelere bağlıdır (Warren, Reeve & Fess, 2002; Akdoğan ve Tenker, 1997; Akgüç, 1991).

Alacak devir hızı (ADH); alacakların yılda kaç kez tahsil edildiğini göstermekte ve net satışlar / ticari alacaklar formülüyle hesaplanmaktadır. ADH'nin yüksek olması istenmektedir. Yüksek ADH; firmanın alacak tahsil yeteneğinin yüksek olduğunu, alacak politikasının güçlü olduğunu, müşterilerinin risk profilinin düşük olduğunu, finansman ihtiyacının düşük ve çalışma sermayesinin alacaklara bağlı olduğunu göstermektedir (Tandoğan, 2002).

Çalışma sermayesi devir hızı (ÇSDH); işletme sermayesi devir hızı olarak da ifade edilen ÇSDH, net satışlar / işletme sermayesi formülüyle hesaplanmaktadır.

Net çalışma sermayesi devir hızı (NÇSDH); net işletme sermayesi devir hızı olarak da ifade edilen oran, net satışlar / net işletme sermayesi formülüyle bulunmaktadır. NÇSDH; 1 liralık net işletme sermayesinin işletme satışlarında ortaya çıkardığı satış kapasitesini göstermektedir (Ayboğa ve Erol, 2022).

Maddi duran varlık devir hızı (MDVDH); net satışlar / net maddi duran varlıklar formülüyle hesaplanan MDVDH, maddi yapıdaki varlıkların ne derece etkin kullanıldığını ölçmektedir (Aydoğdu, 2010).

Borç devir hızı (BDH); kredili alımlar tutarı / ortalama ticari borç formülüyle hesaplanan BDH, 1 yıl içinde borç ödeme kabiliyetini ortaya koymaktadır (Akgüç, 2010).

Aktif devir hızı (AKDH); varlıkların ne derece etkin kullanıldığını gösteren olup, net satışlar / toplam aktif formülüyle hesaplanmaktadır. AKDH'nin yüksek olması firmanın tam kapasite ile çalıştığını gösterirken, eğer firmada sabit varlıklar fazlaca bulunuyorsa AKDH genellikle düşüktür (Ceylan ve Korkmaz, 2013; Keown vd. 1998).

Yapılan çalışmada amaçlanan ise; Türkiye Cumhuriyeti Merkez Bankası'na (TCMB) kayıtlı insan sağlığı ve sosyal hizmetler sektörü için 2009-2021 yılları arası 13 yıllık dönemde hangi faaliyet oranının daha önemli olduğunu tespit ederek bu tespite yönelik değerlendirmelerde bulunmaktır. Çalışmada faaliyet oranlarının önem düzeyini tespit etmek için SD, Critic ve LOPCOW olmak üzere 3 çok kriterli karar verme tekniğinden yararlanılmıştır. Daha sonra bu sonuçları birleştirip tek bir sıralama elde etmek için Copeland yöntemi kullanılmış ve hangi faaliyet oranının insan sağlığı ve sosyal hizmetler sektöründe daha önemli olduğu saptanmıştır.

2. LİTERATÜR İNCELEMESİ

Araştırmanın konusuna ve amacına uygun literatürdeki çalışmalar hakkında kronolojik olarak bilgi verilmiştir.

Tutar ve Güngör Tanç (2022) araştırmalarında pandeminin yarattığı etkilerin hastanenin finansal performansındaki sonuçları ölçülmüştür. Örneklem; Mersin'de faaliyet gösteren bir devlet hastanesidir. Veriler; temel finansal tablolar yardımıyla elde edilmiş ve finansal performans analizi için ise karşılaştırmalı tablolar yöntemi tercih edilmiştir. Bulgulara göre; hastanenin dönen varlıkları, ticari alacakları, stokları, dönem net zararı ve faaliyet zararı 2020 yılında oldukça artmıştır. Bunun temel sebebi; Covid-19 salgınıdır. Fakat bu etkinin görülmesi adına devam eden yıllarda da analizlerin yapılması gerektiği önerilmektedir.

Işıkçelik ve Ağırbaş (2022) orta ve büyük ölçekli sağlık kurumlarının 2020 yılına ait finansal performansını Gri İlişkisel Analiz (GİA) tekniğiyle ölçmüşlerdir. Analiz sonucunda; orta ölçekli kurumların büyük ölçekli kurumlara kıyasla finansal performansının daha iyi olduğu tespit edilmiştir. Ayrıca oran bazlı bakıldığında; likidite ve devir hızı olarak büyük ölçekli, kârlılık açısından orta ölçekli ve finansal yapı açısından her iki grubun eşit düzeyde performans gösteren sağlık kurumları olduğu ortaya çıkarılmıştır.

Ekinci ve Bakır (2021) yeni kurulan kamuya bağlı bir özel dal hastanesinin finansal analizi ilk 5 yıla ait temel finansal tablolar aracılığıyla yapılmıştır. Yöntem olarak ise oran analizi kullanılmıştır. Sonuç olarak; hastanenin etkili bir finansal performans göstermesi için likidite durumunu koruması, maliyetlerini kontrol etmesi, alacak-borç yönetiminde etkinliği sağlaması ve finansal göstergelerini düzenli olarak kontrol etmesi gerektiği vurgulanmıştır.

Timurtaş (2021) kamu-özel ortaklığına dayalı hastanelerle sadece kamuya bağlı hastaneler arasındaki sağlık hizmetinin verimlilik ve performansını kıyaslamıştır. Araştırmada literatür taranmış ve çalışmanın amacına uygun 5 araştırma değerlendirilmiştir. Sonuç olarak; kamu-özel ortaklığına dayalı hastanelerin kamu hastanelerine göre performansı daha yüksek ve verimli olduğu görülmüştür. Ancak bu konunun daha net çıkarımlar yapabilmek adına derinlemesine incelenmesi gerektiği önerilmiştir.

Yiğit (2020) araştırmasında 2009-2019 yılları arasında Türkiye'deki hastane hizmetleri alt sektörünün finansal performansını ve risk durumunu analiz etmiştir. Oran analizi yardımıyla 11 finansal performans değerlendirme kriterini TOPSIS yöntemiyle analize tabi tutmuştur. Risk durumunu ise Altman Z Skorunu kullanarak ölçmüştür. TOPSIS skorlarına göre; en yüksek finansal performans 2010 yılında, en düşük finansal performans ise 2018 yılında gerçekleşmiştir. Altman Z Skoru ise en yüksek 2009 yılında en düşük ise 2018 yılında görülmektedir. Hastane sektörünün 2009 ve 2010 yıllarında finansal riski olmadığı; fakat 2017 ve 2018 yıllarında riski yüksek finansal olarak başarısız olduğu tespit edilmiştir.

Yiğit (2019) çalışmasında kamu hastanelerinin performansını TOPSIS yöntemi ile analiz etmiştir. Örneklem evrenin tamamından oluşmakta olup Sağlık Bakanlığı'na bağlı A1 grubunda yer alan tüm hastaneleri içermektedir. Performans değerlendirme kriterleri; hekim başına düşen günlük poliklinik sayısı, yatak başına düşen hekim oranı, yatak başına düşen hemşire oranı, hekim başına ağırlıklı ameliyat sayısı, yatak doluluk oranı, yatak devir hızı ve ortalama kalış gün sayısıdır. Analiz sonucunda; performansı en yüksek hastane Giresun Üniversitesi Prof. Dr. A. İlhan Özdemir Hastanesi, en düşük puana sahip hastane

ise Gülhane Eğitim ve Araştırma Hastanesi olarak tespit edilmiştir. İl bazlı en düşük performans ise sırasıyla İzmir, Ankara, İstanbul, Antalya ve diğer illere ait olarak bulunmuştur.

Çil Koçyiğit ve Kocakoç (2019) çalışmalarında Ankara ilindeki 13 kamu hastanesinin 2008-2017 yılları arası 10 yıllık mali tabloları yardımıyla oran analizi gerçekleştirmişlerdir. Elde edilen bulgulara göre; likidite oranlarında düşüşler olduğu, borçların hatta kısa vadeli borçların oldukça arttığı, özkaynakların azaldığı, riskin artış gösterdiği, maddi duran varlık ve duran varlıkların gereğinden fazla kullanıldığı ve kârlılığın istenilen düzeyde olmadığı görülmüştür.

Kar, Özer ve Avcı (2019) çalışmalarında Türkiye'deki kamu ağız ve diş sağlığı merkezlerinin tümüne ait finansal performans analizi yapmışlardır. Araştırmanın örneklemini aynı zamanda evreni olup Türkiye'deki 126 ağız ve diş sağlığı merkezini kapsamaktadır. Kullanılan yöntem, TOPSIS yöntemidir. Yıl olarak, 2016 yılı analiz edilmiştir. Değerlendirme kriterleri; toplam tahakkuk gelirleri / toplam gider, global bütçe dışı diğer tahsilat / global bütçe dışı diğer tahakkuk, tahakkukların muhasebeleştirilmesi süresi ve net borç / net hizmet tahakkuk tutarıdır. Elde edilen bulgulara göre; en iyi ya da en ideal finansal performans 1603530 ID numaralı ağız ve diş sağlığı merkezi olarak belirlenmiştir.

Alper ve Biçer (2017) oran analizi yardımıyla bir kamu hastanesinin 3 yıllık mali tablolarını kullanarak finansal analizini gerçekleştirmişlerdir. Sonuçları sektör oranlarıyla kıyaslamışlardır. Bulgulara göre; hastanenin likiditesinin yeterli, net çalışma sermayesinin iyi, alacak tahsilinde sorun yaşamadığı, stok devir hızının yüksek, finansal yapısının güçlü ve kârlılık durumunun ilk 2 yıldan sonra artmaya başladığı görülmüştür.

Özer (2012) kamu hastanesinin son 3 yıla ait mali tabloları yardımıyla retrospektif analizini yapmayı amaçlamıştır. Oran analizi ve karşılaştırmalı tablolar analizi yöntem olarak kullanılmıştır. Örneklem yılı; 2008, 2009 ve 2010'dur. Sonuçlar; alacak devir hızının düşük olduğu ve buna istinaden alacak tahsilinde sıkıntılar bulunduğunu göstermekte hatta özkaynak ağırlıklı finansal yapıya sahip hastanenin kârlılık düzeyinde 3 yılda oldukça dalgalanmalar yaşandığı görülmüştür.

Özgülbaş vd. (2008) araştırmalarında; Türkiye'deki 797 özel hastanenin 1994-2005 yılları arasında kapsayan 12 yıllık bir veri seti yardımıyla finansal analizini gerçekleştirmişlerdir. Analiz yapılırken oran ve trend analizi kullanılmıştır. Ayrıca araştırmada finansal performans etki eden faktörler Mann-Whitney U testi ile belirlenmiştir. Sonuç olarak; likidite durumu, net çalışma sermayesi, finansal yapıları, alacak yöntemi, tahsilat süresi ve kârlılık oranlarının finansal performansı etkileyen faktörler olduğu saptanmıştır.

3. ARAŞTIRMANIN YÖNTEMİ

Araştırmada faaliyet oranlarının önem derecesini bulabilmek için 3 farklı çok kriterli karar verme tekniği yardımıyla kriterler sıralanmış ve bu sıralama başka bir yöntem yardımıyla bütünleştirilmiştir. Kullanılan 3 yöntem; SD, Critic ve LOPCOW yöntemleridir. 3 yöntemin sonuçları ise Copeland yöntemiyle tek bir sıralama hâline dönüştürülmüştür.

3.1. SD Yöntemi

SD yöntemi; objektif çok kriterli değerlendirme kriterlerinden olan ve standart sapma yöntemi olarak da ifade edilen Entropi, Critic ve CILOS gibi nesnel çok kriterli karar verme teknikleri arasındadır. Bu yöntemde kriter ağırlıkları belirlenirken standart sapmadan yararlanılmaktadır (Bağcı ve Yüksel Yiğiter, 2019).

SD yöntemi 3 adımdan oluşmaktadır (Diakoulaki, Mavrotas & Papayannakis, 1995):

Adım 1: Araştırmanın veri setinden karar matrisi oluşturulması kısmıdır. Bu adım çok kriterli karar verme tekniklerinin birçoğunda bulunmaktadır.

Adım 2: Karar matrisi sonucu elde edilen verileri normalize etme işlemidir. Bu adımda pozitif nitelikli fayda kriterleri 1 numaralı formülle, negatif nitelikli maliyet kriterleri ise 2 numaralı formülle normalize edilmektedir.

$$r_{ij} = \frac{x_{ij} - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n \text{ (fayda kriteri için)} \quad (1)$$

$$r_{ij} = \frac{x_j^{\max} - x_{ij}}{x_j^{\max} - x_j^{\min}} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n \text{ (maliyet kriteri için)} \quad (2)$$

Adım 3: Yöntemin son adımı; kriterlerin ağırlıklarının bulunması ve hangi kriterin daha önemli olduğunun tespit edilmesidir. Bu tespit 3 numaralı formülle yapılmakta ve ağırlığı en çok olan kriter en önemli kriter olarak saptanmaktadır.

$$w_j = \frac{\sigma_j}{\sum_{k=1}^n \sigma_k} \quad (j = 1, 2, \dots, m) \quad (3)$$

3.2. Critic Yöntemi

Critic yöntemi; objektif çok kriterli karar verme tekniklerinden biri olan ve içerisinde diğer yöntemlerden farklı kriterler arası ilişkiyi gösteren korelasyon matrisi bulunan bir tekniktir. Bu teknik 4 aşamadan meydana gelmektedir (Jahan vd. 2012).

1. Aşama: Karar matrisini oluşturup verileri normalleştirme kısmıdır. Bu kısım 4 numaralı formülde olumlu kriterleri hesaplarken, 5 numaralı formülde olumsuz kriterleri tespit etmektedir.

$$R_{ij} = (X_{ij} - X_{jmin}) / (X_{jmax} - X_{jmin}) \text{ olumlu kriterler için;} \quad (4)$$

$$R_{ij} = (X_{jmax} - X_{ij}) / (X_{jmax} - X_{jmin}) \text{ olumsuz kriterler için;} \quad (5)$$

2. Aşama: Kriterler arası ilişkiyi gösteren korelasyon matrisi oluşturmaktır. Bu matrisi oluşturulurken 6 numaralı formül kullanılmaktadır.

$$\rho_{jk} = \frac{\sum_{i=1}^m (r_{ij} - \bar{r}_j)(r_{ik} - \bar{r}_k)}{\sqrt{\sum_{i=1}^m (r_{ij} - \bar{r}_j)^2 \sum_{i=1}^m (r_{ik} - \bar{r}_k)^2}} \quad (j, k = 1, 2, \dots, n) \quad (6)$$

3. Aşama: Belirlenen korelasyon matrisine göre her bir kriterin standart sapmaları 7 numaralı formülle bulunmakta ve ardından 8 numaralı formülle toplam bilgi düzeyi ölçülmektedir.

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^m (r_{ij} - \bar{r}_j)^2}{m}} \quad (7)$$

$$C_j = \sigma_j \sum_{k=1}^n (1 - \rho_{jk}) \quad j = 1, 2, \dots, n \quad (8)$$

4. Aşama: Son adımda toplam bilgi düzeyi kullanılarak kriter ağırlıkları 9 numaralı formülle hesaplanmakta ve ağırlığı en çok olan kriter en önemli kriter olarak belirlenmektedir.

$$w_j = \frac{C_j}{\sum_{k=1}^n (C_k)} \quad (j = 1, 2, \dots, n) \quad (9)$$

3.3. LOPCOW Yöntemi

Güncel çok kriterli karar verme tekniklerinden olan LOPCOW yöntemi Ecer ve Pamucar (2022) tarafından geliştirilmiştir. Nesnel kriterlerden biri olarak literatürde yerini bulmuş ve 4 adımdan oluşmaktadır (Ecer ve Pamucar, 2022).

Adım 1: Araştırmanın veri setinden karar matrisi oluşturulması kısmıdır. Bu adım çok kriterli karar verme tekniklerinin genelinde bulunmaktadır.

Adım 2: Bu adımda veriler normalize edilerek standart hâle getirilir ve birçok yöntemde bu adım mevcuttur. 10 numaralı formülle fayda kriterleri, 11 numaralı formülle maliyet kriterleri normalize edilmektedir.

$$r_{ij} = \frac{x_{ij} - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n \text{ (fayda kriteri için)} \quad (10)$$

$$r_{ij} = \frac{x_j^{\max} - x_{ij}}{x_j^{\max} - x_j^{\min}} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n \text{ (maliyet kriteri için)} \quad (11)$$

Adım 3: Üçüncü adımda her kritere ait yüzde değeri 12 numaralı formülle bulunmaktadır.

$$PV_{ij} = \left| \ln \left(\frac{\sqrt{\frac{\sum_i^m r_{ij}^2}{m}}}{\sigma} \right) \cdot 100 \right| \quad (12)$$

Adım 4: Son adımda kriter ağırlıkları 13 numaralı formülle hesaplanmakta ve ağırlığı en yüksek olan kriter en önemli kriter olarak belirlenmektedir.

$$W_j = \frac{PV_{ij}}{\sum_{i=1}^n PV_{ij}} \quad (13)$$

3.4. Copeland Yöntemi

Copeland yöntemi, Saari ve Merlin (1996) tarafından geliştirilen ve birden çok tekniğin sıralamalarını tek bir sıra hâline dönüştüren yöntemlerden biridir. Literatürde “Borda Sayım” yöntemi gibi Copeland yöntemine benzeyen yöntemler de mevcuttur.

Copeland yöntemi; kıyaslama kullanarak sıralama gerçekleştirir ve galip ya da mağlup olma durumuna göre 1 veya 0 puanı vermektedir. Ardından yöntem bu puanları toplam skora dönüştürüp sıralamayı tamamlamaktadır (Çakır, 2017).

4. BULGULAR

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Araştırmada 2009-2021 yılları arasını kapsayan 13 yıllık veri seti yardımıyla TCMB'ye kayıtlı insan sağlığı ve sosyal hizmetler sektörünün faaliyet oranları önem düzeyi ölçülmüştür. Araştırmada kullanılan faaliyet oranları Tablo 1'de görülmektedir.

Tablo 1: Örneklem

Alternatifler	Kriterler
2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020 ve 2021 yılları	Stok devir hızı (SDH), Alacak devir hızı (ADH), Çalışma sermayesi devir hızı (ÇSDH), Net çalışma sermayesi devir hızı (NÇSDH), Maddi duran varlık devir hızı (MDVDH), Borç devir hızı (BDH), Aktif devir hızı (AKDH)

Tablo 1'de örneklem; 13 alternatif ve 7 kriterden oluşmaktadır. Hedeflenen, 7 kriter içerisinde hangisinin daha önemli olduğunu ölçmektir. Ölçüm yapılırken 3 farklı çok kriterli karar verme tekniğiyle önem düzeyleri tespit edilip ardından kullanılan Copeland yöntemiyle bu sıralamalar bütünleştirilmiştir. İlk kullanılan yöntem SD yöntemidir. SD yöntemi skorları Tablo 2'de görülmektedir.

Tablo 2: SD Skorları

Kriterler	Puanlar
NÇSDH	0,151654
ADH	0,149774
AKDH	0,149183
MDVDH	0,145799
ÇSDH	0,143867
SDH	0,130886
BDH	0,128837

SD skorlarına göre; belirlenen zaman diliminde insan sağlığı ve sosyal hizmetler sektörü için en önemli gösterge net çalışma sermayesi devir hızı iken, önem düzeyi en düşük gösterge ise borç devir hızı olarak saptanmıştır. SD yönteminin ardından önem düzeyini ölçmek için kullanılan ikinci yöntem Critic yöntemidir. Critic yöntemine ait sonuçlar Tablo 3'de verilmiştir.

Tablo 3: Critic Puanları

Sıralama	Puanlar
SDH	0,196731
ÇSDH	0,149618
BDH	0,142878
ADH	0,137939
MDVDH	0,131233
NÇSDH	0,130205
AKDH	0,111395

Critic puanlarına göre; aynı sektör için en önemli gösterge stok devir hızı iken, en önemsiz gösterge ise aktif devir hızı olarak belirlenmiştir. Critic yönteminden sonra ise üçüncü bir

yöntem olan LOPCOW yöntemiyle önem düzeyleri son kez hesaplanmış ve sonuçlar Tablo 4’de verilmiştir.

Tablo 4: LOPCOW Skorları

Sıralama	Puanlar
SDH	0,255205
NÇSDH	0,179352
MDVDH	0,161501
ÇSDH	0,155536
AKDH	0,153956
ADH	0,064196
BDH	0,030254

LOPCOW skorlarına göre; stok devir hızı insan sağlığı ve sosyal hizmetler sektörü için en önemli faaliyet oranı iken, borç devir hızı ise önemi en az olan faaliyet oranı olarak tespit edilmiştir.

3 farklı yöntemle elde edilen sıralama sonuçları ve skorlarını tek bir sıralama hâline getirip daha sağlıklı yorumlar yapabilmek için Copeland yöntemi kullanılmıştır. Copeland yöntemi sonucunda 3 farklı yöntem tek bir yöntem indirgenmiş ve sonuçlar Tablo 5’de görülmüştür.

Tablo 5: Copeland Skorları

Sıralama	Puanlar
SDH	8
NÇSDH	6
ADH	4
ÇSDH	2
MDVDH	0
AKDH	-6
BDH	-10

Copeland sonucuna göre; kullanılan 3 yöntemin ortak kararı olarak insan sağlığı ve sosyal hizmetler sektörü için en önemli faaliyet oranı stok devir hızı, ardından net çalışma sermayesi devir hızı onu takip ederken; önemi en düşük faaliyet oranı ise borç devir hızı olarak ortaya çıkarılmıştır.

5. SONUÇ

Özelleştirme uygulamalarının artmasıyla birlikte hizmet sektöründe de rekabet giderek artmış ve artık kamu işletmelerinde de performans ölçümünün önemi ortaya çıkmaya başlamıştır. Hizmet sektörüne verilen önemi arttırmak için, verilen hizmetin kalitesini müşteriler tarafından asgari kabul edilebilir düzeye çıkarmak hatta daha da geliştirmek gereklidir. Hizmet kelimesi kullanıldığında akla ilk gelen kavram ise insan hayatının vazgeçilmez unsuru olan sağlıktır.

Sağlık sektöründe özel veya kamu biçiminde sınıflandırılan hastanelerde, finansal performans ölçümü hastanelerin geleceğe yönelik hedef belirlemeleri açısından son derece önem taşımaktadır. Başarılı durumdaki hastaneler borç-özkaynak dengesini koruyabilmektedir. Yapılan çalışmada finansal analizin türlerinden olan oran analizi kullanılarak veri seti oluşturulmuştur. Oluşturulan veri seti, faaliyet oranlarını içermektedir. Faaliyet oranlarının seçilmesinin nedeni; örneklemdaki işletmelerin aktiflerini ne derece etkin kullandığını tespit ederek varlıklarının verimliliğini belirlemektir. Faaliyet oranları ne derece yüksek olursa varlıkların verimli kullanıldığı görülmektedir. Çalışmanın amacı; TCMB'ye kayıtlı insan sağlığı ve sosyal hizmetler sektöründe faaliyet oranlarının etkinliği ölçülmüştür. Etkinlik ölçümü için; SD, Critic ve LOPCOW yöntemleri kullanılmış ve ardından bulunan sonuçlar Copeland yöntemiyle tek bir sıralamaya dönüştürülmüştür. Çalışmada kullanılan faaliyet oranları; stok devir hızı, alacak devir hızı, çalışma sermayesi devir hızı, net çalışma sermayesi devir hızı, maddi duran varlık devir hızı, borç devir hızı ve aktif devir hızıdır. Kullanılan 3 yönteme göre elde edilen sonuçlar bağlamında SD yönteminde en önemli faaliyet oranı net çalışma sermayesi, önem düzeyi en düşük faaliyet oranı ise borç devir hızı iken; Critic yönteminde en önemli faaliyet oranı stok devir hızı, önemi en az olan ise aktif devir hızı; LOPCOW yönteminde ise yine stok devir hızı en önemli faaliyet oranı, borç devir hızı önemi en düşük faaliyet oranı olarak saptanmıştır. Elde edilen sonuçları bütünleştirip tek bir sıralama hâline getiren Copeland yönteminde insan sağlığı ve sosyal hizmetler sektöründe faaliyet oranlarından en önemlisi stok devir hızı, önem düzeyi en düşük olan ise borç devir hızı olarak tespit edilmiştir. Stok devir hızının, hastaneler için stoklarını ne kadar hızlı paraya çevirdiğini gösterdiğinden dolayı yüksek olması tercih edilmektedir. Hatta bu oranın yüksek olmasıyla birlikte hastanenin gereksinim duyduğu hasta sayısı, ilaç ve tıbbi malzeme hareketliliği de yüksek olacaktır. Dolayısıyla bu yükseliş; hastanedeki ameliyat, acil, yoğun bakım vb. servis hizmetlerinde yoğunluğun arttığını ve hastanenin işlevselliğini de ortaya koymaktadır.

KAYNAKÇA

- Akdoğan, N. & Tenker, N. (1997). *Finansal tablolar ve mali analiz teknikleri*. 5. Baskı, İstanbul: Lebib Yalkın Yayınları ve Basım İşleri A.Ş.
- Akgüç, Ö. (1991). *Kredi taleplerinin değerlendirilmesi*. 5. Baskı, İstanbul: Avcıol Basın-Yayın.
- Akgüç, Ö. (2010). *Finansal yönetim*. 9.Baskı, İstanbul: Avcıol Basın Yayın.
- Akgüç, Ö. (2013). *Mali tablolar analizi*. Genişletilmiş 15. baskı, İstanbul: Arayış Basım Yayın.
- Alper, A. & Biçer, E. B. (2017). Kamu hastanelerinde finansal performansın oran analizi ile ölçülmesi: bir kamu hastanesi örneği. *Cumhuriyet Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 18(2): 337-357.
- Avcı, K. (2014). Bir eğitim ve araştırma hastanesinin finansal ve operasyonel performans göstergeleri arasındaki ilişki. *Hacettepe Sağlık İdaresi Dergisi*, 17(1): 1-20.
- Ayboğa, M. H. & Erol, M. (2022). Ekonomik krizin zor durumda bıraktığı işletmelerde işletme sermayesi yönetiminden beklentiler. *Uluslararası Beşeri ve Sosyal Bilimler İnceleme Dergisi*, 6(1): 31-39.
- Aydoğdu, S. (2010). *Altı sigmayı kullanan bir işletmenin mali tablolar analizi*. Marmara Üniversitesi, Sosyal Bilimler Enstitüsü Yüksek Lisans Tezi, İstanbul.
- Bağcı, H. & Yüksel Yiğiter, Ş. (2019). BİST’te yer alan enerji şirketlerinin finansal performansının SD ve Waspas yöntemleriyle ölçülmesi. *Bingöl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 9(9): 877-898.
- Ceylan, A. & Korkmaz, T. (2013). *Finansal yönetim temel konular*. 7. Baskı, Bursa: Ekin Basın Yayın Dağıtım.
- Çakır, E. (2017). Kriter ağırlıklarının SWARA – Copeland yöntemi ile belirlenmesi: bir üretim işletmesinde uygulama. *Adnan Menderes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 4(1): 42-56.
- Çil Koçyiğit, S. & Kocakoç, N. (2019). Ankara ili kamu hastanelerinin 2008-2017 dönemi finansal performans analizi. *İşletme Araştırmaları Dergisi*, 11(2): 1280-1293.
- Çil Koçyiğit, S. (2011). *Hastane işletmelerinde finansal performans ölçümü ve Türkiye özel hastaneler uygulaması*. Ankara: Gazi Kitabevi.
- Demir, M. & Tuncay, M. (2012). Türk gıda sektörünün faaliyet ve kârlılık oranları açısından analizi: İMKB gıda sektöründe işlem gören işletmeler üzerinde bir araştırma (2000-2008 dönemi). *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 17(2): 367-392.
- Diakoulaki, D., Mavrotas, G. & Papayannakis, L. (1995). Determining objective weights in multiple criteria problems: the Critic method. *Computers & Operations Research*, 22(7): 763-770.
- Doğru, E. (2010). *Değer yaratan faaliyetler açısından işletme başarısı ve çimento sanayii işletmelerinde bir araştırma*. Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü Yüksek Lisans Tezi, Isparta.

- Ecer, F. & Pamucar, D. (2022). A Novel LOPCOW-DOBI multi-criteria sustainability performance assessment methodology: an application in developing country banking sector. *Omega*, 112(112690): 1-17.
- Ekinci, G. & Bakır, İ. (2021). Sağlık kurumlarında finansal performans analizi A1 dal hastanesi örneği. *Uluslararası Sağlık Yönetimi ve Stratejileri Araştırma Dergisi*, 7(1): 1-18.
- Işıkçelik, F., Ağırbaş, İ. (2022). Sağlık kurumları finansal performansının Gri İlişkisel Analiz ile değerlendirilmesi. *Alanya Akademik Bakış Dergisi*, 6(3): 2565-2582.
- Jahan, A. et al. (2012). A Framework for weighting of criteria in ranking stage of material selection process. *The International Journal of Advanced Manufacturing Technology*, 58(1-4): 411-420.
- Kar, A., Özer, Ö. & Avcı, Keziban (2019). Türkiye'deki ağız ve diş sağlığı merkezlerinin finansal performans değerlendirilmesi. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, 60: 87-99.
- Keown, Arthur J. vd. (1998). *Foundations of financial management*. Second Edition, America: Prentice Hall International.
- Li, L. X., Benton, W. C. & Leong, G. K. (2002). The impact of strategic operations management decisions on community hospital performance. *Journal of Operations Management*, 20(4): 389-408.
- Özer, Ö. (2012). Mali tablolar analizi: bir hastane örneği. *Gümüşhane Üniversitesi Sosyal Bilimler Elektronik Dergisi*, 3(6): 183-199.
- Özgülbaş N. (2005). Sağlık kurumlarında finansal performans ölçümü ve finansal performansı artırmak için kullanılacak stratejiler. *Verimlilik Dergisi*, 3: 125-144.
- Özgülbaş, N., Koyuncugil, A. S., Duman, R. & Hatipoğlu, B. (2008). Özel hastane sektörünün finansal değerlendirilmesi. *Muhasebe ve Finansman Dergisi*, 40: 120-131.
- Palamutçu, S. (2013). *Kamu ve özel sağlık işletmelerinde finansal performansın oran analizi ile ölçülmesi ve karşılaştırılması*. Yüksek Lisans Tezi, Beykent Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul.
- Saari, D. G. & Merlin, V. R. (1996). The Copeland method. *Economic Theory*, 8: 51-76.
- Tandoğan, B. (2002). *Finansal tabloların analizi ve finansman yöntemlerinin değerlendirilmesi*. 2. Baskı, Bursa: Vakıf Sistem Pazarlama Yazılım Servis.
- Timurtaş, M. (2021). Kamu özel ortaklığı modeli hastanelerinde verimlilik ve performansın karşılaştırılması: bir sistematik derleme. *Journal of Health Sciences and Management*, 1: 35-44.
- Tutar, M. & Güngör Tanç, Ş. (2022). Covid 19'un Mersin ilinde faaliyet gösteren bir devlet hastanesinin finansal performansı üzerine etkisinin incelenmesi. *İşletme Akademisi Dergisi*, 3(3): 339-350.
- Türkiye Cumhuriyet Merkez Bankası, (2023). Sektör bilançoları istatistikleri. 20.02.2023 tarihinde <https://www.tcmb.gov.tr/wps/wcm/connect/TR/TCMB+TR/Main+Menu/Istatistikler/Reel+Sektor+Istatistikleri/Sektor+Bilancolari/Sektor+Bilanco+Verileri/> adresinden erişilmiştir.

- Warren, C. S. , Reeve, J. M. & Fess, P. E. (2002). *Corporate financial accounting*. 7th Edition, South-Western, Cincinnati, OH.
- Yiğit, A. (2019). Türkiye’de eğitim ve araştırma hastaneleri performansının TOPSIS yöntemi ile analizi. *Ankara Sağlık Bilimleri Dergisi*, 8(2): 72-85.
- Yiğit, V. (2020). Hastane hizmetleri alt sektörünün finansal performans analizi. *Uluslararası Sağlık Yönetimi ve Stratejileri Araştırma Dergisi*, 6(3): 609-624.

**INVESTIGATION OF INTERVENTION PROGRAMS APPLIED FOR FRAILITY IN
OLDER ADULTS**

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ABSTRACT

Purpose: This review study was conducted to examine the intervention programs for frailty in the elderly and the role of the public health nurse.

Method: Literature search Google Academic through the keywords 'elderly, fragility, frailty syndrome, nursing, prevention, intervention' and using the PubMed database. English and Turkish articles published between 2015 and 2022 and whose full texts are available were reviewed.

Results: When the literature on the subject is examined, the health problems of elderly individuals, who constitute approximately 9.1% of the world population, are characterized by the emergence of several complex health conditions called geriatric syndromes. One of the important health problems of elderly people is fragility. The concept of fragility, which is defined as the state of weakness and the deterioration of adaptation to stress as a result of the decrease in physiological reserves with aging, is extremely important for elderly individuals. Studies in the literature direct us to prevention and intervention programs at this point. In a study, it was determined that the concept of vulnerability negatively affects functional independence and life activity. In another study, it was determined that the development of delirium in fragile individuals was higher than in non-fragile individuals.

Conclusion: It has been determined that trainings such as exercise and diet within the scope of the intervention programs implemented in line with the studies in the literature are factors that can have a healing effect on the course of the frailty level. In addition, it is seen that the interventions applied as a result of the early detection of vulnerability protect the independence of individuals. It is recommended that screening and follow-up of elderly individuals by public health nurses in primary health care services, early detection of frailty in line with the literature, and implementation of effective intervention programs that prevent and reduce frailty.

Anahtar Kelimeler: Elderly, frailty, nursing, intervention program

INTRODUCTION

With the improvement of living standards worldwide, medical and technological developments, controlling infectious diseases, vaccination programs, improvements in health policies, prolonging life expectancy, and providing treatment for many diseases, the human lifespan is getting longer, and the elderly population is gradually increasing (Santrock 2015, Top ve Dikmetaş 2015). According to the data of the World Health Organization, which states that the proportion of the elderly population is increasing in every country, by 2050, the population of people aged 60 and over in the world is expected to double (2.1 billion) (WHO 2021, Beard et al. 2016). In Turkey, it is seen that the elderly population has reached 8 million 245 thousand 124 according to the 2021 data published by the Turkish Statistical Institute (TUIK). It is stated that the proportion of the elderly population in the total population has increased to 9.7% (TUIK 2021). The accumulation of a wide variety of molecular and cellular damage over time causes aging at the biological level. Biological aging leads to a gradual decrease in physiological and mental capacity, an increase in disease risks and ultimately death. In addition, old age is characterized by the emergence of several complex health conditions called the geriatric syndrome. Geriatric syndromes are often the result of multiple underlying factors such as frailty, falls, urinary incontinence, delirium and pressure sores (WHO 2021). Among geriatric syndromes, frailty, which is frequently encountered with prolonged life expectancy, has become an issue that needs to be handled carefully in all health care providers.

The concept of fragility is defined in the literature as the state of weakness and deterioration of adaptation to stress, which occurs as a result of the decrease in physiological reserves in multiple organ systems with aging (Yoltay & Korkmaz 2021, Demiray et al. 2022). Although aging is not synonymous with the concept of fragility, age is an effective factor in the development of frailty (Yoltay & Korkmaz 2021). In a prevalence study, it was found that the prevalence of frailty is higher in people over the age of 80 than in other age groups (Büyüksülu 2020).

The ethology of frailty syndrome has not been fully explained, but advanced age, low education level, smoking and alcohol consumption, high body mass index, malnutrition, decreased immunity, genetic and environmental factors, being single, depression, antidepressant drug use, presence of mental disability, cardiovascular disease. There are studies showing that systemic diseases, sarcopenia and fragility are related. (Mello et al. 2014, Bandeen-Roche et al. 2015, Graham & Brown 2017, Şahin & Akçiçek 2019, Çakmak & Inkaya 2021, Kong 2021). In another study, it was concluded that the risk factors associated with frailty are female gender, sedentary life, presence of comorbidities, polypharmacy, malnutrition, staying at home, going

to the emergency department at least once in the last year, and a history of hospitalization (Büyükuslu 2020).

When the clinical features of fragile individuals are observed, it is stated that there are postural disorders, loss of muscle strength, decrease in appetite, weakness, unexplained anemia, amnesia, deterioration in cognitive processes, decrease in visual and hearing acuity, and decreased reflexes (Kapucu and Ünver 2017, Michel and Walston 2018, Şahin and Akçiçek 2019). Neurological diseases such as depression, cancer, kidney diseases, blood diseases, diabetes mellitus, Parkinson's and Alzheimer's are counted as the most common co-morbidities in fragile individuals (Şahin ve Akçiçek 2019). According to the analysis of meta-analysis studies in which many studies were included, it is stated that frail elderly individuals have more cognitive impairment than non-fragile elderly individuals (Büyükuslu 2020).

It is reported that with the control of the fragility process, the quality of life of elderly individuals will increase by preserving their independence (Kapucu & Ünver 2017). It is stated that it is possible to reverse the frailty state when appropriate exercise activities are performed for the frail individual who has been identified in the early period. It is stated that if it is not noticed, it can cause much more serious problems that progress to immobility or mortality (Akturan et al. 2020). For these reasons, this review study was conducted to examine intervention programs for frailty in elderly individuals.

METHOD

The literature search was conducted using the Google Scholar and PubMed database, using the keywords 'elderly, fragility, frailty syndrome, nursing, prevention, intervention, frailty assessment'. English and Turkish articles published between 2015 and 2022 and whose full texts are available were reviewed.

RESULTS

The intervention studies implemented for vulnerability are listed below.

In an intervention study by Nagai et al. (2018), due to the uncertainty of the effect of increased physical activity (PA) in addition to resistance exercise (RT) on frailty, in this study, in addition to resistance strength training, physical activity intervention with feedback was used in frail older adults physical and mental health. It is aimed to investigate the effect on the results. 41 elderly individuals living in Japan with an average age of 81.5 were included in this study. Randomly selected individuals received resistance training with either the PA (RPA group) or RT group for six months. Instrumental activities of daily life, state of movement, level of muscle strength and health-related quality of life, frailty status and frailty scores were evaluated. It was

stated that while a significant increase was observed in the number of daily steps taken and lower extremity muscle strength of the participants in the RPA group, a significant decrease was achieved in frailty scores. In this study, administration of a PA intervention in addition to RT reduced frailty scores in older adults with frailty symptoms. Also, it is reported to be applicable because it increases muscle strength and mobility in the lower extremities (Nagai et al. 2018).

In another intervention study by Hsieh et al. (2019), effective individualized home-based exercise and nutrition interventions were developed to reduce vulnerability. 319 pre-frail or frail older adults; randomly assigned to any of the four study groups (control, exercise, nutrition, and nutrition+exercise [combination]). An exercise intervention was created from a combination of training that included flexibility, strength, balance, and endurance. As a nutritional intervention, it was aimed to maintain the desired body weight by consuming a certain number of servings from all six food groups and ensuring adequate caloric intake (fruits, vegetables, foods high in protein, cereals, plant oils). Calorie needs of the participants were evaluated by considering age, gender, height, weight and physical activity levels. Participants were recommended about 3 to 7 exercise sessions per week. All participants in the combination and exercise groups were encouraged to complete 6 months of home-based exercise, and their daily exercise performance was recorded in an exercise diary. Evaluation of all participants at baseline, month 1, month 2, month 3 and month 6 was performed monthly by a trained case manager who did not know to which intervention group the participants belonged. When the results of this study are examined, it has been reported that individualized home-based exercise and diet interventions are effective in improving frailty and physical performance in pre-frail or frail older adults in the community. In addition, it is stated that nutritional intervention can play an active role in improving mental health in pre-frailty or older adults. As a result, it is recommended to identify pre-vulnerable or frail older adults in clinical and public health units, community-based hospitals. Implementation of individualized exercise and nutrition intervention programs is another recommendation to improve and manage frailty (Hsieh et al. 2019).

The effect of a Multisystem Physical Exercise Program (MPE) by Chittrakul et al. (2020) on fall prevention and health-related quality of life in older adults with pre-frailty was evaluated in the study. This research was carried out with 72 individuals aged 65 and over, 36 people in the multi-system physical exercise group and 36 people in the control group. This intervention was carried out 3 days a week for 12 weeks and consisted of proprioception (awareness of body

movement and position), muscle strengthening, reaction time and balance exercise. According to the results of the research; It has been reported that the MPE program significantly increases muscle strength by improving proprioception, reaction time and postural sway, in addition to reducing the risk of falls in older adults with anterior fragility. In line with these results, it is recommended that the that the MPE program be used in primary care practices in individuals with pre fragility (Chittrakul et al. 2020).

In another intervention study by Sadjapong et al. (2020), the aim of the Multi-component exercise program (MCEP) is to investigate its effectiveness on fragility, physical performance and blood biomarkers. This study included 64 elderly adults, 32 people in the MCEP group and 32 people in the control group. The combined center and home-based multi-component exercise program consists of chair aerobics, resistance and balance. This training was carried out 3 days a week for 24 weeks. It has been concluded that the combined center and home-based multi-component exercise program is effective in returning frailty to pre- frailty, improving balance and improving physical performance, especially in the elderly population. It has been reported that the Multi-Component Exercise Program has made significant progress on the frailty scores of the participants, the Berg Balance Scale (BBS) and the Timed Up and Go test (TUG) (Sadjapong et al. 2020).

CONCLUSION

In conclusion, in line with the research, early detection of frailty in elderly individuals and planning of intervention programs suitable for the individual are extremely important. At the same time, it has been determined that programs such as exercise and diet within the scope of intervention programs for frailty can improve the course of frailty level. Also, it is seen that the interventions applied as a result of the early detection of vulnerability protect the independence of individuals. In primary health care services, it is recommended to carry out screenings and follow-ups for elderly individuals by nurses, early detection of frailty, and implementation of effective intervention programs that prevent and reduce frailty.

REFERENCES

- Akturan S., Tuncel B., Kartçı S., Tuz C., 2020. Aile hekimlerinin 'kırılganlık' bilgi düzeylerinin değerlendirilmesi; Kesitsel bir çalışma. *The Journal of Turkish Family Physician*, 11(4), 171-8.
- Bandeem-Roche, K., Seplaki, C. L., Huang, J., Buta, B., Kalyani, R. R., Varadhan, R., Xue, Q. L., Walston, J. D., & Kasper, J. D., 2015. Frailty in Older Adults: A Nationally Representative Profile in the United States. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 70(11), 1427-1434.
- Beard JR, Officer AM, Cassels AK., 2016. The World Report on Ageing and Health. *Gerontologist*. 56(2):163-6.
- Büyüksulu N., Cin P., 2020. Yaşlılarda Kırılganlık Sendromu ve Omega-3 Çoklu Doymamış Yağ Asitleri. *Ankara Medical Journal*, (4), 1099-1111.
- Chittrakul J., Siviroj P., Sungkarat S., Sapbamrer R., 2020. Multi-System Physical Exercise Intervention for Fall Prevention and Quality of Life in Pre-Frail Older Adults: A Randomized Controlled Trial. *International Journal of Environmental Research and Public Health*, 17,3102, 1-13.
- Çakmak B., İnkaya B., 2021. COVID-19 Pandemisi ve Kırılgan Yaşlılarda Hemşirelik Yaklaşımları. *Ankara Sağlık Bilimleri Dergisi*, 10(1), 84-91.
- Demiray E, Alkan S, Önder T, Öntürk H, Önder A, 2022. Yaşlılıkta Kırılganlık ve Üriner Sistem Enfeksiyonları. *Black Sea Journal of Health Science*, 5(1), 143-148.
- Graham A, Brown CH., 2017. Frailty, aging, and cardiovascular surgery. *Anesth Analg* 124(4): 1053– 1060.
- Hsieh T., Su S., Chen C., Kong Y., Hu M., Hsu L., Wu S., Chen L., Chang L., Chuang S., Pan W., Hsu C., 2019. Individualized home-based exercise and nutrition interventions improve frailty in older adults: a randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, 16:119, 2 -15.
- Kapucu S, Ünver G, 2017. Kırılgan Yaşlı ve Hemşirelik Bakımı. *Osmangazi Tıp Dergisi*, 39, 122-129.
- Kong, L., Zhao, H., Fan, J., Wang, Q., Li, J., Bai, J., & Mao, J. (2021). Predictors of frailty among Chinese community-dwelling older adults with type 2 diabetes: a cross-sectional survey. *BMJ open*, 11(3), e041578.
- Mello, A. d. C., Engstrom, E. M., & Alves, L. C. (2014). Health-related and sociodemographic factors associated with frailty in the elderly: a systematic literature review. *Cadernos de Saúde Pública*, 30(6), 1143-1168.
- Michel, J.-P., & Walston, J. D., 2018. *Oxford textbook of geriatric medicine*. Oxford University Press, 430-435.
- Nagai, K., Miyamoto, T., Okamae, A., Tamaki, A., Fujioka, H., Wada, Y., Uchiyama, Y., Shinmura, K., & Domen, K. (2018). Physical activity combined with resistance training reduces symptoms of frailty in older adults: A randomized controlled trial. *Archives of Gerontology and Geriatrics*, 76, 41–47. <https://doi.org/10.1016/j.archger.2018.02.005>

- Sadjapong U., Yodkeeree S., Sungkarat S., Siviroj P., 2020. Multicomponent Exercise Program Reduces Frailty and Inflammatory Biomarkers and Improves Physical Performance in Community-Dwelling Older Adults: A Randomized Controlled Trial. *International Journal of Environmental Research and Public Health*, 17, 3760, 1-15.
- Santrock, J. W., 2015. Yaşam boyu gelişim. (G. Yüksel, Çev.). Ankara Nobel Akademik Yayıncılık Eğitim Danışmanlık Tic. Limited Şti., 10-56.
- Kayhan Koçak Ö. Kırılganlık El Kitabı. Ed:Şahin S., Akçiçek F., 2017. İzmir. ss. 7-28.
- Top M, Dikmetas E., 2015. Quality of life and attitudes to ageing in turkish older adults at old people's homes. *health expect*, 18(2), 288-300.
- TÜİK, 2021, TÜİK Veri Portalı İstatistiklerle Yaşlılar, 2021. Erişim tarihi 25.01.2023. Erişim adresi; <https://data.tuik.gov.tr/Bulten/Index?p=Istatistiklerle-Yaslilar-2021-45636>.
- WHO, 2021. Erişim tarihi: 20.01.2023. Erişim adresi, <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>
- Yoltay H., Korkmaz F., 2021. Kalp Cerrahisinde Kırılgan Hasta ve Hemşirelik Bakımı. *Cumhuriyet Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi*, 6(2), 120-128.

**COMPARISON OF MACHINE LEARNING AND MONTE CARLO SIMULATION
BASED MODELS FOR SYSTEM MARGINAL PRICE PREDICTION**

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Abstract

The System Marginal Price (SMP) is the purchase price derived by taking into account all bids received in the balancing energy market. An accurate SMP prediction is critical for electricity generators and suppliers. If generators and suppliers can precisely predict the SMP, they will be able to make more accurate market bids and limit potential losses. This study aims to compare machine learning-based eXtreme Gradient Boosting Regressor (XGBoostRegressor), Support Vector Regressor (SVR), Extreme Learning Machines (ELM), and Monte Carlo Simulation-based models for SMP prediction. Multiple parameters and time delay options have been tested for 7 different days. A dataset of 45790 rows consisting of 30 attributes obtained from Energy Exchange Istanbul (EXIST) has been created. The MAPE's obtained with XGBoostRegressor, SVR, ELM and Monte Carlo Simulation varied from 2.23% to 45.7% on different days. Examination of the results of the prediction models indicates that models based on machine learning and Monte Carlo Simulation can be effective in predicting SMP and that further research can be conducted to improve their performance.

Keywords: System Marginal Price, Forecasting, Machine Learning, Monte Carlo Simulation

Introduction

The electricity sector worldwide has undergone significant and transformative changes since the early 1980s in order to improve economic efficiency. Prior to these changes, the electricity sector was monopolized by state-owned, vertically integrated entities that controlled all aspects of generation, transmission, distribution, and retail activities. Consumers were obligated to purchase electricity at a price set by these monopolies. Governments have allowed investors to participate in the energy market as they cannot handle the huge demand for energy alone. This has led to a liberalization of the energy market, which involves a reduction in public spending and an increase in private sector investments (Wang and Ramsay 1997). Turkey has followed this pattern by creating an electricity market similar to a stock market, allowing for trade to be carried out through a pool system (Ünal et al. 2022, Arslan and Ertuğrul 2022). The electricity market in Turkey is divided into three markets, including the day-ahead market, intra-day market, and balancing market. The balancing market provides reserve capacity to ensure real-time balancing for system operators, and frequency control and demand control services are guaranteed through ancillary services. The balancing power market determines the price of the bid, which is associated with the net volume of orders issued in the market. (Sirin and Yilmaz 2021, Dursun et al. 2020).

Following the liberalization and restructuring of the electricity sector, activities such as unbundling and privatization became prevalent. The primary objective of these changes was to create a competitive market where utilities and consumers could compete to sell and purchase electricity at a price that is not government-regulated. As electricity markets have undergone restructuring and liberalization, accurate electricity price forecasting has become increasingly vital for various market participants, including utilities, generators, and consumers. The ability to accurately predict electricity prices enables utilities to develop effective supply strategies and optimize their bilateral contracts to maximize profits, while consumers can use the forecast to derive their electricity consumption and bidding strategies to minimize consumption costs (Ozgiiner 2012). With the growth of the competitive energy market, electricity price forecasts such as the System Marginal Price (SMP) have become even more important, as they provide essential information for electricity generators and other energy service providers to participate in the market and maximize profits.

The SMP, in particular, is a reference price used to settle transactions in the Day-Ahead Market (DAM) and is crucial for generators and other energy service providers to make informed decisions. However, predicting the SMP has become a more complex process due to the volatile nature of electricity as a commodity. The SMP can change rapidly, sometimes within an hour,

to balance supply and demand. Furthermore, the SMP is affected by several factors, such as long-term contracts between suppliers and consumers, the price of primary energy sources, and power grid expansion planning (Mount 2001).

In the past, the objective of power system planning and management was to reduce production and operating costs. However, the introduction of competition in the electricity market has changed the objective to maximizing profits or returns for market participants. Predicting the System Marginal Price (SMP) is significant for both consumers and producers of electrical power. However, the prediction of SMP is difficult because it is volatile and depends on various variables, such as the price of oil, load demand, and natural parameters. A good SMP prediction can assist both consumers and electric power companies in maximizing their profit. The price of primary energy sources also affects the SMP, making electricity more volatile and challenging to predict than other traded commodities.

To overcome these challenges, it is essential to develop a robust and adaptable SMP forecasting model that can account for both short-term and long-term variation (Jufri et al. 2019). This study compares different machine learning-based models for predicting the SMP, including the eXtreme Gradient Boosting Regressor (XGBoostRegressor), Support Vector Regressor (SVR), Extreme Learning Machines (ELM), and Monte Carlo Simulation-based models. By evaluating the performance of these models, we can determine which ones are most effective in forecasting the SMP and can be used by market participants to make informed decisions and maximize their profits.

Literature Review

In recent years, various methods have been proposed for the prediction of System Marginal Price (SMP) in electricity markets. These methods use a wide range of techniques from traditional time series analysis to machine learning and deep learning algorithms. This literature review focuses on the machine learning-based approaches, specifically the eXtreme Gradient Boosting Regressor (XGBoostRegressor), Support Vector Regressor (SVR), Extreme Learning Machines (ELM), and Monte Carlo Simulation-based models for SMP prediction. According to a recent study by (Shim et al. 2023), a 2-Step method was proposed for SMP forecasting after load forecasting using XGBoost, random forest, light gradient boosting machine, and linear regression models. The study performed feature selection using Shapley additional explanations and Pearson correlation coefficient, and the hyperparameters of the forecasting model were adjusted by Grid search. The ensemble model of LGBM and random forest showed the best performance in MAPE except for spring. The study concluded that the proposed method can be

useful for power generation companies or virtual transaction operators participating in the electricity market for SMP forecasting. In a recent study, (Zhao et al. 2022) proposed an ultra-short-term power load forecasting method based on the windowed XGBoost model and real-time electricity prices. The proposed method aims to reduce the complexity of the model and capture the autocorrelation effect of the predicted object. The model's forecast accuracy is significantly improved by introducing real-time electricity prices. The superiority and feasibility of the proposed method were verified by simulating actual data from the national electricity market of Singapore (NEMS) and comparing it with several deep learning algorithms. In a recent study, the authors proposed an adaptive long-term electricity price forecasting model using Monte Carlo simulation to reduce risks and maximize outcomes in the electricity market (Poullikkas 2018). The proposed method showed good performance in electricity and oil price prediction for various forecasting periods. A K-means, Support Vector Machine and Support Vector Regression (k-SVM-SVR) model was proposed by the authors to predict day-ahead electricity prices in the single electricity market (SEM) in Ireland. The model achieved approximately 20% improvement and reduced error variances over the existing predictions available to market participants in Ireland (Lynch et al. 2019). A comparative analysis of machine learning methods in the Turkish electricity market was conducted to analyze system marginal price (SMP), and the results showed that comparing with support vector machines (SVM)-based methods, k-nearest neighbors (KNN)-based methods, the ensemble-based method gives better results (İpek 2023). According to a comparative analysis of machine learning models for System Marginal Price (SMP) prediction in the Greek energy market, the use of artificial neural networks and neuro-fuzzy models can lead to increased profits and more efficient portfolio management for producers. The study found that ANFIS outperformed other models in terms of accuracy and is more suitable for the problem under study (Panapakidis and Moschakis 2019). According to a research study, comparing traditional time series forecasting algorithms, adaptive or self-adaptive approaches to forecasting short term system marginal prices (SMPs) would be more suitable in predicting energy demands in territories such as Ireland, considering factors such as meteorological forecasts, forecasted demand, and network topology constraints (Li et al. 2017). In conclusion, machine learning-based approaches, including XGBoostRegressor, SVM, ELM, and Monte Carlo Simulation-based models, have been proposed as effective methods for SMP prediction in electricity markets. These methods utilize historical SMP data, as well as other relevant information, such as weather forecast data, temperature, load, and wind speed, to forecast SMP for the next hour

or day. The results of these studies showed that the proposed machine learning-based models outperformed traditional time series methods in terms of accuracy and robustness.

Dataset Generation

We use a dataset obtained from the Energy Exchange Istanbul, which includes hourly SMP values from January 2017 to March 2022, along with several other attributes.

These attributes are: *Historical SMP (System Marginal Price)*, *Natural Gas (Amount of electricity production from natural gas source)*, *Dam (Amount of electricity production from dam source)*, *Lignite A (Amount of electricity production from lignite source)*, *Stream (Amount of electricity production from stream source)*, *Imported Coal (Amount of electricity production from imported coal source)*, *Wind (Amount of electricity production from wind source)*, *Solar (Amount of electricity production from solar energy source)*, *Fuel Oil (Amount of electricity production from fuel source)*, *Geothermal (Amount of electricity production from geothermal source)*, *Bituminous Coal (Amount of electricity production from bituminous coal source)*, *Asphaltite Coal (Amount of electricity production from asphaltite coal source)*, *Biomass (Amount of electricity production from biomass energy source)*, *Naphta (Amount of electricity production from the distillation of petroleum between 100 and 250 degrees Celsius)*, *SMP (TL/Mil) (Previous SMP in TL / Milli Watt Hour (MWh))*, *SMP (USD/Mil) (Previous SMP in USD / Milli Watt Hour (MWh))*, *SMP (EURO/Mil) (Previous SMP in EUR / Milli Watt Hour (MWh))*, *EURO_open (Opening value of EURO)*, *EURO_close (Closing value of EURO)*, *USD_open (Opening value of USD)*, *USD_close (Closing value of USD)*, *BIST30_open (Opening value of Exchange İstanbul-30)*, *BIST30_close (Closing value of Exchange İstanbul-30)*, *BIST100_open (Opening value of Exchange İstanbul-100)*, *BIST100_close (Closing value of Exchange İstanbul-100)*, *Wet_Istanbul (Temperature in Istanbul during the day (in °C))*, *Wet_Ankara (Temperature in Ankara during the day (in °C))*, *Wet_Izmir (Temperature in Izmir during the day (in °C))*, *Wet_Antalya (Temperature in Antalya during the day (in °C))*, *Wet_Bursa (Temperature in Bursa during the day (in °C))*.

Methodology

Developing accurate and effective prediction models in the energy sector requires careful selection of relevant attributes and features in the dataset. In this study, the Minimum Redundancy Maximum Relevance (mRMR) feature selection algorithm was employed to identify the most important features in the dataset for developing successful prediction models.

In this study, a total of four algorithms were utilized, among which three were machine learning algorithms namely Support Vector Regression (SVR), XGBoost Regressor, and Extreme Learning Machine (ELM), while the fourth algorithm was Monte Carlo simulation.

SVR is a type of supervised learning algorithm that is commonly used for regression analysis. The algorithm works by finding a hyperplane in a high-dimensional space that optimally separates the input data into different classes. The goal is to find the hyperplane that maximizes the margin between the two classes while minimizing the classification error (Drucker et al. 1996).

The XGBoost Regressor is a powerful gradient boosting algorithm that is widely used in the field of machine learning. It works by iteratively adding weak decision trees to the ensemble, with each new tree correcting the errors made by the previous trees (Chen and Guestrin 2016). The Extreme Learning Machine (ELM) is a type of artificial neural network that is known for its fast learning speed and good generalization performance. Unlike traditional neural networks, ELM only requires a single hidden layer and randomly assigns the weights between the input layer and the hidden layer. This simplifies the training process and reduces the risk of overfitting (Huang et al. 2011).

Monte Carlo simulation is a statistical method that uses random sampling to simulate real-world scenarios. In this study, Monte Carlo simulation was used to generate multiple scenarios of energy consumption and price fluctuations to test the robustness and accuracy of the developed prediction models (Mooney 1997).

The performance of each of the four machine learning algorithms was evaluated using Mean Absolute Percentage Error (MAPE) metric. The models were developed using Python programming language and its associated libraries (Scikitlearn, XGBoost, Tensorflow, Pandas, Numpy).

In this study, two techniques were used as pre-processing technique: Gaussian Filter (GF) and Exponential Smoothing (ES). The GF technique was used to remove the noise from the dataset. Noise in the dataset can lead to inaccurate predictions, so this technique was applied to ensure that the data was as clean as possible before analysis. The ES technique was used to give more weight to newer data when previous price changes were less important. This technique is useful when there are seasonal patterns in the data, as it allows for the identification of these patterns and their impact on future prices. These two techniques were applied at predefined time intervals for energy price prediction. The results of the predictions were then compared, so that

the success rates and accuracies of each technique could be compared. This comparison allowed for the identification of the most accurate and successful technique for energy price prediction. Our experiments showed that the GF, and ES smoothing techniques are both useful for energy price prediction. Each technique has its strengths and weaknesses. Comparing the results of these techniques, due to being slightly better, Gaussian Filter was used to derive final results to be presented.

Overall, the combination of mRMR feature selection algorithm and the four machine learning algorithms showed promising results for predicting energy consumption and prices in the energy sector. Accurate and reliable prediction models can help energy companies optimize their supply strategies, maximize profits, and reduce risks. Additionally, consumers can benefit from accurate price predictions to develop effective bidding and consumption strategies to minimize costs.

Results and Discussion

There are several relatively diverse and hard to be forecasted days selected to be test our models. The days selected for the SMP prediction are June 30/2021, July 21/2021, July 23/2021, October 29/2021, December 31/2021, March 19/2022 and March 20/2022.

The following conditions were considered in the selection of the test dates:

- Dates in the last three months,
- Random (June 30/2021),
- The effect of the holiday on the SMP (October 29/2021),
- The last day of the year (December 31/2021),
- The weekend (March 19/2022 and March 20/2022).

The hyperparameters and MAPE's of the developed models are given in Table 1 through Table 5. All the results are obtained from mRmR and Gaussian filter applied experiments which result better than alternative techniques.

Table 1. The hyperparameters and MAPE's of XGBoost Regressor-based models (Number of forecasts: 24)

Test date	Training start	Feature selecti	Scaler	Learning rate	Gamma	Max depth	Predict on number	Min. child weight	MAPE (%)
10/29/	10/29/1	mRMR	Standa	0,01	0.1	1	1000	1	8.9
12/31/	12/31/2	mRMR	Standa	0,01	0.1	1	1000	10	11.1
7/21/2	7/21/19	mRMR	Standa	0,01	0.1	1	1000	10	20.6
7/23/2	7/23/20	mRMR	Standa	0,01	0.1	1	1000	10	21.0
3/19/2	3/19/21	mRMR	Standa	0,01	0.1	1	1000	10	2.63
3/20/2	3/20/21	mRMR	Standa	0,01	0.1	1	1000	10	12.3
6/30/2	6/30/20	mRMR	Standa	0,01	0.1	3	1000	10	4.7

Table 2. The hyperparameters and MAPE's of SVR-based models (Number of forecasts: 24)

Test date	Training start date	Feature selectio	Scaler	Kernel functio	Epsilon	C	Gamma	Degree	MAPE (%)
10/29/2	10/29/1	mRMR	Standa	rbf	0.0003	0.0	0.1	3	9.2
12/31/2	12/31/2	mRMR	Standa	rbf	0.0003	0.0	0.1	3	10.1
7/21/21	7/21/19	mRMR	Standa	rbf	0.0003	0.1	0.1	3	21.6
7/23/21	7/23/20	mRMR	Standa	Linear	0.0001	1	1	3	23.0
3/19/22	3/19/21	mRMR	Standa	Linear	0.0003	10	0.1	3	2.23
3/20/22	3/20/21	mRMR	Standa	Linear	0.0001	1	1	3	11.8
6/30/21	6/30/20	mRMR	Standa	Linear	0.003	0.1	1	3	4.3

Table 3. The hyperparameters and MAPE's of ELM-based models (Number of forecasts: 24)

Test date	Training start date	Target feature	MAPE(%)
10/29/21	10/29/19	SmfDolar	24.4
12/31/21	12/31/20	SmfDolar	32.3
7/21/21	7/21/19	SmfDolar	43.8
7/23/21	7/23/20	SmfDolar	45.7
3/19/22	3/19/21	SmfDolar	34.4
3/20/22	3/20/21	SmfDolar	23.8
6/30/21	6/30/20	SmfDolar	7.8

Table 4. The MAPE's of Monte Carlo Simulation model (Number of forecasts: 24)

Test date	Training start date	Feature selection	Scaler	Kernel function	Batch size	MAPE (%)
10/29/21	10/29/19	MLFS	Standart	Linear	1	13.1
12/31/21	12/31/20	MLFS	Standart	Linear	1	11.5
7/21/21	7/21/19	MLFS	Standart	Linear	1	22.6
7/23/21	7/23/20	MLFS	Standart	Linear	1	31
3/19/22	3/19/21	MLFS	Standart	Linear	1	17.4
3/20/22	3/20/21	MLFS	Standart	Linear	1	11.2
6/30/21	6/30/20	MLFS	Standart	Linear	1	4.9

Table 5. The overall performance of all Machine learning models (Number of forecasts: 24)

Test date	Training start date	Feature selection	Target feature	MAPE(%)		
				SVR	XGBoostR	ELM
10/29/21	10/29/19	mRMR	SmfDolar	9.2	8.9	13.1
12/31/21	12/31/20	mRMR	SmfDolar	10.1	11.1	11.5
7/21/21	7/21/19	mRMR	SmfDolar	21.6	20.6	22.6
7/23/21	7/23/20	mRMR	SmfDolar	23.0	21.0	31
3/19/22	3/19/21	mRMR	SmfDolar	2.23	2.63	17.4
3/20/22	3/20/21	mRMR	SmfDolar	11.8	12.3	11.2
6/30/21	6/30/20	mRMR	SmfDolar	4.3	4.7	4.9

- Based on results obtained, SVR has the lowest MAPE (2.23%) for the test day June 30, 2021 and the highest MAPE (5.02%) for the test day Mach 19, 2022.
- Based on results obtained, XGBoost-Regressor has the lowest MAPE (2.63%) for the test day June 30, 2021 and the highest MAPE (5.67%) for the test day Mach 19, 2022.
- Based on results obtained, ELM are examined, the lowest MAPE (4.9%) for the test day June 30, 2021 and the highest MAPE (22.6%) for the test day July 21, 2021.
- Based on results obtained, Monte Carlo Simulation has the lowest MAPE (7.8%) for the test day June 30, 2021 and the highest MAPE (45.7%) for the test day July 23, 2021.
- Based on results, it's clear that Machine learning-based methods are more successful than Monte Carlo Simulation method.

Conclusion

This research aimed to develop prediction models for electricity producers and suppliers operating in the Turkish market using both deep learning and statistics-based methods. The models were tested by generating 24-hour forecasts over 7 different days, and their performance was evaluated using the mean absolute percentage error (MAPE). The results of the study indicated that the SVR method had the lowest average MAPE of 2.30%, suggesting it was the most accurate model. Overall, machine learning-based models were found to be more effective at predicting SMP than Monte Carlo simulation models.

References

- Wang, A.J. and Ramsay, B., 1997. Prediction of system marginal price in the UK Power Pool using neural networks. *Proceedings of International Conference on Neural Networks (ICNN'97)*, 4, pp.2116-2120 vol.4.
- Ünal, B.B., Onaygil, S., Acuner, E. and Cin, R., 2022. Application of energy efficiency obligation scheme for electricity distribution companies in Turkey. *Energy Policy*, 163(issue C), p. S0301421522000763. <https://EconPapers.repec.org/RePEc:eee:enepol:v:163:y:2022:i:c:s0301421522000763>.
- Arslan, B. and Ertuğrul, İ., 2022. ÇOKLU REGRESYON, ARIMA VE YAPAY SİNİR AĞI YÖNTEMLERİ İLE TÜRKİYE ELEKTRİK PİYASASINDA FİYAT TAHMİN VE ANALİZİ. *Journal of Management and Economics Research*, 20(1), pp.331-353. DOI: 10.11611/yead.988146
- Sirin, S.M. and Yilmaz, B.N., 2021. The impact of variable renewable energy technologies on electricity markets: An analysis of the Turkish balancing market. *Energy Policy*, 151, p.112093.
- Dursun, A., Eke, İ. and Tezcan, S.S., 2020. Gün Öncesi Piyasası için Yapay Sinir Ağları ile Türkiye Enterkonnekte Sistemi İletim Hatları Kayıplarının Tahmini. *International Journal of Engineering Research and Development*, 12(2), pp.549-564. DOI: 10.29137/umagd.600962
- Ozgiiner, E., 2012. Short term electricity price forecasting in Turkish electricity market (Master's thesis, Middle East Technical University).
- Mount, T., 2001. Market power and price volatility in restructured markets for electricity. *Decis Support Syst*, 30(3), pp.311-325.
- Jufri, F.H., Oh, S. and Jung, J., 2019. Day-ahead system marginal price forecasting using artificial neural network and similar-days information. *Journal of Electrical Engineering & Technology*, 14(2), pp.561-568.
- Shim, S.W., Lee, D.H., Roh, J.H. et al., 2023. A Machine Learning-Based Algorithm for Short-Term SMP Forecasting Using 2-Step Method. *J. Electr. Eng. Technol.* <https://doi.org/10.1007/s42835-023-01473-4>
- Zhao, X., Li, Q., Xue, W., Zhao, Y., Zhao, H. and Guo, S., 2022. Research on Ultra-Short-Term Load Forecasting Based on Real-Time Electricity Price and Window-Based XGBoost Model. *Energies*, 15(19), p.7367.
- Poullikkas, A., 2018. An adaptive longterm electricity price forecasting modelling using Monte Carlo simulation. *Journal of Power Technologies*, 98(3), pp.267.
- Lynch, C., Kehoe, J., Bain, R., Zhang, F., Flynn, J., O'Leary, C., ... & Feijoo, F. 2019. Application of a SVM-based model for day-ahead electricity price prediction for the single electricity market in Ireland. In *Proceedings of the 39th International Symposium on Forecasting (ISF)*, Thessaloniki, Greece, pp. 16-19.
- İpek, A. B. 2023. Analysis of System Marginal Price in the Turkish Electricity Market. In H. Arias Gomez and G. Antořová (eds.), *Considerations of Territorial Planning, Space, and Economic Activity in the Global Economy*, IGI Global, pp. 225-240. Available at: <https://doi.org/10.4018/978-1-6684-5976-8.ch013> (Accessed: 27 April 2023).
- Panapakidis, I. P., and Moschakis, M. N. 2019. Comparison of Machine Learning Models for the Prediction of System Marginal Price of Greek Energy Market. *International Journal of Energy and Environmental Engineering*, 13(3), 148-152.

- Li, P., Arci, F., Reilly, J., Curran, K., Belatreche, A., and Shynkevich, Y. 2017. Predicting short-term wholesale prices on the Irish single electricity market with artificial neural networks. In 2017 28th Irish Signals and Systems Conference (ISSC), Killarney, Ireland, pp. 1-8. Available at: <https://doi.org/10.1109/ISSC.2017.7983623> (Accessed: 27 April 2023).
- Drucker, H., Burges, C. J., Kaufman, L., Smola, A., and Vapnik, V. 1996. Support vector regression machines. In *Advances in neural information processing systems*, 9.
- Chen, T., and Guestrin, C. 2016. XGBoost: A Scalable Tree Boosting System. In *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, New York, NY, USA, ACM, pp. 785-794. Available at: <https://doi.org/10.1145/2939672.2939785> (Accessed: 27 April 2023).
- Huang, G. B., Wang, D. H., and Lan, Y. 2011. Extreme learning machines: a survey. *International journal of machine learning and cybernetics*, 2, 107-122.
- Mooney, C. Z. 1997. Monte carlo simulation. Sage.

**YARI KURAK İKLİM KOŞULLARINDA KURU FASULYENİN (*Phaseolus Vulgaris*
L.) BITKİ SU TÜKETİMİNİN İKİ FARKLI YÖNTEMLE BELİRLENMESİ**

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Özet

Bu çalışmanın amacı doğrudan bitki su tüketimini belirlemeye yarayan su dengesi eşitliği ve iklim parametrelerinden yararlanarak bitki su tüketimini tahmin etmeye yarayan Penman Monteith eşitliği (ET_o miktarına bağlı olarak çeşitli bitkilerin ET_a miktarlarının tahmin edilmesinde kullanılan yöntem) FAO 56 modifikasyonu tahmin yöntemini kullanarak kuru fasulye (*Phaseolus vulgaris L.*) bitkisinin Siirt ili iklim koşullarında bitki su tüketimini belirlemektir. Araştırmada bitki materyali olarak Nevşehir derin kuyu kuru fasulye türü kullanılmıştır. Çalışma 2017 yılı fasulye bitkisinin yetiştirme sezonu boyunca Siirt üniversitesi Ziraat Fakültesi deneme arazisinde tarla koşullarında yürütülmüştür. Erken vejetatif dönemde su dengesi eşitliğine göre günlük ET_a değeri 5.3 mm gün^{-1} arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde $9.5-10 \text{ mm gün}^{-1}$ olarak belirlenmiştir. Penman Monteith eşitliği ile saptanan referans bitki su tüketimi ise 9.0 mm gün^{-1} olarak hesaplanmıştır. Aylık olarak (Temmuz ayı) ise su dengesi eşitliğine göre 290.0 mm ay^{-1} , Penman Monteith eşitliğine göre $275.51 \text{ (Temmuz ayı) mm ay}^{-1}$ olarak hesaplanmıştır. Yetiştirme sezonu boyunca kuru fasulye bitkisine uygulanan sulama suyu miktarı 693.0 mm olup su dengesi eşitliği yöntemine göre mevsimlik bitki su tüketimi (ET_a) $748.0 \text{ mm mevsim}^{-1}$, Penman Monteith FAO 56 modifikasyonu eşitliğine göre ise ET_o miktarı $778.33 \text{ mm mevsim}^{-1}$ olarak tespit edilmiştir. Sonuç olarak çalışmada gerçek su tüketimi ile hesaplanan (kıyas) su tüketimi arasındaki farkın önemsiz olduğu ve daha fazla meteorolojik veri kullanarak bitki su tüketim tahmininde daha gerçekçi sonuçlara ulaşan Penman-Monteith eşitliği kullanılarak fasulye bitkisinin yarı kurak iklim koşullarında sulama programlarının hazırlanmasında kullanılabileceği önerilebilir.

Anahtar Kelimeler: Kuru fasulye, Bitki su tüketimi, Su dengesi denklemi, iklim

Teşekkür:

Bu çalışmanın bir kısmı 2023 yılında yurt dışı indeksli bir dergiye yayınlanmak amacıyla gönderilmiştir.

**DETERMINATION OF PLANT WATER CONSUMPTION OF DRY BEANS
IN SEMI-ARID CLIMATE CONDITIONS WITH TWO DIFFERENT
METHODS**

Abstract

The aim of this study is the water balance equation, which directly determines the plant water consumption, and the Penman Monteith equation, which is used to estimate the plant water consumption by utilizing the climate parameters (the method used to estimate the ET_a amount of various plants depending on the ET_o amount) FAO 56 modification using the estimation method of dry beans (*Phaseolus vulgaris*). L.) plant in Siirt province climatic conditions to determine the plant water consumption. Nevşehir deep well dry bean type was used as plant material in the research. The study was carried out in field conditions in the experimental field of the Faculty of Agriculture of Siirt University during the growing season of the bean plant in 2017. According to the water balance equation in the early vegetative period, while the daily ET_a value varied between 5.3 mm day⁻¹, it was determined as 9.5-10 mm day⁻¹ before and during flowering. The reference plant water consumption determined by the Penman Monteith equation was calculated as 9.0 mm day⁻¹. On a monthly basis (July), it was calculated as 290.0 mm ay⁻¹ according to the water balance equation, and 275.51 (July) mm month⁻¹ according to the Penman Monteith equation. The amount of irrigation water applied to the dry bean plant during the growing season was 693.0 mm, seasonal plant water consumption (ET_a) according to the water balance equation method was determined as 748.0 mm season⁻¹, and according to the Penman Monteith FAO 56 modification equation, the amount of ET_o was determined as 778.33 mm season⁻¹. As a result, it can be suggested that the difference between the actual water consumption and the calculated (comparative) water consumption in the study is insignificant and it can be used in the preparation of irrigation programs in semi-arid climatic conditions of the bean plant by using the Penman-Monteith equation, which achieves more realistic results in estimating plant water consumption by using more meteorological data.

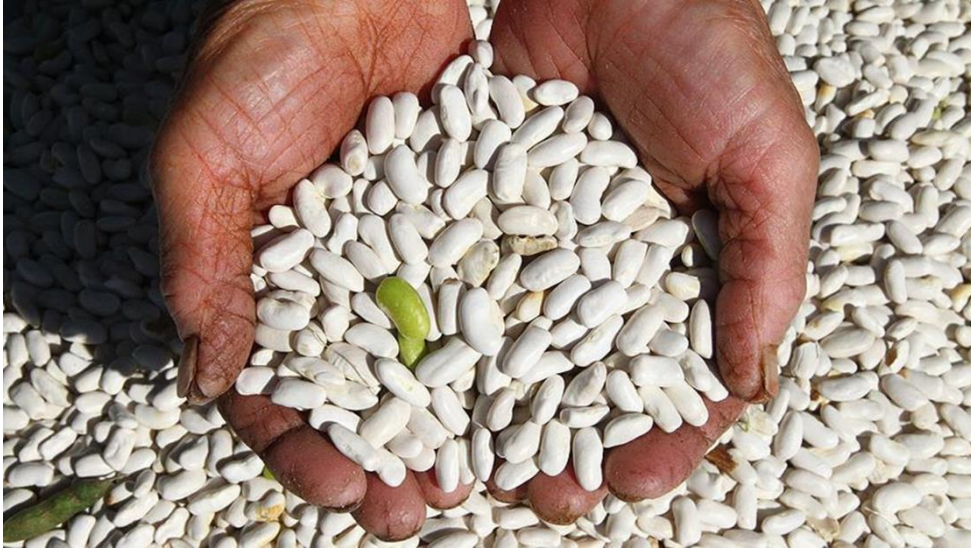
Keywords: Dry beans, Plant water consumption, Water balance equation, climate

**Thanks: A part of this study will be published in a foreign indexed journal in 2023.
sent for the purpose.*

Giriş

Gıda ve Tarım Örgütü (FAO) 2020 yılı verilerine göre 34,80 milyon hektar alanda 790 kg/ha verim ortalaması ile 27,55 milyon ton kuru fasulye üretimi gerçekleşmiştir. Hindistan, Myanmar ve Brezilya dünya üretimin sıralamasında ilk üçte yer almaktadır. Türkiye, 2020 yılı dünya üretim sıralamasında 19'uncu, verim sıralamasında ise 12'inci sırada yer almaktadır (TÜİK, 2020). Şekil 1'de Nevşehir derin kuyu kuru fasulyesi görülmektedir.

2020 yılında kuru fasulye üretim alanlarında pandemi nedeni ile 2019 yılına göre 1,12 milyon ha artış yaşanmıştır. Üretimde ise bir önceki yıla göre 1,5 milyon tonluk artış gerçekleşmiştir. Dünya 2020 yılı üretiminin %20'si Hindistan, %11'i Myanmar, %11'i ise Brezilya tarafından gerçekleştirilmiştir. TÜİK tarafından açıklanan 2020 yılı verilerine göre yaklaşık 1 milyon dekar alanda 280 bin ton üretim gerçekleşmiştir. Son 10 yılda (2011-2020 yılları) ülke genelinde 79 bin tonluk üretim artışı sağlanırken, iller bazında en fazla üretim artışı Niğde'de gerçekleşmiştir. TÜİK 2019/2020 pazarlama yılı verilerine göre yeterlilik oranı %76, ülke tüketimi 276 bin ton, kişi başı tüketim ise 3,3 kg/yıl'dır (TÜİK, 2020).



Şekil 1.Nevşehir derin kuyu kuru fasulyesi

Türkiye sahip olduğu toprak ve su kaynakları ile çok değişik iklim koşulları yönünden dünyada tarımsal potansiyeli yüksek olan sayılı ülkeler arasında bulunmaktadır. Ülkemizde işlenen arazi 28.5 milyon hektardır. Yapılan etütlere göre, mevcut su potansiyeli ile teknik ve ekonomik olarak sulanabilecek arazi miktarı 8.5 milyon hektar olarak hesaplanmıştır. Sulanan alan ise 5.5 milyon ha'dır. Siirt ilinin yüzölçümü 598.700 ha.'dır. Bu alanın yaklaşık, teknik anlamda sulanabilecek arazi varlığı 24.115 ha'dır. Günümüzde bitkilerin sulanmasında yüzey sulama yöntemleri yetersiz kalmakta ve uygulanan sulama suyunun yalnızca 1/3'ü bitkiler tarafından terleme (transpirasyon) yoluyla kullanılmaktadır. Bu nedenle, bitkilerin her yöre ve her bitki

için bitki su tüketimlerinin geliştirilmesine yönelik çalışmaların yapılmasına gereksinim duyulmaktadır. Ulusal ve uluslararası kaynaklarda 'Evapotranspirasyon' olarak adlandırılan ve ETa simgesiyle gösterilen terimin Türkçe' deki karşılığı 'Bitki Su Tüketimi' olarak tanımlanmaktadır (Bayramoğlu, 2013; Uçak ve ar., 20216). Bitki su tüketiminin (Evapotranspirasyon, ETa) saptanması; su kaynaklarının işletilmesi, sulama sistemlerinin planlanması ve sulama programlarının yapılabilmesi için temel bir ihtiyaçtır. Bitkisel üretimde bitki su tüketiminin dikkate alınması ve suyun ölçülü kullanılması, hem verim hem de toprak-su kaynaklarının korunması açısından büyük önem taşımaktadır (Abtew ve Obeysekera, 1995; Güngör et al., 2004; Demir ve Meral, 2016). Günümüzde sulama programlarının oluşturulmasında dikkate alınan en önemli parametrelerden biriside bitki su tüketimidir. Bitki su tüketimi lizimetre sistemleri, tarla deneme parselleri ve bitki kök bölgesindeki nem azalmasının denetimi gibi metotlardan faydalanarak doğrudan hesaplanabilmektedir (Şarлак ve Bağçacı, 2020; Kırnak ve Gençoğlan, 2001). Sulama uygulamalarında bitki su tüketiminin dikkate alınmadığı ve homojen bir su dağılımının yapılamadığı, salma sulama yönteminin kullanılması durumunda, bitki gelişiminde büyük bir öneme sahip olan demir mineralinin topraktan yıkanarak etkili kök bölgesi altında sızmasına sebep olmaktadır (Fulton, 2013; Jarvis Shean et al., 2018). Uygulamada sulama programı, genellikle yetiştirici deneyimlerine veya toprak su dengesi (iklim temelli yöntem) belirlenmesine dayanmaktadır. Sulama programı oluşturulmasında ve bitki su tüketiminin saptanmasında alternatif metotlardan birisi de, toprak suyunun ölçülmesi (gravimetrik) yöntemidir (Pardossi et al., 2009). Bitki su tüketimi ve sulama suyu ihtiyacı bitki, toprak ve iklim özelliklerine bağlı olarak değişkenlik göstermektedir. Tarımsal sulamada su kaynaklarının optimum bir randımanla kullanımı, bitki su tüketimini esas alan sulama programları hazırlanarak, bitkinin suya ihtiyacı olduğu zamanlarda sulama yapılması ve her sulamada bitkiye ihtiyacı kadar su verilmesi ile sağlanabilmektedir (Jensen ve Allen, 2016). Bitki su tüketim yöntemleri direkt olarak veya indirekt olarak iklim parametrelerine bağlı olarak birçok yöntemle tespit edilebilmektedir. Direkt yöntemler uzun bir zaman dilimi ve fazla miktarda iş gücü gerektirirken, indirekt yöntemler daha basit ve daha hızlı uygulanabilmektedir (Kaya 2011). ETo'ı belirleyen etmenler iklim parametreleri ve hava verileridir. Örneğin FAO56 Penman-Monteith yöntemi değerlendirildiği bölgede çayır bitkileri ETo değeriyle oldukça sıkı şekilde benzerlik gösterdiği için, fiziksel olarak, fizyolojik ve aerodinamik parametrelerin her ikisini de açıkça birleştirmiş bir yöntem olması sebebiyle tek yöntem olarak tavsiye edilmektedir. Yöntemin ilk aşamasında birçok iklim verisi formüle dâhil olduğu için zorluklar yaşanmasına karşın araştırmadaki ilerlemeler ve bitkiler kıyas ürünlerini içeren geçerli tahminleri ile büyük çapta aşılmıştır (Allen et al., 1998). Bu çalışmanın amacı

doğrudan bitki su tüketimini belirlemeye yarayan su dengesi eşitliği ve iklim parametrelerinden yararlanarak bitki su tüketimini tahmin etmeye yarayan Penman Monteith eşitliği (ETo miktarına bağlı olarak çeşitli bitkilerin ET miktarlarının tahmin edilmesinde kullanılan yöntem) FAO 56 modifikasyonu yöntemini kullanarak fasulye bitkisinin Siirt iklim koşullarında bitki su tüketimini belirlemektir.

2. Gereç ve Yöntem

2.1. Deneysel Çalışmalar

Damlama sulama yönteminin kullanıldığı deneme parsellerinde su dağıtımı, 4 atm çalışma basıncı ve 16 mm dış çapa sahip yumuşak PE lateral boru hatları kullanılarak sağlanmıştır. Araştırma alanının toprakları ağırdır ve 6 mm h⁻¹ infiltrasyon oranına sahiptir. Her lateralde, sıralı tip basınç düzenleyicisi ve 1 atm çalışma basıncında 4 L h⁻¹ akış hızına sahip damlatıcılar kullanılmış ve aralarında 0.33 m boşluk bırakılmıştır. Bu nedenle, bitki damla sulama yöntemi ile sulama suyu sadece doğru miktarda uygulanmıştır. Herhangi bir sızma veya yüzey akışı meydana gelmesine izin verilmemiştir. Sırta ekilecek tohum yatağı hazırlanmıştır. Her parsel, sıra arasında 70 cm boşluk, sıra üzeri 35 cm boşluk, parsellerin boyutları 6 m uzunluğunda ve 2,8 m genişliğinde (parsel yüzeyi = 16,8 m²) olmak üzere 4 çizgiye sahip olacak şekilde tasarlanmıştır. Tohumun 4-5 cm derinlikte ekildiğinden emin olmak için 4 hatlı pnömatik tohum makinası kullanılmıştır. Sulama konuları ve tekrarlar arasındaki etkileşimleri önlemek için 2 m tampon bölge oluşturulmuştur. Çalışmada, etkili kök derinliğinin (90 cm) nem içeriği her sulamadan önce gravimetrik yöntem kullanılarak tespit edilmiştir. Her tür için tam sulama (I100) ile kontrol parselinde 90 cm toprak derinliğinde eksik nemi tarla kapasitesine getirmek için kullanılmıştır. Bu amaçla, sulama öncesi her sulama derinliği için 90 cm'lik toprak profilinin 0-30, 30-60 ve 60-90 cm'lik tabakalarından alınan toprak numuneleri toplanmış ve kuru toprak ağırlık yüzdesi (%Pw) olarak belirlenmiştir. Her katman için belirlenen nem içeriği, denklem 1 kullanılarak derinlemesine nem içeriğine dönüştürülmüştür.

$$d=(Pw-PwAW)*As*D/100..... (1)$$

Burada; d derinliğinde toprak nem içeriğidir (mm), Pw tarla kapasitesi (%), PwAW;her katmanın nem içeriği (%), As ,Toprak birim ağırlığı (g/cm³)

D katman derinliği (mm) olduğu gibi uygulanacak suyun hacmi aşağıdaki denklem kullanılarak hesaplanmıştır (Eq. (2));

Her tabaka için hesaplanan su içeriği nin eklenmesiyle, etkili kök derinliği için toplam su miktarı (dT) bulunmuştur (Eq. (2)).

$$dT=d(0-30)+ d(30-60) + d(60-90) (2)$$

Her sulama konusunun aylık ve mevsimsel evapotranspirasyon değerleri, büyüme mevsiminde hasadın başlangıcında ve sonunda ölçülen toprağın nem oranı (90 cm) su bütçe yöntemi ve nem içeriği değerleri kullanılarak hesaplanmıştır (Zelege ve Wade 2012).

Bitkinin su tüketiminin hesaplanmasında aşağıdaki su dengesi denklemi kullanılmıştır (Eq. (4)) (Zelege ve Wade 2012).

$$ETa = P + I - Rf - Dp \pm \Delta S \dots\dots\dots(Eq. (5)).$$

ETa: Evapotranspirasyon (mm),

P: yağış (mm),

I: sulama suyu miktarı (mm),

Rf: yüzey akışı (mm),

Dp: Derin infiltrasyon (mm) ve

ΔS (mm) kökündeki toprak nem değişimidir. Çalışmada tercih edilen damla akış hızı toprağın sızma hızından daha düşük olduğundan, yüzey akışı oluşmamıştır. Sulama suyu miktarı mevcut nemi saha kapasitesine getirmek için yeterli olduğu için derin bir sızma meydana gelmediği varsayılmıştır. Penman-Monteith yöntemine göre referans (kıyas) bitki su tüketiminin hesaplanması aşağıda formülde verilmiştir.

Bu yöntemde kıyas bitki su tüketimi;

Bu yöntemde kıyas bitki su tüketimi;

$$ET = \frac{\delta}{\delta + \gamma^*} (R_n - G) \frac{1}{\lambda} + \frac{\gamma}{\delta + \gamma^*} \frac{900}{T + 273} u_2 (e_a - e_d)$$

(1.3) eşitliği ile tahmin edilmektedir.

Bu eşitlikteki bazı terimlerin hesaplanmasında kullanılan eşitlikler ise aşağıda verilmiştir.

$$\delta = \frac{4098e_a}{(T+237.3)^2} \quad (1.4)$$

$$\lambda = 2.501 - 2.361 \times 10^{-3}T \quad (1.5)$$

$$\gamma = 0.0016286 \frac{P}{\lambda} \quad (1.6)$$

$$\gamma^* = \gamma(1 + 0.34u_2) \quad (1.7)$$

$$R_n = R_{n_s} - R_{n_l} \quad (1.8)$$

$$R_{n_s} = 0,75R_s \quad (1.9)$$

$$R_{n_l} = 2,451f(T)f(e_d)f\left(\frac{n}{N}\right) \quad (1.10)$$

$$R_s = \left(0.25 + 0.50\frac{n}{N}\right)R_a \quad (1.11)$$

$$e_d = e_a \frac{RH}{100} \quad (1.12)$$

$$u_2 = u_z \left(\frac{z}{z}\right)^{0.2} \quad (1.13)$$

Bu eşitliklerde;

ET = Referans bitki su tüketimi, mm/gün,

δ = Buhar basıncı eğrisinin eğimi, kPa/°C

γ^* = Modifiye psikrometrik sabite, kPa/°C

γ = Psikrometrik sabite, kPa/°C

P = Atmosfer basıncı, kPa

R_n = Bitki yüzeyindeki net radyasyon, $\frac{MJ}{M^2 \text{ gün}}$

R_a = Atmosferin dış yüzüne ulaşan radyasyon, $\frac{MJ}{M^2} / \text{gün}$

$$R_s = \text{Yeryüzüne ulaşan kısa dalgali radyasyon, } \frac{MJ}{M2} / \text{gün}$$

$$R_{ns} = \text{Kısa dalgali net radyasyon, } \frac{MJ}{M2} / \text{gün}$$

$$R_{nl} = \text{Uzun dalhalı net radyasyon, } \frac{MJ}{M2} / \text{gün}$$

$$f(T) = \text{Sıcaklık fonksiyonu}$$

$$T = \text{Sıcaklık, } ^\circ C$$

$$f(e_d) = \text{Buhar basıncı fonksiyonu}$$

$$e_d = \text{Ortalama hava sıcaklığındaki gerçek buhar basıncı, kPa}$$

$$e_a = \text{Ortalama hava sıcaklığındaki doymun buhar basıncı, kPa}$$

$$f(n/N): \text{Güneşlenme oranı fonksiyonu}$$

$$n = \text{Güneşlenme süresi, h}$$

$$N = \text{Olası maksimum güneşlenme süresi, h}$$

$$G = \text{Topraktaki ısı akımı, MJ/m2/gün}$$

(Ardışık periyotlarda toprağın ortalama sıcaklığı çok fazla değişmediğinden ihmal edilebilir.)

$$\lambda = \text{Buharlaşma gizli ısı, } \frac{MJ}{kg} \left(\text{ortalama bir değer olarak } 2.45 \frac{MJ}{kg} \text{ alınabilir} \right)$$

$$u_2 = \text{Rüzgar hızının 2 m yükseklikteki eşdeğeri, m/s}$$

$$u_z = z \text{ m yükseklikte ölçülmüş rüzgar hızı, } \frac{m}{s}$$

$$z = \text{Rüzgar hızının ölçüldüğü yükseklik, m}$$

(Türkiye’de meteoroloji bültenlerinde genellikle 10 m yükseklikte ölçülmüş rüzgar hızı değerleri verilmektedir) ve RH = Ortalama bağıl (nispi) nem, % değerlerini göstermektedir. Çizelge 1’de Siirt ilinin uzun yıllar iklim verileri görülmektedir.

Çizelge 1. Siirt iline ait uzun yıllık meteorolojik veriler (1938-2019).

Parametre	Maksimum Sıcaklık (°C)	Minimum Sıcaklık (°C)	Ortalama Nispi Nem (%)	Toplam Yağış Ortalaması (mm)	Maksimum Yağış (mm)	Ortalama Buharlaşma (mm)	Ortalama Güneşlenme Süresi (Saat)
Rasat Süresi (Yıl)	79	79	78	78	79	79	57
Ocak	19.7	-19.3	71.9	34.6	53.4	12.0	3.6
Şubat	20.6	-16.5	67.1	29.4	53.2		4.4
Mart	28.5	-13.3	62.0	24.1	63.0	33.0	5.4
Nisan	32.9	-4.1	58.0	22.4	71.4	84.0	6.5
Mayıs	36.2	2.0	50.7	21.2	68.1	186	9.0
Haziran	40.2	8.2	34.6	15.5	16.7	284.8	11.7
Temmuz	44.4	13.1	27.4	13.5	22.2	368.0	12.2
Ağustos	14.4	46.0	26.4	13.3	12.2	351.8	11.4
Eylül	39.9	8.5	31.2	14.4	37.5	254.3	9.9
Ekim	36.6	0.3	46.7	49.7	70.8	137.6	7.2
Kasım	25.8	-14.1	62.4	82.5	102.9	53.0	5.2
Aralık	24.3	-14.6	70.6	94.5	71.8	13.1	3.6
Yıllık	46	-19.3	50.8	719.8	102.9	1753.6	7.5

3. Bulgular ve Tartışma

Kuru fasulye bitkisinin ekim tarihi 1.ürün olarak toprağın ısınma durumuna da bağlı olarak Mayıs ayının ilk haftasında yapılmıştır, hasat tarihi ise bitkinin yapraklarının kurduğu ve generatif gelişmenin tamamlandığı Eylül ayında gerçekleşmiştir. Erken vejetatif dönemde su dengesi eşitliğine göre günlük bitki su tüketimi (ETa) değeri 5.3 mm gün⁻¹ arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde 9.5 mm gün⁻¹ olarak belirlenmiş olup, Penman Monteith eşitliği ile saptanan referans bitki su tüketimi ise 9.0 mm gün⁻¹ olarak hesaplanmıştır. Aylık olarak ise su dengesi eşitliğine göre 290.0 mm ay⁻¹, Penman Monteith eşitliğine göre 275.51 mm ay⁻¹ olarak hesaplanmıştır. Araştırmanın yürütüldüğü yıl fasulye bitkisine uygulanan sulama suyu miktarı 693.0 mm olup su dengesi eşitliği yöntemine göre mevsimlik bitki su tüketimi (ETa) 748.0 mm mevsim⁻¹, Penman Monteith FAO 56 modifikasyonu eşitliğine göre ise ETo miktarı 778.33 mm mevsim⁻¹ olarak tespit edilmiştir.

4. Sonuç

Son zamanlarda küresel ısınmaya bağlı olarak ciddi bir tehdit olarak karşımıza çıkan ani iklimsel değişim, ülkemizdeki kısıtlı olan su kaynaklarının tükenmesine yol açmakta önemli bir oynamaktadır. Bunun yanında kuru fasulyenin yetiştiriciliği alanında daha fazla teşvik edilmesi için yapılan çalışmada gerçek su tüketimi ile hesaplanan referans su tüketimi arasında farkın önemsiz olduğu belirlenmiştir. Öte yandan su tüketiminin en yoğun olarak kullanıldığı alanların sulama amaçlı olduğu düşünüldüğünde sulama projelerinin gerçekçi olarak iklim verilerine bağlı, uzun ya da kısa dönemlere ilişkin bitkilerin kullanacakları su miktarının belirlenmesi gereklidir. Sonuç olarak bitki su tüketiminin saptanmasında daha fazla meteorolojik veri kullanarak bitki su tüketim tahminlerinde daha gerçekçi sonuçlara ulaşan bir yöntem olan Penman-Monteith eşitliği kullanılarak kuru fasulyenin sulama programı hazırlanmasında kullanılabilir olduğu önerilebilir.

Referanslar

- Abtew, W., Obeysekera, J. (1995). Lysimeter study of evapotranspiration of cattails and comparison of three estimation methods. *Trans. of the ASAE*, 38(1), 121-129.
- Bayramođlu, E. (2013). Trabzon İlinde İklim Deđişikliğinin Mevsimsel Bitki Su Tüketimine Etkisi. Kastamonu: Kastamonu Üniversitesi.
- Çelik, O.C. 2008. Kordiyerit + Müllit, Kordiyerit + Anortit, Kordiyerit + Anortit + Müllit kompozit refrakterlerinin mikroyapısal incelenmesi. Gebze Yüksek Teknoloji Enstitüsü, Mühendislik ve Fen Bilimleri Enstitüsü, Malzeme Bilimi ve Mühendisliği Ana Bilim Dalı, Yüksek Lisans Tezi.
- Demir, A., Meral, R. 2016. Bingöl İli Koşullarında Referans Bitki Su Tüketiminin Doğrudan ve Farklı Tahmin Yöntemleri ile Belirlenmesi. *Türk Tarım ve Doğa Bilimleri Dergisi* 3(1): 45–51, 2016
- Fulton, A., (2013). Evaluating water requirements of developing walnut orchards in Sacramento Valley. http://walnutresearch.ucdavis.edu/2013/2013_113.pdf. (Erişim tarihi: 16.02.2019)
- Güngör, Y., Erözel, A. Z., & Yıldırım, O. (2004). Sulama. Ankara: Ankara Üniversitesi Ziraat Fakültesi Yayınları.
- Hamzawy, E. M., El-Kheshen, A. A., & Zawrah, M. F. (2005). Densification and properties of glass/cordierite composites. *Ceramics international*, 31(3), 383-389. <https://doi.org/10.1016/j.ceramint.2004.06.003>
- Kaya, S. 2011. «Yarı-Kurak İklim Koşullarında Farklı Yöntemlerle Hesaplanan Referans Evapotranspirasyon Değerlerinin Karşılaştırılması.» *Bingöl Üniversitesi Fen Bilimleri Dergisi* 1, no. 1 : 58-60.
- Kırnak, H. ve Gençođlan, C. «Use of crop water stress index for scheduling irrigation in second crop corn.» *Ziraat Fakültesi Dergisi* 5, no. 3 4 (2001): 67-75.
- Jarvis Shean, K., Fulton, A., Doll, D., Lampinen, B., Hanson, B., Baldwin, R., Lightle, D., (2018). Young orchard handbook. <http://ccfruitandnuts.ucanr.edu/files/238596.pdf>. (Erişim tarihi: 16.02.2019)
- Jensen, M.E., Allen, R.G., (2016). Evaporation, evapotranspiration, and irrigation water requirements. American Society of Civil Engineers (ASCE), ISBN: 978-0-784-47920-9, New York, USA, 744s.
- Pardossi, A., Incrocci, L., Incrocci, G., Malorgio, F., Battista, P., Bacci, L., Rapi, B., Marzalletti, P., Hemming, J., Balendonck, J. (2009). Root zone sensors for irrigation management in intensive agriculture. *Sensors* 9:2809–2835.
- Şarlak, N., Bađçacı, S.Ç. (2020). Ampirik potansiyel evapotranspirasyon tahmin yöntemlerinin değerlendirilmesi: Konya havzası. *Teknik Dergi*, 31(1), 9755-9772.
- TÜİK, 2020. Türkiye İstatistik Kurumu Yıllığı
- Uçak, A.B., Öktem, A., Sezer, C., Cengiz, R. ve İnal, B. 2016 «Determination of Arid and Temperature Resistant Sweet Corn (*Zea mays saccharata* Sturt) Lines.» *International Journal of Environmental & Agriculture Research (IJOEAR)* 2, no. 7 (2016): 79-88. [https://doi.org/10.1016/S0272-8842\(02\)00100-1](https://doi.org/10.1016/S0272-8842(02)00100-1)
- Zelege, K.T., Wade, L.J., 2012. Evapotranspiration estimation using soil water balance. *Weather and Crop Data*, Rijeka, Croatia, pp. 41

ÇEREZLİK KABAĞIN (*Cucurbita Pepo L.*) BİTKİ SU TÜKETİMİNİN DOĞRUDAN
BELİRLENMESİ

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ÖZET

Bu çalışmanın amacı doğrudan bitki su tüketimini belirlemeye yarayan su dengesi eşitliğinden yararlanarak kabak bitkisinin Siirt iklim koşullarında bitki su tüketimini belirlemektir. Araştırmada bitki materyali olarak Nevşehir çevresinde kabak popülasyonu (*Cucurbita pepo L.*) kullanılmıştır. Çalışma 2017 yılı kabak bitkisinin yetişme sezonu boyunca Siirt üniversitesi Ziraat Fakültesi deneme arazisinde bölünmüş parseller deneme deseninde tarla koşullarında yürütülmüştür. Erken vejetatif dönemde su dengesi eşitliğine göre günlük ETa değeri 4.9 mm gün⁻¹ arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde 9.4 mm gün⁻¹ olarak belirlenmiştir. Aylık olarak (Temmuz ayı) ise su dengesi eşitliğine göre 291.4 mm ay⁻¹ olarak hesaplanmıştır. Yetişme sezonu boyunca kabak bitkisine uygulanan sulama suyu miktarı 573.20 mm olup su dengesi eşitliği yöntemine göre mevsimlik bitki su tüketimi (ETa) 628.30 mm olarak tespit edilmiştir. Sonuç olarak çalışmada gerçek su tüketimi ile hesaplanan bitki su tüketimi değeri kullanarak kabak bitkisinin yarı kurak iklim koşullarında sulama programlarının hazırlanmasında çiftçilerin kullanılabileceği önerilebilir. Ayrıca bu konularda çalışan diğer araştırmacılarında bu ve benzeri çalışmalarda bu araştırmadan elde edilen çıktıları kullanabileceği söylenebilir.

Anahtar Kelimeler: Kabak, Bitki su tüketimi, Su dengesi eşitliği, İklim

*Teşekkür

*Bu çalışmanın bir kısmı 2023 yılında yurt dışında indeksli bir dergiye yayınlanmak amacıyla gönderilmiştir.

**DIRECT DETERMINATION OF PLANT WATER CONSUMPTION OF SQUASH
(*Cucurbita Pepo L.*)**

ABSTRACT

The aim of this study is to determine the plant water consumption of zucchini in Siirt climatic conditions by using the water balance equation that directly determines the plant water consumption. Nevşehir framed pumpkin population (*Cucurbita pepo L.*) was used as plant material in the study. The study was carried out in field conditions in the experimental design of divided plots in the experimental land of the Faculty of Agriculture of Siirt University during the growing season of the zucchini plant in 2017. According to the water balance equation in the early vegetative period, while the daily ET_a value changed between 4.9 mm day⁻¹, it was determined as 9.4 mm day⁻¹ before and during the flowering period. On a monthly basis (July), it was calculated as 291.4 mm month⁻¹ according to the water balance equation. The amount of irrigation water applied to the zucchini plant during the growing season was 573.20 mm, and seasonal plant water consumption (ET_a) was determined as 628.30 mm according to the water balance equation method. As a result, it can be suggested that farmers can be used in the preparation of irrigation programs in semi-arid climatic conditions of zucchini by using the plant water consumption value calculated with the actual water consumption in the study. In addition, it can be said that other researchers working on these issues can use the outputs obtained from this research in this and similar studies.

Keywords: Pumpkin, Crop water consumption, water balance equation, Climate data

*Thanks

*Part of this study was sent for publication in an indexed journal abroad in 2023.

1. GİRİŞ

Kabak Çekirdeği üretimi ülkemizde uzun yıllardan beri yapılmakla birlikte 2004 yılından sonra üretim alanı ve miktarında daha hızlı bir artış olmuştur. Türkiye'nin kabak çekirdeği üretimi Orta Anadolu Bölgesi'ndeki illerde daha yüksek düzeydedir. Kabak çekirdeği kuruyemiş olarak kullanımı yanında bir sanayi ürünüdür. Gıda sektöründen ilaç ve kozmetik sektörüne kadar olan geniş bir yelpazede değerlendirilme şansına sahiptir. Kabak çekirdeği yetiştiriciliği son 20 yılda önemli bir sektör haline gelmiştir. Özellikle iç bölgelerde alternatif ürün olarak değerlendirilmekte, üretim alanları giderek artış göstermektedir. 2020 yılı itibarıyla ülkemizin kabak çekirdeği üretimi 57.184 ton'dur (TÜİK, 2020).

Türkiye sahip olduğu toprak ve su kaynakları ile çok değişik iklim koşulları yönünden dünyada tarımsal potansiyeli yüksek olan sayılı ülkeler arasında bulunmaktadır. Ülkemizde işlenen arazi 28.5 milyon hektardır. Yapılan etütlere göre, mevcut su potansiyeli ile teknik ve ekonomik olarak sulanabilecek arazi miktarı 8.5 milyon hektar olarak hesaplanmıştır. Sulanan alan ise 5.5 milyon ha'dır. Siirt ilinin yüzölçümü 598.700 ha'dır. Bu alanın yaklaşık, teknik anlamda sulanabilecek arazi varlığı 24.115 ha'dır. Günümüzde bitkilerin sulanmasında yüzey sulama yöntemleri yetersiz kalmakta ve uygulanan sulama suyunun yalnızca 1/3'ü bitkiler tarafından terleme (transpirasyon) yoluyla kullanılmaktadır. Bu nedenle, bitkilerin her yöre ve her bitki için bitki su tüketimlerinin geliştirilmesine yönelik çalışmaların yapılmasına gereksinim duyulmaktadır. Ulusal ve uluslararası kaynaklarda 'Evapotranspirasyon' olarak adlandırılan ve ETa simgesiyle gösterilen terimin Türkçe' deki karşılığı 'Bitki Su Tüketimi' olarak tanımlanmaktadır (Bayramoğlu, 2013; Uçak ve ar., 20216). Bitki su tüketiminin (Evapotranspirasyon, ETa) saptanması; su kaynaklarının işletilmesi, sulama sistemlerinin planlanması ve sulama programlarının yapılabilmesi için temel bir ihtiyaçtır. Bitkisel üretimde bitki su tüketiminin dikkate alınması ve suyun ölçülü kullanılması, hem verim hem de toprak-su kaynaklarının korunması açısından büyük önem taşımaktadır (Abtey ve Obeysekera, 1995; Güngör et al., 2004; Demir ve Meral, 2016). Günümüzde sulama programlarının oluşturulmasında dikkate alınan en önemli parametrelerden biriside bitki su tüketimidir. Bitki su tüketimi lizimetre sistemleri, tarla deneme parselleri ve bitki kök bölgesindeki nem azalmasının denetimi gibi metotlardan faydalanarak doğrudan hesaplanabilmektedir (Şarlak ve Bağcı, 2020; Kırnak ve Gençoğlu, 2001). Sulama uygulamalarında bitki su tüketiminin dikkate alınmadığı ve

homojen bir su dağılımının yapılamadığı, salma sulama yönteminin kullanılması durumunda, bitki gelişiminde büyük bir öneme sahip olan demir mineralinin topraktan yıkanarak etkili kök bölgesi altında sızmasına sebep olmaktadır (Fulton, 2013; Jarvis Shean et al., 2018). Uygulamada sulama programı, genellikle yetiştirici deneyimlerine veya toprak su dengesi (iklim temelli yöntem) belirlenmesine dayanmaktadır. Sulama programı oluşturulmasında ve bitki su tüketiminin saptanmasında alternatif metotlardan birisi de, toprak suyunun ölçülmesi (gravimetrik) yöntemidir (Pardossi et al., 2009). Bitki su tüketimi ve sulama suyu ihtiyacı bitki, toprak ve iklim özelliklerine bağlı olarak değişkenlik göstermektedir. Tarımsal sulamada su kaynaklarının optimum bir randımanla kullanımı, bitki su tüketimini esas alan sulama programları hazırlanarak, bitkinin suya ihtiyacı olduğu zamanlarda sulama yapılması ve her sulamada bitkiye ihtiyacı kadar su verilmesi ile sağlanabilmektedir (Jensen ve Allen, 2016). Bitki su tüketim yöntemleri direkt olarak veya indirekt olarak iklim parametrelerine bağlı olarak birçok yöntemle tespit edilebilmektedir. Direkt yöntemler uzun bir zaman dilimi ve fazla miktarda iş gücü gerektirirken, indirekt yöntemler daha basit ve daha hızlı uygulanabilmektedir (Kaya 2011). Bu çalışmanın amacı doğrudan bitki su tüketimini belirlemeye yarayan su dengesi eşitliğinden yararlanarak kabak bitkisinin Siirt iklim koşullarında bitki su tüketimini doğrudan (su dengesi eşitliği) belirlemektir.

2. Gereç ve Yöntem

2.1. Deneysel Çalışmalar

Damla sulama yönteminin kullanıldığı deneme parsellerinde su dağıtımı, 4 atm çalışma basıncı ve 16 mm dış çapa sahip yumuşak PE lateral boru hatları kullanılarak sağlanmıştır. Araştırma alanının toprakları ağırdır ve 6 mm h^{-1} infiltrasyon hızına sahiptir. Her lateralde, sıralı tip basınç düzenleyicisi ve 1 atm çalışma basıncında 4 L h^{-1} akış hızına sahip damlaticılar kullanılmış ve aralarında 0.33 m boşluk bırakılmıştır. Bu nedenle, bitki damla sulama yöntemi ile sulama suyu sadece doğru miktarda uygulanmıştır. Herhangi bir sızma veya yüzey akışı meydana gelmesine izin verilmemiştir. Sırta ekilecek tohum yatağı hazırlanmıştır. Her parsel, sıra arasında 70 cm boşluk, sıra üzeri 35 cm boşluk, parsellerin boyutları 6 m uzunluğunda ve 2,8 m genişliğinde (parsel yüzeyi = 16,8 m²) olmak üzere 4 çizgiye sahip olacak şekilde tasarlanmıştır. Tohumun 4-5 cm derinlikte ekildiğinden emin olmak için 4 hatlı pnömatik tohum makinası kullanılmıştır. Sulama konuları ve tekrarlar arasındaki etkileşimleri önlemek için 2 m tampon bölge oluşturulmuştur. Çalışmada, etkili kök derinliğinin (90 cm) nem içeriği her sulamadan önce gravimetrik yöntem kullanılarak

tespit edilmiştir. Her tür için tam sulama (I100) ile kontrol parselinde 90 cm toprak derinliğinde eksik nemi tarla kapasitesine getirmek için kullanılmıştır. Bu amaçla, sulama öncesi her sulama derinliği için 90 cm'lik toprak profilinin 0-30, 30-60 ve 60-90 cm'lik tabakalarından alınan toprak numuneleri toplanmış ve kuru toprak ağırlık yüzdesi (%Pw) olarak belirlenmiştir.

Her katman için belirlenen nem içeriği, denklem 1 kullanılarak derinlemesine nem içeriğine dönüştürülmüştür.

$$d=(Pw-PwAW)*As*D/100..... (1)$$

Burada; d derinliğinde toprak nem içeriğidir (mm), Pw tarla kapasitesi (%), PwAW;her katmanın nem içeriği (%), As ,Toprak birim ağırlığı (g/cm^3)

D katman derinliği (mm) olduğu gibi uygulanacak suyun hacmi aşağıdaki denklem kullanılarak hesaplanmıştır (Denklem. (2));

Her tabaka için hesaplanan su içeriği nin eklenmesiyle, etkili kök derinliği için toplam su miktarı (dT) bulunmuştur (Denklem. (2)).

$$dT=d(0-30)+ d(30-60) + d(60-90) (2)$$

Her sulama konusunun aylık ve mevsimsel evapotranspirasyon değerleri, büyüme mevsiminde hasadın başlangıcında ve sonunda ölçülen toprağın nem oranı (90 cm) su dengesi eşitliği denkelemi kullanılarak hesaplanmıştır (Zelege ve Wade 2012).

Bitkinin su tüketiminin hesaplanmasında aşağıdaki su dengesi denklemini kullanılmıştır (Eş. (4)) (Zelege ve Wade 2012).

$$ETa= P + I - Rf - Dp \pm \Delta S(Eş. (4)).$$

ETa: Evapotranspirasyon (mm),

P: yağış (mm),

I: sulama suyu miktarı (mm),

Rf: yüzey akışı (mm),

Dp: Derin infiltrasyon (mm) ve

ΔS (mm) kökündeki toprak nem değişimidir. Çalışmada tercih edilen damlatıcı akış hızı toprağın sızma hızından daha düşük olduğundan, yüzey akışı oluşmamıştır. Sulama suyu miktarı mevcut nemi saha kapasitesine getirmek için yeterli olduğu için derin bir sızma meydana gelmediği varsayılmıştır.

2. Bulgular ve Tartışma

Kabak bitkisinin ekim tarihi 1.ürün olarak toprağın ısınma durumuna da bağlı olarak Mayıs ayının ilk haftasında yapılmıştır, hasat tarihi ise bitkinin yapraklarının kurduğu ve genaratif gelişmenin tamamlandığı Eylül ayında gerçekleşmiştir. Erken vejetatif

dönemde su dengesi eşitliğine göre günlük bitki su tüketimi (ETa) değeri 4.9 mm gün^{-1} arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde 9.4 mm gün^{-1} olarak belirlenmiştir. Aylık olarak ise su dengesi eşitliğine göre 291.4 mm ay^{-1} , olarak hesaplanmıştır. Araştırmanın yürütüldüğü yıl kabak bitkisine uygulanan sulama suyu miktarı 573.20 mm olup su dengesi eşitliği yöntemine göre mevsimlik bitki su tüketimi (ETa) 628.30 mm olarak tespit edilmiştir.

4. Sonuç

Son zamanlarda küresel ısınmaya bağlı olarak ciddi bir tehdit olarak karşımıza çıkan ani iklimsel değişim, ülkemizdeki kısıtlı olan su kaynaklarının tükenmesine yol açmakta önemli bir oynamaktadır. Bunun yanında kabak bitkisi yetiştiriciliği alanında daha fazla teşvik edilmesi için yapılan çalışmada gerçek su tüketimi ile hesaplanan referans su tüketimi arasında farkın önemsiz olduğu belirlenmiştir. Öte yandan su tüketiminin en yoğun olarak kullanıldığı alanların sulama amaçlı olduğu düşünüldüğünde sulama projelerinin gerçekçi olarak iklim verilerine bağlı, uzun ya da kısa dönemlere ilişkin bitkilerin kullanacakları su miktarının belirlenmesi gereklidir. Sonuç olarak bitki su tüketiminin saptanmasında daha gerçekçi sonuçlara ulaşan bir yöntem olan su dengesi eşitliği yönteminin sulama programlarının hazırlanmasında kullanılması önerilebilir. Araştırmadan elde edilen sonuçlar diğer araştırmacılar tarafından da test edilebilir.

KAYNAKLAR

- Abtew, W., Obeysekera, J. (1995). Lysimeter study of evapotranspiration of cattails and comparison of three estimation methods. *Trans. of the ASAE*, 38(1), 121-129.
- Altaş, N. (1997), "Tipoloji", *Eczacıbaşı Sanat Ansiklopedisi*, Cilt 3, YEM Yayınevi, İstanbul; 1779.
- Bayramoğlu, E. (2013). Trabzon İlinde İklim Değişikliğinin Mevsimsel Bitki Su Tüketimine Etkisi. Kastamonu: Kastamonu Üniversitesi.
- Aymanino, C. (1985), "Type and Typology", *Architectural Design* 55: 5-6.
- Çelik, O.C. 2008. Kordiyerit + Müllit, Kordiyerit + Anortit, Kordiyerit + Anortit + Müllit kompozit refrakterlerinin mikroyapısal incelenmesi. Gebze Yüksek Teknoloji Enstitüsü, Mühendislik ve Fen Bilimleri Enstitüsü, Malzeme Bilimi ve Mühendisliği Ana Bilim Dalı, Yüksek Lisans Tezi.
- Demir, A., Meral, R. 2016. Bingöl İli Koşullarında Referans Bitki Su Tüketiminin Doğrudan ve Farklı Tahmin Yöntemleri ile Belirlenmesi. *Türk Tarım ve Doğa Bilimleri Dergisi* 3(1): 45–51, 2016.
- Fulton, A., (2013). Evaluating water requirements of developing walnut orchards in Sacramento Valley. http://walnutresearch.ucdavis.edu/2013/2013_113.pdf. (Erişim tarihi: 16.02.2019)
- Güngör, Y., Erözel, A. Z., & Yıldırım, O. (2004). *Sulama*. Ankara: Ankara Üniversitesi Ziraat Fakültesi Yayınları.
- Hamzawy, E. M., El-Kheshen, A. A., & Zawrah, M. F. (2005). Densification and properties of glass/cordierite composites. *Ceramics international*, 31(3), 383-389. <https://doi.org/10.1016/j.ceramint.2004.06.003>
- Kaya, S. 2011.«Yarı-Kurak İklim Koşullarında Farklı Yöntemlerle Hesaplanan Referans Evapotranspirasyon Değerlerinin Karşılaştırılması.» *Bingöl Üniversitesi Fen Bilimleri Dergisi*1, no. 1 : 58-60.
- Kırnak, H, ve Gençoğlan, C. «Use of crop water stress index for scheduling irrigation in second crop corn.» *Ziraat Fakültesi Dergisi* 5, no. 3 4 (2001): 67-75.
- Jarvis Shean, K., Fulton, A., Doll, D., Lampinen, B., Hanson, B., Baldwin, R., Lightle, D., (2018). *Young orchard handbook*. <http://ccfruitandnuts.ucanr.edu/files/238596.pdf>. (Erişim tarihi: 16.02.2019)
- Jensen, M.E., Allen, R.G., (2016). *Evaporation, evapotranspiration, and irrigation water requirements*. American Society of Civil Engineers (ASCE), ISBN: 978-0-784-47920-9, New York, USA, 744s.
- Pardossi, A., Incrocci, L., Incrocci, G., Malorgio, F., Battista, P., Bacci, L., Rapi, B., Marzioletti, P., Hemming, J., Balendonck, J. (2009). Root zone sensors for irrigation management in intensive agriculture. *Sensors* 9:2809–2835.
- Şarlak, N., Bağcı, S.Ç. (2020). Ampirik potansiyel evapotranspirasyon tahmin yöntemlerinin değerlendirilmesi: Konya havzası. *Teknik Dergi*, 31(1), 9755-9772.
- Uçak, A.B., Öktem, A., Sezer, C., Cengiz, R. ve İnal, B. 2016 «Determination of Arid and Temperature Resistant Sweet Corn (*Zea mays saccharata* Sturt) Lines.» *International Journal of Environmental & Agriculture Research (IJOEAR)* 2, no. 7 (2016): 79-88. [https://doi.org/10.1016/S0272-8842\(02\)00100-1](https://doi.org/10.1016/S0272-8842(02)00100-1)
- Zeke, K.T., Wade, L.J., 2012. Evapotranspiration estimation using soil water balance. *Weather and Crop Data*, Rijeka, Croatia, pp. 41

INVESTIGATION OF ANTIBACTERIAL ACTIVITY OF *Capsicum Annuum* L.
EXTRACT ON *Escherichia Coli* And *Staphylococcus aureus*

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ABSTRACT

Since the discovery of antibiotics, the use of herbal antiseptics has declined significantly. The development of strains resistant to many antibiotics and the emergence of consumer insecurity due to "unnatural" food ingredients have led to an increased interest in natural antimicrobials in the food industry. This research was carried out to determine fruit extracts for use in traditional medicine and as food ingredients due to their antibacterial activities. In this study, antibacterial activity of extracts obtained from *Capsicum annuum* fruit against bacterial strains of *Staphylococcus aureus* ATCC 29213 and *Escherichia coli* ATCC 25922 were investigated in vitro. The fruits of the plant were dried and then were extracted by using different solvents (methanol, ethanol, ethyl acetate and acetone). The antibacterial activity of *Capsicum annuum* fruit extracts was evaluated by disc diffusion method. According to the results the highest antibacterial activity was observed against *Staphylococcus aureus* with ethanol extract an inhibition zone of 26 mm. The extracts showed limited inhibition effect (about 8-12 mm inhibition zone) against *Escherichia coli*.

Keywords: *Capsicum annuum* L., antibacterial activity, disc diffusion method

Introduction

Many developing countries use traditional medicine as their primary level of health care. Many drugs currently used are economically expensive and not readily available in rural areas. Inconsistent use of these drugs can lead to microbial drug resistance. Medicinal plants contain a wide variety of chemicals with important therapeutic properties that can be used in the treatment of human diseases. Approximately 80% of individuals in developed countries use traditional medicines based on medicinal plants (Akinpelu et al., 2008). Pepper (*Capsicum annuum* L.) is a member of the Solanaceae family and is believed to be originated from Central and South America. Peppers belong to the genus *Capsicum*. *C. annuum*, *C. frutescens*, *C. chinense*, *C. pubescens*, and *C. baccatum* are grown domestically or commercially. Peppers are excellent sources of phytochemicals, such as anthocyanins, vitamins, phenolic acids, flavonoids, carotenoids, and capsaicinoids. Capsaicinoids called capsaicin, homocapsaicin dihydrocapsaicin, nordihydrocapsaicin, and homodihydrocapsaicin are found in the structure of pepper. It has been reported that the capsaicinoid content of different pepper species is also different (Hülül, 2016). Numerous studies have demonstrated the antibacterial activity of capsaicin and dihydrocapsaicin bioactive compounds isolated from *Capsicum annuum*. Since the discovery of antibiotics, the use of herbal antiseptics has declined significantly. As a result of the studies, capsaicin in various pharmaceutical forms; it is also indicated in the symptomatic treatment of muscle, joint and arthritis pain, in the treatment of ulcers and obesity, in the relief of neuropathy pain, in the treatment of neurogenic pain such as Herpes zoster. It has been proven that capsaicin can be a P-gp inhibitor or substrate that plays an important role in drug-nutrient, drug-drug and drug absorption interactions. The development of strains resistant to many antibiotics and the emergence of consumer insecurity due to "unnatural" food ingredients have led to an increased interest in natural antimicrobials in the food industry (Thomas et al., 1998; Sener and Sahin, 2010; Hülül, 2016) This research was carried out to determine fruit extracts for use in traditional medicine and as food ingredients due to their antibacterial activities.

Materials and Methods

Chemicals

All of the chemicals used in this study were obtained from Sigma Aldrich (Germany).

Plant material

Capsicum annuum was collected in August 2021 in Uşak Province of Turkey. The plant samples were cleaned and dried via herbarium techniques of Davis (1972). After the plant material was dried, it was pulverized with the help of a grinder. Powder samples were weighed

(15 gr); Different solvents (acetone, methanol, ethyl acetate, chloroform) were used in the determined ratios (150 ml) in glass jars with lids for 2 days. A rotary evaporator was used to remove the solvents of the samples, which were filtered into glass balloons with the help of blotting paper. Solvents were evaporated under vacuum at 40-45 °C. The amount of the extract was determined by weighing the balloons used before and after the procedures, and thus the samples were prepared for the determination of antibacterial activity (Lin et.al., 1999).

Preparation of Test Microorganisms

Bacterial strains used in the determination of antibacterial activity were inoculated into Tryptic Soy Broth medium and activated by incubation at 37 °C for 24 hours. Activated bacteria were inoculated on Sheep Blood Agar by streaking and fresh cultures were prepared. Petri dishes in which bacteria were cultivated were incubated at 37 °C for 24 hours. After incubation, the bacterial density was adjusted to 0.5 Mc Farland (10^8 CFU/ml) and made ready for the study.

Experimental Procedure

The obtained extract was prepared to be absorbed into the discs at the desired concentration (3200 µg/10µl) by adding DMSO at the determined rate. Commercially available 6 mm diameter, antibiotic-free blank sterile discs were impregnated with 10 µl/disc of the prepared extracts and the discs were left to dry overnight. The discs on which the extracts were impregnated were placed at equal distances by pressing lightly on the medium with the help of sterile forceps. Discs impregnated with DMSO were used as negative control. Clindamycin (10 µg), Tetracycline (10 µg) and Amoxicillin-Clavulanic acid (30 µg) antibiotic discs were used as positive controls. The inhibition zone diameters formed after incubation were measured (Ferreira et. al., 2006).

Measurement of zone diameters

Inhibition zone diameters (mm) formed around the discs were measured to determine whether the plant material had antibacterial activity against microorganisms that were incubated for 24 hours at 37 °C. The results were recorded by taking the average of the zone diameters in the three replication experiments. By looking at the zone diameters formed around the discs, it was determined whether the plant material had antibacterial activity on the bacteria used in the study.

Results and Discussions

Disk diffusion method was used in this study. The effect of *Capsicum annuum* L. on *Staphylococcus aureus* is shown in Table 1.

Table 1. The effect of *Capsicum annuum* L. on *Staphylococcus aureus*

Extracts	Zone diameters (mm)				
	<i>Capsicum annuum</i>	Control	Clindamycin	Tetracycline	Amoxicillin-Clavulanic acid
Ethanol	26	0	31	18	30
Acetone	20				
Methanol	18				
Ethyl acetate	16				

A disk of 3200 µg of ethanol extract formed a 26 mm inhibition zone diameter. Inhibition zone diameter of 20 mm for acetone extract, 18 mm for methanol extract and 16 mm for ethyl acetate extract was observed. No effect was observed in DMSO-impregnated discs used as negative control.

Table 2. The effect of *Capsicum annuum* L. on *Escherichia coli*

Extracts	Zone diameters (mm)				
	<i>Capsicum annuum</i>	Control	Clindamycin	Tetracycline	Amoxicillin-Clavulanic acid
Ethanol	12	0	8	18	23
Acetone	8				
Methanol	8				
Ethyl acetate	8				

According to Table 2, a disk of 3200 µg of ethanol extract formed a 12 mm inhibition zone diameter. Inhibition zone diameter of 8 mm for acetone, methanol and ethyl acetate extracts were observed. No effect was observed in DMSO-impregnated discs used as negative control. The differences in inhibitory activity observed against the bacterial species would be due to the difference in genetic and structural composition of the isolates and strains. The presence of potential antimicrobial substances was identified by chemical analysis of *C. annuum* fruit extract which showed the presence of alkaloids, polyphenols, flavonoids, anthocyanins, anthraquinones, tannins, triterpenes, and saponins. This partially corroborates the results of previous reports (Samrot et.al., 2018).

It is reported that nearly nine thousand plant species grow naturally in our country and there are few studies on their chemical contents and medicinal effects. According to the research prepared by the World Health Organization (WHO) based on publications in many countries, it is reported that the total number of medicinal plants used for treatment is around 20 000. In the studies, the antimicrobial effects of the pepper plant were determined by some studies. Oussalah et al. (2007), conducted research to determine the effects of *Allium sativum* (garlic)

and *Capsicum annuum* var. *conoides* (red pepper) on fecal microflora and blood lipid levels. In this study, rats were fed 2% food containing red pepper and garlic and 19% fatty beef for 4 weeks (Oussalah et al., 2007). As a result, the ratio of bacteria belonging to the Enterobacteriaceae family, which is a fecal bacterial group; *Capsicum annuum* var. *conoides* in added foods; they report a reduction from 9.4 to 9.0 log cfu/g. They also reported that the rate of *Bifidobacterium* sp. and *Staphylococcus* sp. species decreased from 8.7 to 7.6 log cfu/g (Oussalah et al., 2007). It has been shown in different studies that the antibacterial activity in plants differs according to the plant variety. It is stated that this difference is due to factors such as the possible absence of the active substance in the content of the sample in the extracted medium or the different concentration of the active substance (Omidbeygi et. al., 2007; Hülül, 2016).

Conclusion

In this study, antibacterial activity of extracts obtained from *Capsicum annuum* fruit against bacterial strains of *Staphylococcus aureus* and *Escherichia coli* were investigated in vitro. The fruits of the plant were dried and then were extracted by using different solvents (methanol, ethanol, ethyl acetate and acetone). The antibacterial activity of *Capsicum annuum* fruit extracts were evaluated by disc diffusion method. According to the results the highest antibacterial activity was observed against *Staphylococcus aureus* with ethanol extract an inhibition zone of 26 mm. The extracts showed limited inhibition effect (about 8-12 mm inhibition zone) against *Escherichia coli*.

References

- Akinpelu, D. A., Aiyegoro, O. A., & Okoh, A. I. (2008). In vitro antimicrobial and phytochemical properties of crude extract of stem bark of *Azelaia africana* (Smith). *African journal of biotechnology*, 7(20).
- Davis, P. H., 1972. *Flora of Turkey and the East Aegean Islands*. Edinburgh: Edinburgh University Press, 4: 382-387.
- Ferreira, A., Proença, C., Serralheiro, M. L. M., & Araujo, M. E. M. (2006). The in vitro screening for acetylcholinesterase inhibition and antioxidant activity of medicinal plants from Portugal. *Journal of ethnopharmacology*, 108(1), 31-37.
- Hülül, M. (2016). *Hatay, Kahramanmaraş ve Şanlıurfa biberlerinin antioksidan ve antibakteriyal özellikleri/Antioxidant and antibacterial properties of pepper in Hatay, Kahramanmaraş and Sanliurfa*. PhD Thesis.
- Lin, J., Opoku, A. R., Geheeb-Keller, M., Hutchings, A. D., Terblanche, S. E., Jäger, A. K., & Van Staden, J. (1999). Preliminary screening of some traditional zulu medicinal plants for anti-inflammatory and anti-microbial activities. *Journal of Ethnopharmacology*, 68(1-3), 267-274.
- Omidbeygi, M., Barzegar, M., Hamidi, Z., & Naghdibadi, H. (2007). Antifungal activity of thyme, summer savory and clove essential oils against *Aspergillus flavus* in liquid medium and tomato paste. *Food control*, 18(12), 1518-1523.
- Oussalah, M., Caillet, S., Saucier, L., & Lacroix, M. (2007). Inhibitory effects of selected plant essential oils on the growth of four pathogenic bacteria: *E. coli* O157: H7, *Salmonella typhimurium*, *Staphylococcus aureus* and *Listeria monocytogenes*. *Food control*, 18(5), 414-420.
- Samrot, A. V., Raji, P., Selvarani, A. J., & Nishanthini, P. (2018). Antibacterial activity of some edible fruits and its green synthesized silver nanoparticles against uropathogen—*Pseudomonas aeruginosa* SU 18. *Biocatalysis and agricultural biotechnology*, 16, 253-270.
- Şener, E., & Şahin, S. (2010). Kapsaisin: Farmakokinetik. Toksikolojik ve Farmakolojik Özellikleri *Hacettepe Üniversitesi Eczacılık Fakültesi Dergisi*, 29(2), 149-163.
- Thomas, B. V., Schreiber, A. A., & Weisskopf, C. P. (1998). Simple method for quantitation of capsaicinoids in peppers using capillary gas chromatography. *Journal of agricultural and food chemistry*, 46(7), 2655-2663.

FUMIGANT TOXICITY OF ESSENTIAL OIL OF *Capsicum annuum* L. (Solanaceae)
To *Tenebrio Molitor* L., 1758 (Coleoptera: Tenebrionidae)

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ABSTRACT

Especially during the storage of foods such as corn, oats and wheat, there may be major problems due to the presence of insects such as the yellow mealworm *Tenebrio molitor*. Insects in stored bran and grains contaminate food through their excrement and old cuticle fragments, as well as indirectly through saprophytic microorganisms. All these factors cause quality loss in warehouse products. Therefore, it is important to control the *T. molitor* pest. Pest insects can be controlled by chemical methods such as pesticides; however, these chemicals may cause undesirable effects on the environment and non-target organisms. Therefore, safer control methods such as natural extracts of plants are becoming important for pest control. The present study was undertaken to investigate the effects of essential oil *Capsicum annuum* fruit against larval stage of the important stored-product pest, *T. molitor*. The results indicated that mortality increased with the increasing concentration of essential oil. Also, increasing doses of essential oil caused decreasing in SOD, CAT, GPx activities and increasing in MDA level. But there were no statistically differences between control and treatment groups in AChE activities. These results indicate that *C. annuum* essential oil exerts its effectiveness at the applied doses by creating oxidative stress.

Keywords: pest control, pepper, mealworm

Introduction

Many plants, their essential oils and extracts, have potential in medical procedures and applications in the pharmaceutical, cosmetic and food industries (Tepe et al., 2005). *Capsicum annuum* L. is mostly used commercially.

The genus *Capsicum* is a member of the Solanaceae family and has five commonly cultivated species: *Capsicum annuum*, *Capsicum baccatum*, *Capsicum chinense*, *Capsicum frutescens* and *Capsicum pubescens*. However, there are 20 registered wild species (Heiser, 1973). The chemical composition of foods is quite complex and contains both volatile and non-volatile substances. Some of these substances contribute to the flavor of food. Since the aroma component (volatile taste) is generally responsible for the characteristic flavor of foods, the essential oil compounds have attracted the most attention. The fruits of the *Capsicum* species have a relatively low essential oil content, reported to range from about 0.1% to 2.6% in capsicum. The initial essential oil content of freshly picked fruit is highly dependent on the species/culture grown and the maturity stage at harvest. However, the final essential oil content of the dried product may be lower and depends on the drying procedure, time and storage condition (whole or ground). For example, paprika powder usually contains less than 0.5% essential oil (Nadeem et al., 2011). Especially during the storage of foods such as corn, oats and wheat, there may be major problems due to the presence of insects such as the yellow mealworm *Tenebrio molitor*. Adults are reddish brown, 1.25-1.8 cm long. The eggs are shaped like white beans. The larvae are similar to the wireworm, 2.5 cm in length, the larva that emerges from the egg first turns white and then cream. The female lays her eggs singly or in groups. Active at night, these insects cause significant damage to stored products. There are different control methods such as cultural precaution and physical control to control the pests in stored products, but other than these, control methods have started to be used with extracts obtained from plants (Chonwaski et.al., 2014).

Insects in stored bran and grains contaminate food through their excrement and old cuticle fragments, as well as indirectly through saprophytic microorganisms. All these factors cause quality loss in warehouse products. Therefore, it is important to control the *T. molitor* pest. Pest insects can be controlled by chemical methods such as pesticides; however, these chemicals may cause undesirable effects on the environment and non-target organisms. Therefore, safer control methods such as natural extracts of plants are becoming important for pest control (Costa et.al., 2020). The present study was undertaken to investigate the effects of essential oil *Capsicum annuum* fruit against larval stage of the important stored-product pest, *T. molitor*.

Materials and Methods

Chemicals

All of the chemicals used in this study to determine the AChE activity, MDA level and antioxidant enzyme activities were obtained from Sigma Aldrich (Germany).

***Tenebrio molitor* culture**

Insects were cultivated in plastic containers (30 x 25 x 15 cm). Corn flour (30%) and wheat flour (70%) were added as a food source and pasteboards were added for egg deposition. Thinly sliced potato or apple was added each week for water source and regulating for humidity of containers. Twenty individuals of the larvae were selected randomly from one population.

Plant material, isolation and analysis of the essential oil

Capsicum annuum was collected in August 2021 in Uşak Province of Turkey. The plant samples were cleaned and dried via herbarium techniques of Davis (1972). 200 g of *C. annuum* fruit essential oil was extracted from plant material by hydrodistillation using a modified Clevenger apparatus for 3 to 4 h at a laboratory scale. With this method, secondary plant metabolites (mainly terpenes and phenolic compounds) are obtained in a relatively pure fraction excluding most of primary metabolites. The essential oil obtained was kept at 4°C until beginning of the study.

Toxicity of essential oil to *Tenebrio molitor*

Capsicum annuum essential oil was tested for its fumigant effect against larvae stage of *Tenebrio molitor*. Larvae were placed into 1 L glass jars. 3 replicates were tested for each concentration of *Capsicum annuum* essential oil and each replicate consisted of 20 insects. We used 2.5 × 2.5 cm filter paper strips for application of essential oil then the filter paper was attached to the bottom of the cover of glass jars. Larvae were exposed to different concentrations of essential oil (0, 1, 2, 4, 8, 16 and 32 µL/L air) for 24 h. We determined the mortalities and values of LC₅₀ and LC₉₉. The control groups of larval stage involved the same conditions without essential oil. Larvae were cooled on ice then sterilized with ethanol. Then, the extracts of larvae were prepared with a homogenizer, centrifuged and the supernatants were taken for examination of MDA level and CAT, SOD, GPx, AChE activities. Measurement of these parameters were determined by a UV-VIS spectrophotometer (Biotech Engineering, Spectroscan 60 DV). Protein concentrations were estimated according to the method of Lowry et al. (1951).

Measurement of oxidative stress parameters and AChE activities

Activity of AChE was measured by the procedure of Ellman et al. (1961). The reaction was monitored at 412 nm wavelength and the activity was estimated as U/mg protein. The levels of

MDA were measured by thiobarbituric acid (TBA) test as described by Ohkawa et al. (1979). We measured the absorbance at 532 nm. We defined the MDA level as nmol/mg protein. We measured the enzyme activity of CAT based on procedure of Aebi (1984). This procedure is based on determining the hydrolysis of H₂O₂. The absorbance was determined at 240 nm and the activity was given as mmol/mg protein. The method of Marklund and Marklund (1974) was used for SOD activity assessment at 440 nm and the enzymatic activity was indicated as U/mg protein. The GPx activity was measured by the procedure which was identified by Paglia and Valentine (1987). The reaction was searched at 340 nm and the activity was indicated as nmol/mg protein.

Statistical analysis

The data were analyzed in IBM SPSS 26.0 program for Windows by one-way analysis of the variance and Tukey test for multiple comparisons at a significance level of 0.05. LC₅₀ and LC₉₉ values were estimated by probit analysis with IBM SPSS 26.0 (Abbott, 1925).

Results and Discussions

These results indicate that essential oil *Capsicum annuum* can be used against *Tenebrio molitor* in a pest control program. The LC₅₀ and LC₉₉ values (μL/L air) of *Capsicum annuum* essential oil against *Tenebrio molitor* larvae are given in Table 1.

Table 1. LC₅₀ and LC₉₉ values (μL/L air) of *Capsicum annuum* essential oil against *Tenebrio molitor* larvae.

Time (24 h)	n	LC ₅₀ μL/L air	LC ₉₉ μL/L air	df ^b	sig	Chi-Square
larvae	20	8,558	19,064	5	0,423 ^a	4,939

n: number of the tested insects

a: Since the significance level is greater than 0,150, no heterogeneity factor is used in the calculation of confidence limits.

b: Statistics based on individual cases differ from statistics based on aggregated cases.

32 μL/L was the most effective essential oil dose against *Tenebrio molitor* larvae. Increasing doses of essential oil caused decreasing in SOD, CAT, GPx and AChE activities and increasing in MDA level.

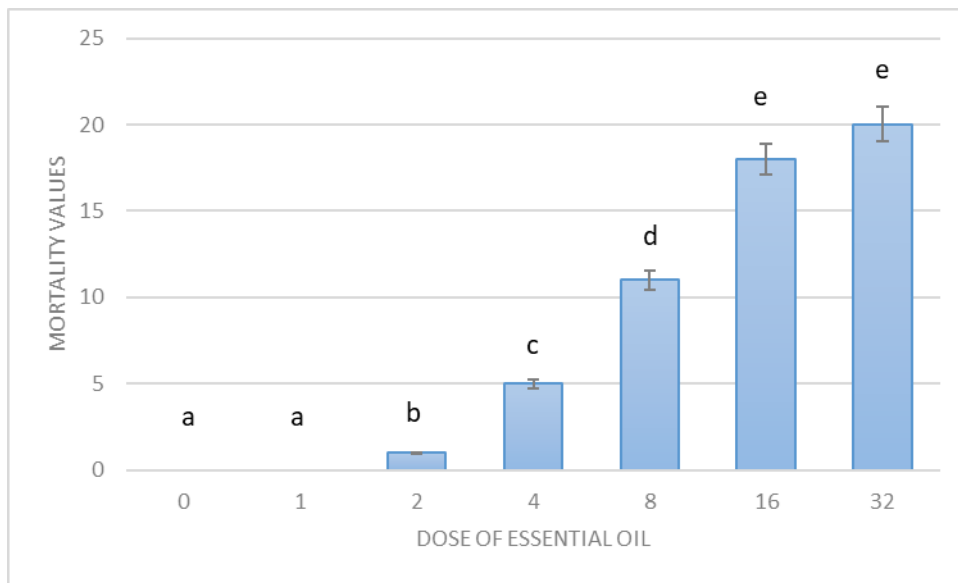


Figure 1. The mortality values of *Tenebrio molitor* larvae after exposure to *Capsicum annuum* essential oil for 24 h. Letters above bars indicate significant differences between concentrations. Bars with the same letter are not significantly different. Error bars indicate SD of means.

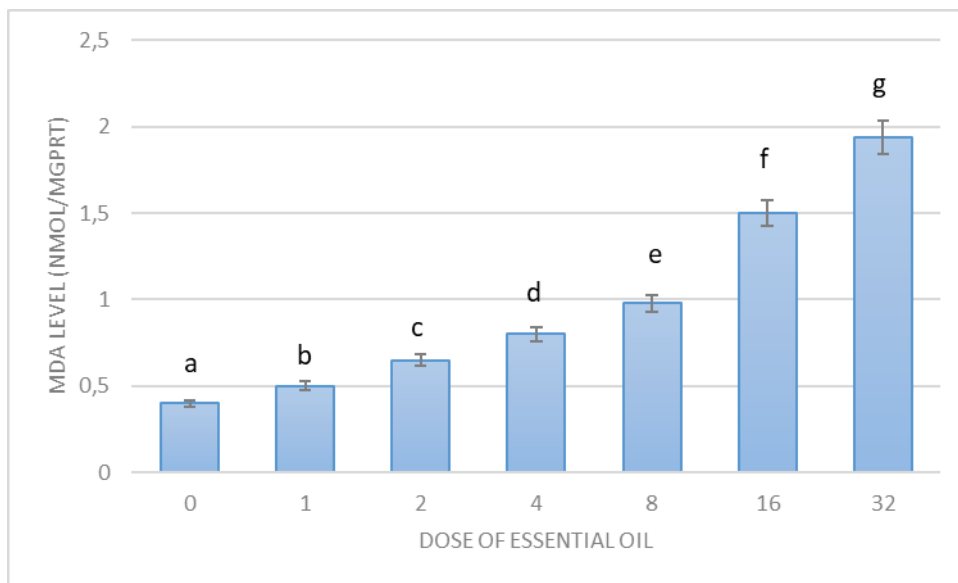


Figure 2. MDA levels of *Tenebrio molitor* larvae after exposure to *Capsicum annuum* essential oil for 24 h. Letters above bars indicate significant differences between concentrations. Bars with the same letter are not significantly different. Error bars indicate SD of means.

Table 2. Enzyme activities of *Tenebrio molitor* larvae after exposure to *Capsicum annuum* essential oil for 24 h.

Enzymes	control	1 μ L/L air	2 μ L/L air	4 μ L/L air	8 μ L/L air	16 μ L/L air	32 μ L/L air
AChE (U/mg protein)	0,038 \pm 0,0029 ^a	0,038 \pm 0,0031 ^a	0,037 \pm 0,0028 ^a	0,035 \pm 0,0024 ^a	0,034 \pm 0,0037 ^a	0,034 \pm 0,0033 ^a	0,034 \pm 0,0039 ^a
SOD (U/mg protein)	0,04 \pm 0,0015 ^a	0,039 \pm 0,0012 ^a	0,037 \pm 0,0011 ^a	0,034 \pm 0,0016 ^b	0,03 \pm 0,0013 ^c	0,026 \pm 0,0013 ^d	0,021 \pm 0,0017 ^e
CAT (mmol/mg protein)	64,3 \pm 3,74 ^a	62,7 \pm 4,11 ^a	61,2 \pm 4,80 ^a	59,3 \pm 3,62 ^a	50,2 \pm 4,10 ^b	39,9 \pm 5,26 ^c	30,1 \pm 4,42 ^d
GPx (nmol/mg protein)	0,365 \pm 0,012 ^a	0,363 \pm 0,017 ^a	0,33 \pm 0,014 ^b	0,305 \pm 0,016 ^b	0,267 \pm 0,020 ^c	0,231 \pm 0,013 ^d	0,205 \pm 0,011 ^e

Values are mean \pm standard deviation. Significance at $P < 0.05$. Within each row, means followed by the same letter are not significantly different.

Like our study, Adamski et al. (2016) stated that the repellent effect increased depending on time and concentration in their study with *S. tuberosum* extract against larvae and adults. In another study (Ignatowicz, 1998), they found that extracts obtained from the young leaves of *Artemisia vulgaris* L. and *Tanacetum vulgare* had a repellent effect on *Sitophilus granarius* and *S. oryzae*.

Conclusion

The results indicated that mortality increased with the increasing concentration of essential oil. Also, increasing doses of essential oil caused decreasing in SOD, CAT, GPx activities and increasing in MDA level. But there were no statistically differences between control and treatment groups in AChE activities. Today, there is a need for studies on herbal preparations within the framework of organic agriculture and good agricultural practices. Continuing research on this subject and studies on formulations are important. These results indicate that *C. annuum* essential oil exerts its effectiveness at the applied doses by creating oxidative stress.

References

- Abbott, W., (1925). A method for computing the effectiveness of an insecticide. *Journal of Economic Entomology*, 18: 265-267.
- Adamski, Z., Bufo, S. A., Chowański, S., Falabella, P., Lubawy, J., Marciniak, P., ... & Rosiński, G. (2019). Beetles as model organisms in physiological, biomedical and environmental studies—a review. *Frontiers in physiology*, 10, 319.
- Aebi, H. (1984). Catalase in vitro. *Methods in Enzymology*, 105: 121-126.
- Azizoglu, U., S. Yilmaz, S. Karaborklu & A. Ayvaz (2011). Ovicidal Activity of Microwave and UV Radiations on Mediterranean Flour Moth *Ephestia kuehniella* Zeller, 1879 (Lepidoptera: Pyralidae). *Türkiye Entomoloji Dergisi*, 35: 437-446.
- Chowański, S., Kudlewska, M., Marciniak, P., & Rosiński, G. (2014). Synthetic Insecticides-- is There an Alternative?. *Polish Journal of Environmental Studies*, 23(2).
- Costa, S., Pedro, S., Lourenço, H., Batista, I., Teixeira, B., Bandarra, N. M., ... & Pires, C. (2020). Evaluation of *Tenebrio molitor* larvae as an alternative food source. *NFS journal*, 21, 57-64.
- Davis, P. H. (1972). *Flora of Turkey and the East Aegean Islands*. Edinburgh: Edinburgh University Press, 4: 382-387.
- Ellman, G. L., K. D. Courtney, Jr. V. Andres & R. M. Featherstone (1961). A new and rapid colorimetric determination of acetylcholinesterase activity. *Biochemical Pharmacology*, 7: 88-95.
- Heiser, C. B. (1973). Introgression re-examined. *The Botanical Review*, 39, 347-366.
- Ignatowicz, S. (1998). Powdered herbs of the daisy family (Compositae) as repellents or attractants for the grain weevil, *Sitophilus granarius* (L.), and the rice weevil, *S. oryzae* (L.). *Annals of Warsaw Agricultural University SGGW, Horticulture (Landscape Architecture)*, (19), 15-28.
- Lowry, O. H., N. J. Rosebrough, A. L. Farr & R. J. Randall (1951). Protein measurement with the folin phenol reagent. *The Journal of Biological Chemistry*, 193 (1): 265-75.
- Marklund, S. & G. Marklund, (1974). Involvement of the superoxide anion radical in the autoxidation of pyrogallol and a convenient assay for superoxide dismutase. *European Journal of Biochemistry*, 47: 469-474.
- Nadeem, M., Anjum, F. M., Khan, M. R., Saeed, M., & Riaz, A. (2011). Antioxidant potential of bell pepper (*Capsicum annum* L.)-A review. *Pakistan Journal of Food Science*, 21(1-4), 45-51.
- Ohkawa, H., N. Ohishi & K. Yagi (1979). Assay for lipid peroxides in animal tissues by thiobarbituric acid reaction. *Analytical Biochemistry*, 95: 351-358.
- Paglia, D. E. & W. N. Valentine, 1987. Studies on the quantitative and qualitative characterization of glutathione peroxidase. *Journal of Laboratory and Clinical Medicine*, 70: 158-165.
- Tepe, B., Daferera, D., Sokmen, A., Sokmen, M., & Polissiou, M. (2005). Antimicrobial and antioxidant activities of the essential oil and various extracts of *Salvia tomentosa* Miller (Lamiaceae). *Food chemistry*, 90(3), 333-340.

KEDI VE KÖPEKLERDE HEMOTORAKS

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Özet

Plevral boşluk seröz zarlarla kaplıdır ve normalde parietal dolaşım (esas olarak interkostal arterler) tarafından sürekli olarak üretilen ve sağlıklı hayvanlarda parietal ve visseral plevranın kılcal damarları ve lenfatik sistemi tarafından boşaltılan az miktarda seröz sıvı içerir. Hemotoraks, göğüs duvarı, plevra veya intratorasik yapıların herhangi bir dokusunun bozulmasını takiben plevral boşluğa kanamayı yansıtan özel bir plevral efüzyon vakasını temsil eder. Hastalığın patogenezi göre pet hekimliğinde acil durum kategorisinde değerlendirilmektedir. Bu araştırmada kedi ve köpeklerde hemotoraksın klinik bulguları, tanı yöntemleri ve tedavisi hakkında bilgi verilmiştir.

Anahtar Kelimeler: Kedi, köpek, semptom, hemotoraks

HEMOTHORAX IN CAT AND DOGS

Abstract

The pleural cavity is lined by serous membranes and normally contains a small amount of serous fluid that is constantly produced by the parietal circulation (mainly the intercostal arteries) and drained by the capillaries and lymphatic system of the parietal and visceral pleura in healthy animals. Hemothorax represents a specific case of pleural effusion reflecting bleeding into the pleural space following disruption of any tissue of the chest wall, pleura, or intrathoracic structures. According to the pathogenesis of the disease, it is evaluated in the category of emergency in pet medicine. In this study, information was given about the clinical findings, diagnostic methods and treatment of hemothorax in cats and dogs.

Keywords: Cat, dog, symptom, hemothorax

Giriş

Plevral membranlar, tek bir mezotelyal hücre tabakasından ve daha derin bir elastik lifler tabakasından ve seyrek düz kas hücrelerinden oluşur. Arterler, toplardamarlar, kılcal damarlar ve lenfatikler bu derin bağ dokusu tabakasından geçer. Plevral boşluk içindeki sıvı miktarı; net basınç gradyanına, plevral membranların yüzey alanına ve drenaj mekanizmalarına bağlıdır (Stillion ve Letendre, 2015). Haemotorax, plevral boşlukta kanlı bir efüzyonun birikmesi, intratorasik yapıların/damar sisteminin bozulmasından ortaya çıkar. Hemotoraks en sık travma, koagülopati ve neoplazi/inflamatuvar durumlara sekonder olarak ortaya çıkar.

Plevral Boşluğun Anatomisi

Plevral boşluk, göğüs duvarını, akciğerleri, diyaframı ve mediasteni ayıran potansiyel bir bölme olup, plevra pariyetal ve visseral ile kaplıdır. Normalde torasik radyografi veya ultrasonla saptanamayan az miktarda sıvı bulunur. Pariyetal plevral kılcal damarlardaki yüksek hidrostatik basınç ve plevral boşluktaki düşük onkotik basınç, sıvının plevral boşluğa hareketini destekleyen yaklaşık 9 cmH₂O net filtrasyon basıncı oluşturur. Normal plevral sıvının yaklaşık %75'i, düz kas kasılmaları ve lenfatik akışı artıran solunum hareketi ile lenfatikler yoluyla boşaltılır. Plevral boşlukta kalan herhangi bir sıvı daha sonra düşük hidrostatik basınçları nedeniyle visseral plevral venöz kılcal damarlara hareket eder. Visseral plevranın büyük vaskülaritesi, akış direncini daha da azaltır ve net sıvı emilimini artırır (Stillion and Letendre, 2015). Plevral sıvının fizyolojik hacimleri türler arasında değişir (0.04 ila 0.6 ml/kg aralığında), canlı ağırlık artışıyla birlikte plevral sıvı hacmi/kg miktarında da azalma olmaktadır. Genel olarak köpeklerde plevral boşluğundaki sıvı miktarı 0.1 ml/kg bulunurken, kedilerin plevral boşluğunda 1 ila 5 ml sıvı bulunur ve bu miktar ise 0.3 ml/kg'a eşdeğerdir.

Patofizyoloji

Patolojik plevral sıvı birikimi, sıvı üretimi ve çıkarılması arasındaki dengesizliği yansıtır. Plevral sıvı birikimi – yani plevral efüzyon – şu durumlarda oluşur: a) Sıvı üretimi artış b) sıvının lenfatik sistem yoluyla yeniden emilmesi/drenajı engellenmesi. Artmış plevral sıvı üretimi aşağıdakilere sekonder olarak ortaya çıkabilir: 1) Azalan onkotik basınç, 2) Artan hidrostatik basınç, 3) Artmış damar geçirgenliği ve plevral sıvı drenajında azalma olabilir: 1) artan lenfatik basınç sonucu, 2) artan lenf sızıntısına ikincil olarak lenf sistemi. Transplevral basınç dengesindeki değişiklikler (yani, artan hidrostatik basınç veya azalmış onkotik basınç), bozulmuş lenfatik drenaj veya artan kapiller endotelyal geçirgenliğin tümü, plevral efüzyon gelişimine katkıda bulunabilir (Murphy ve Papsouliotis, 2011). Hemotoraks, göğüs duvarı,

plevra veya intratorasik yapıların herhangi bir dokusunun bozulmasını takiben plevral boşluğa kanamayı yansıtan özel bir plevral efüzyon vakasını temsil etmektedir (Scott, 2003).

Hemotoraksın Tanımı

İnsanlarda hemotoraks, hematokritin periferik hematokritin % 50'sinden fazla olduğu kanlı bir eksüdatif efüzyon olarak tanımlanmıştır (Azfar Ali ve ark., 2008). Hematokrit içeren sıvılar periferik hematokritin yüzde 25 ila 50'si hemorajik efüzyon olarak adlandırılır ve alternatif ayırıcı tanılara sahiptir. Veteriner tıbbında standart bir uygulama yoktur. Genel olarak, periferik hematokritin % 25'inden daha büyük bir hematokrit, bir hemotoraks ile uyumlu kabul edilir, ancak bazı araştırmacılar % 20'den fazla paketlenmiş plevral sıvı hücre hacmi kullanır (Rozanski 2017).

Hemotoraks Nedenleri

Kedi ve köpeklerde hemotoraksın farklı nedenlerinin sıklıklarını karşılaştıran veteriner literatüründe herhangi bir yayın bulunmamaktadır. Burada sunulan etiyojilerin listesi bir çalışmadan türetilmiştir. Köpeklerde koagülopatik olmayan spontan hemotoraksın (Nakamura ve ark., 2008), hemotoraksın tanımlandığı olaylar/bozukluklarla ilgili çalışmalar, bireysel vaka çalışmaları ve insan literatüründen spekülatif çıkarımlardır. Genel olarak hemotoraksa künt veya penetran travma veya neoplazi, akciğer lobu torsiyonu, bulaşıcı hastalık ve çeşitli çeşitli durumlarla birlikte spontan olarak ortaya çıkabilir. Kısaca kedi ve köpeklerde hemotoraksın başlıca etiyojileri travma, koagülopati ve neoplazi olarakta özetlenebilir (Tablo 1).

Tablo 1.: Hemotoraksın Sebepleri	
Travma	<ul style="list-style-type: none">• Karayolu trafiği çarpışması.• Penetran yaralanma• Ezilme/basma yaralanması• Hızlanma veya yavaşlama yaralanması
Koagülopati	<p>iyatrojenik</p> <ul style="list-style-type: none">• Göğüs Cerrahisi• İntratorasik ince iğne aspirasyonu• Venipunktür/juguler kateter yerleştirme <p>■ Kusurlu birincil hemostaz</p> <ul style="list-style-type: none">• Trombositopeni• Trombositopati• von Willebrand hastalığı <p>• Kusurlu ikincil hemostaz</p> <p>Kalıtsal faktör eksiklikleri Antikoagülan rodentisit zehirlenmesi Aşırı ibrinoliz/hipoibrinojenemi Tazılarda ameliyat sonrası kanama Angiostrongylus vasorum enfeksiyonu</p>
Spontaneous, non-coagulopathic	<ul style="list-style-type: none">○ Neoplasia• Torasik duvar kitleleri Osteosarkom Kondrosarkom Fibrosarkom Hemanjiyosarkom Mezotelyoma Akciğer karsinomu Metastatik yumurtalık karsinomu
Akciğer lobunun torsiyonu	
İnfeksiyöz hastalıklar	<ul style="list-style-type: none">• <i>Dirofilaria immitis</i>• <i>Streptococcus zooepidemicus</i>
Timik kanama/involüsyon	
Ehlers-Danlos sendromu	
Pancreatitis	

Travma

Torasik travmalar, köpek ve kedilerde künt veya penetran durumların bir sonucu olarak ciddi ve potansiyel olarak yaşamı tehdit eden yaralanmalara neden olur (Hackner, 1995; Looney, 2001; de Laforcade, 2002; Fossum, 2002b; Kirpensteijn, 2002; Yay, 2003; Tello, 2006; Pelosi ve ark., 2008). Göğüs travması, şokun yanı sıra kardiyovasküler ve solunum sistemi yaralanmalarına da neden olur. Göğüs travmasına bağlı olarak sıklıkla karşılaşılan patolojik durumlar; trakeal travma, pnömotoraks, hemotoraks, pulmoner kontüzyon, kaburga kırığı, yelken göğüs, miyokardiyal kontüzyon veya perforasyondur (Salci, 2003a; Salci, 2003b; Salci, 2004).

Tanı

Künt veya penetran torasik veya torakoabdominal travmayı takiben herhangi bir hayvanda ve ayrıca hipovolemi ve eş zamanlı solunum sıkıntısı belirtileri gösteren hayvanlarda hemotorakstan şüphelenilmelidir. Kapsamlı bir öykü, hemotoraksın olası etiyojisine ilişkin değerli ipuçları verebilir (Tablo 1). Kusma ve diyare az sayıda hemotoraks vakasında rapor edilmiştir (Nakamura ve ark. 2008) ve pankreatit düşünülmesine yol açabilir. Az sayıda hemotoraks vakasında kusma ve ishal bildirilmiştir (Nakamura ve diğerleri 2008) ve pankreatit (karın ağrısı ve iştah kaybı ile ilişkiliyse) düşünülmesine yol açabilir. Uyuşukluk dahil belirsiz sistemik belirtiler ve iştahsızlık da zaman zaman rapor edilir, ancak farklılık listesini daraltmaz. Hemotoraksın doğrulanması, plevral sıvı örneğinin analizini gerektirir. Tanısal torakosentez, uygun şekilde aşamalı bir yaklaşımın parçası olarak yapılmalıdır. Bazı durumlarda, plevral sıvı toplanmasından önce/olmadan hemotoraksın varlığından kuvvetle şüphelenilebilir. Bazen torakosentez terapötik olarak gerekli olmayabilir. Tanısal ve terapötik müdahalelerin dengesi, klinik belirtilerin ciddiyetini yansıtmalıdır.

Tablo 1. : Hemotoraksın klinik bulguları

Soluk mukoz membranlar	Uzun süreli kapiler geri çekilme süresi
Değiştirilmiş düşünce	Taşipne
Hipotermi	Kötü/zayıf çevresel nabız kalitesi
Taşikardi (kedilerin kalp atış hızı artmayabilir hızı ve bradikardik olabilir)	Soğuk ekstremiteler
	Hipotansiyon

Semptomlar

Hemotoraksın altta yatan nedenini belirlemeye yardımcı olabilecek diğer fizik muayene bulguları arasında dış yaraların (aşınmış pençeler, kırık kaburgalar, dış sıyrıklar veya morarma), birincil (peteşi veya ekimozlar) veya ikincil (diğer bölgeler) belirtiler hemostatik kusurlar veya kitle lezyonları (vücut duvarında deformasyona neden olan kaburga veya viseral kitleler) dir. Akut kan kaybını takiben, organ perfüzyonunu korumak için plazma hacminin hızlı bir şekilde değiştirilmesi de dahil olmak üzere bir dizi telafi edici değişiklik meydana gelir. Bu, ekstrasvasküler protein havuzunun mobilizasyonu ve ardından kan hacminin genişlemesi ile sağlanır (Adamson ve Hillman 1968). Anekdöt olarak, köpeklerde ve kedilerde paketlenmiş hücre hacmi, önemli kanamadan sonraki altı saat içinde değişebilir, ancak maksimum denge 24 saate kadar sürebilir. Kritik bir durumda bulunan hayvanlarda ilk kan çalışmasını yorumlarken, hematokritin daha da aşağı doğru ayarlanması beklenmelidir. Bu nedenle, intravenöz sıvı

desteđi veya transfüzyon tedavisine devam etme kararları, hayvanın hemodinamik durumunun fiziksel deęerlendirmesine dayanmalıdır. İlk kan numuneleri alınırken periferik damarların (örneğin, sefalik veya safenöz) kullanılması iyi bir uygulama olarak kabul edilir, çünkü bu, bir hematoma oluşması durumunda (örneğin, altta yatan bir koagülopatinin varlığı) boyundaki hayati yapıları sıkıştırma ihtiyacını ortadan kaldırır. Tam bir kan sayımı, anemiyi ölçer ve rejeneratif durumun bir göstergesini sağlar. Retikülositoz köpeklerde sadece üç ila beş gün, kedilerde beş ila yedi gün sonra gelişir ve hemotoraks bağlamında, kronikliđin bir göstergesidir. Otomatik trombosit sayımı, trombositopeniyi dışlamak veya doğrulamak için yararlı olabilir. Bir kan yayması incelemesinde, yüksek güçlü alan başına (x 100 objektif) üç veya daha fazla trombositin varlığı, kanama nedeni olarak trombositopeniyi ekarte etmek için yeterlidir. Tüylü kenar trombosit kümelerinin varlığı açısından da kontrol edilmelidir. Spontan kanamaya neden olacak kadar düşük trombosit sayısı, büyük olasılıkla immün aracılı kökenlidir. Uygun görüntüleme yoluyla altta yatan bir tetikleyici aranmalıdır.

Plevral Efüzyon Varlığına İlişkin Fiziksel Muayene Bulguları

Taşipne	Kısıtlayıcı solunum modeli (sıđ/hızlı solunum)
Ortopne	Solunum sırasında artan karın hareketi
Dispne	Ağızdan nefes alma (kediler)
Öksürük (üretken olmayan ve atelektatik akciđerdeki reseptörlerin uyarılmasına bağlanabilir)	Oskültasyon/perküsyon indisleri
Düzgün bođuk kalp/akciđer sesleri	Akışkan hattının varlığı
Perküsyonda ventral donukluk	

Fiziksel Muayene

Fizik muayene bulguları, altta yatan nedeni ortaya çıkararak veya önemli komorbiditeleri vurgulayarak faydalı tanısal bilgiler sağlayabilir. Hemotorakslı küçük hayvanlarda ortaya çıkan belirtiler, önemli bir kan hacminin yeniden dağılımının hemodinamik sonuçlarını, azalmış toplam akciđer kapasitesinden kaynaklanan solunum yetmezliğini veya altta yatan etiyolojiyi yansıtabilir. Nefes zorluklar ve takipne sadece 20 ml/kg plevral sıvı birikimi. Öyleyse, kan hacminin yüzde 15 ila 20'sinin hızlı kaybı (örn. 20 kg'lık bir köpekte 250 ila 350 ml kan) neden olabilir ve önemli olmayan hipovolemi belirtileri hayvanın nefesi üzerindeki etkisi. Kapasite görece yerleştirmek için plevral boşluđun belirgin solunum yolu olmayan büyük miktarda kan uzlaşma, hemotorakslı hayvanların olmaksızın hipovolemik şok sunabilir.

Tanısal Görüntüleme

Göğüs radyografileri, insan ve veteriner hastalarda plevral efüzyon tanısı için sıklıkla tercih edilen ilk görüntüleme yöntemidir (Stillion and Letendre, 2015). Kısıtlayıcı bir solunum paterninin ve katı kalp/akciğer seslerinin varlığı, plevral boşluk hastalığını oldukça düşündürür. Çeşitli torasik görüntüleme modaliteleri varlığını doğrulayabilir. Plevral sıvı varlığını belirlemede kullanılan tekniğin seçimi, ekipmanın kullanılabilirliğini, uzmanın deneyimini ve hasta stabilitesini yansıtmalıdır. Eğer vakada ciddi solunum yetmezliği varsa torakosentez görüntülemeden önce yapılabilir ve vaka stabil hale getirildikten sonra tanısal görüntüleme yapılmalıdır (Fossum,1998 ; Boysen ve Lisciandro, 2013).

Torasik Ultrasonografi

İnsanlarda ve küçük hayvanlarda plevral boşlukta serbest sıvının saptanması için ultrasonun hem fizik muayene hem de radyografiye eşit veya üstün olduğu kabul edilir (Ma ve Mateer 1997, Lisciandro ve ark., 2008). Ultrason, plevral efüzyonun hızlı bir şekilde saptanmasına izin verir ve radyografi ve BT için gerekli olan aynı düzeyde fiziksel veya kimyasal kısıtlama gerektirmez. TFAST (travma, triyaj veya izleme için sonografi ile torasik odaklı değerlendirme) tekniği, sınırlı ultrasonografi deneyimine sahip bir veterinerin, önemli bir plevral efüzyon olup olmadığını hızla tespit etmek için kullanabileceği bir ultrason yaklaşımıdır (Lisciandro 2011 ; Parlak, K., Zamirbekova, N., Uzunlu, E. O., Ayol, E. T., & Yavru, 2021). TFAST ile amaç tüm göğüs boşluğunu değerlendirmek değil, belirlenmiş bölgelere odaklanmaktır (Boysen ve Lisciandro, 2013).

Göğüs Radyografisi

Plevral efüzyonun radyografik kanıtı, interlobar damarların genişlemesini (orta boy bir köpekte >100 ml sıvı ile görülür (Thrall, 2018), kostofrenik bölgede akciğer kenarlarında taraklaşmayı içerir. Altta yatan bir hastalık sürecinin göstergesi olan diğer anormallikler de tespit edilebilir. Ventrodorsal projeksiyonlar küçük (potansiyel olarak klinik olarak önemsiz) plevral sıvı hacimlerini saptayabilir ve kimyasal veya fiziksel kısıtlama olmaksızın elde edilebilir. Hasta stabilitesi, radyografik görüntülerin elde edilmesinde potansiyel bir sınırlayıcı faktördür (Boysen ve Lisciandro, 2013). Torasik ultrason veya kör torakosentez dispneik bir hastada daha güvenli alternatifler olabilir. Plevral sıvının çıkarılması, intratorasik yapıların radyografik incelemesini de kolaylaştırır (Boysen ve Lisciandro, 2013).

Bilgisayarlı Tomografi

Kesitsel BT, radyografi ve ultrasona göre çeşitli avantajlar sunar. BT, yapıların üst üste binmesi olmadığı için orta düzeyde bir plevral sıvı hacmi varken yapılabilir. BT ayrıca anatomik yapıların üstün çözünürlüğünü sağlayarak radyografide gözden kaçabilecek plevral ve kaburga kitlelerinin saptanmasını sağlar. BT, sıvı birikiminin mediastinal veya plevral kitlelerden ayırt edilmesini kolaylaştırabilir ve ayrıca cerrahi ve onkolojik planlamaya rehberlik edebilir (Walters ve ark., 2018).

Torakosentez

Plevral efüzyondan şüphelenilen dispneik hayvanlarda radyografiler alınmadan önce torakosentez yapılmalıdır. Küçük miktarlarda plevral efüzyonun çıkarılması bile hayvanın ventilasyonunu önemli ölçüde iyileştirerek radyografik prosedürler için daha güvenli manipülasyona izin verebilir (Fossum, 1998).

Torakosentez için ihtiyaç duyulan malzemeler :

- Kelebek iğne (16 - 21 gauge) veya 18 - 20 gauge intravenöz kanül (daha büyük köpekler için daha uzun iğne uzunluğu),
- Şırınga (20 ml),
- Üç yollu musluk veya merkezleme valfi,
- Uzatma seti,
- Steril tüpler (sitolojik analiz, protein/lipit seviyeleri ve kültür ölçümü için),
- Sıvı toplama kabı (sürahi).

Torakosentez sıklıkla bilinçli bir hastada düşük oksijen temini ile yapılır. Gerekirse hafif sedasyon sağlanabilir (örn. düşük doz butorfanol, 0.1 ila 0.2 mg/kg). Hasta konumlandırma, stresi ve dispneyi en aza indirecek şekilde uyarlanmıştır; sternal uzanma veya hayvanın ayakta durması genellikle iyi tolere edilen ve erişilebilir pozisyonlardır. Yerleştirme noktasının etrafına lokal anestetik (lidokain) alınır. Torakosentez, 7. ve 9. interkostal boşluklar arasında (kaudal yerleşimli sinirlere ve damarlara zarar vermemek için kranial kaburgaya kadar) veya uygun bir sıvı cebinin belirlenmesi üzerine ultrason rehberliği ile toraksın ventral üçte birinde olacak şekilde torakosentez yapılır. Sıvı alınana kadar iğne yavaşça aspire edilirken yavaşça ilerletilir. Torakosentezin son noktası genellikle solunum sıkıntısının hafifletilmesidir, ancak

bazı vakalarda yalnızca minimal bir artık hacim bırakmaktan tanınasal yarar (özellikle radyografi için) olabilir. Akciğerler torasik boşluğu hasta edecek şekilde yeniden genişleyemezse, iyatrojenik pnömotoraks riski vardır. Re-ekspansiyon yaralanması, kronik efüzyonlara sekonder plevral fibrozis ile tanımlanır ve radyografilerde akciğer kenarlarında yuvarlaklaşma olduğunda şüphelenilebilir. Bununla birlikte, torakosentezin tehlikeleri abartılmamalı ve özellikle dispneik hastaların, prosedürün komplikasyonlarından ziyade aşırı plevral sıvının zararlı etkilerinden ölme olasılığı daha yüksektir. Ancak hayvanda solunum sıkıntısı göstermiyorsa sıvının çıkarılması gereksiz olabilir, çünkü kan diyafragmatik lenfatikler yoluyla plevral boşluktan hızla geri emilir (Day, 2014).

Sıvı Analizi

Plevral sıvının kaba görünümü açık kan görünümü olsa bile bu yanıltıcı olabilir. Plevral sıvı, hematokrit yüzde 5'i aştığında kanla aynı renge sahiptir ve bu nedenle doğrulamadan önce dikkatli olunmalıdır. Hemotoraks. Plevral sıvının hematokrit/paketlenmiş hücre hacminin ölçülmesi ve periferik kan ile karşılaştırılması, hemotoraksın kesin tanımını tamamlamak için gereklidir. Periferik kana benzer bir hematokrit, yakın zamanda travma/aktif kanamayı düşündürür. Periferik hematokritin %50'sinden fazlasına sahip plevral sıvı hematokritleri en sık travmatik orijinli hemotoraksta görülür ve malignitelere olağandışı kabul edilir. Tüm plevral efüzyon türleri için, biyokimyasal ve sitolojik özelliklerin analizi ve olası kültür dahil olmak üzere daha ileri teşhisler için sıvı toplanmalıdır. Sıvı, bir EDTA tüpüne (sitolojik inceleme ve hücre sayımı), düz bir tüpe (toplam protein ölçümü, pıhtılaşma özellikleri, özel biyokimyasal testler) ve aerobik ve anaerobik kültür için uygun kaplara toplanmalıdır. Örneklemeye (veya aktif patolojik kanama) sırasında meydana gelen iyatrojenik kanama trombositler içerir ve pıhtılaşacaktır. Eritrofagositoz eksikliği de patolojik hemorajik efüzyondan ayırt edilmesine yardımcı olur. Sıvının sitolojik incelemesi, bu özelliklerin değerlendirilmesinde ve atipik hücre materyalinin aranmasında yardımcı olur. Hemanjiyosarkomlar gibi bazı tümörlerin sitoloji temelinde teşhis edilmesi zor olsa da, malign hücrelerin tanımlanması neoplastik bir etiyojeniyi doğrulayabilir. Bu gibi durumlarda histopatolojik örnekler gereklidir.

Tedavi

Hemotoraks yönetimi duruma ve nedene bağlıdır. Oksijen tedavisi ve dolaşım desteğini içeren önlemler, ilk hasta stabilizasyonu için kritik öneme sahiptir. Önemli kan kaybından sonra, bazı hastalar kan ürünleri transfüzyonu için aday olabilir (Allerton, 2019). Solunum sıkıntısı çeken hayvana ek oksijen, fizik muayeneye izin vermek ve vasküler erişim sağlamak için analjezi ve

solunum sıkıntısını hafifletmek için terapötik torakosentez yapılabilir. Bunlar ek olarak hayvan efor/stresten durumlarında uzak tutulmalıdır. Hemotoraks tedavisi, altta yatan bozukluğa göre uyarlanır ve yoğun bakım, ölçülen sıvı çıkarılması, kanamayı durdurmak için doğrudan önlemler ve potansiyel olarak kaybedilen kanın değiştirilmesini içerebilir. Hemotoraks yönetimi vaka ve nedene bağlıdır. Oksijen tedavisi ve dolaşım desteğini içeren önlemler, başlangıç için kritik öneme sahiptir. Önemli kan kaybından sonra, bazı hastalar kan ürünleri transfüzyonu için aday olabilir. Altta yatan bir koagülopatiden şüpheleniliyorsa, kaybedilen eritrositleri ve pıhtılaşma faktörlerini yenilemek için tam kan tercih edilebilir. Bir koagülopati yoksa, paketlenmiş kırmızı kan hücreleri yeterli olabilir. Otolog kan transfüzyonu (hastanın dolaşımına geri dönmek için plevral boşluktan kırmızı kan hücrelerinin toplanması), hemotorakslı bazı kedi ve köpeklerde etkili bir acil durum önlemi olabilir (Higgs ve ark., 2015). Sepsis veya antikoagülan intoksikasyonu durumlarında uygun değildir ve neoplastik bir kökenden şüpheleniliyorsa dikkatle değerlendirilmelidir. Uygulama için her zaman uygun bir filtre kullanılmalıdır.

İmmünsüpresif ilaçlar (\pm vinkristin) ve gerektiğinde kaybedilen kırmızı kan hücrelerinin yerine konması, birincil immün aracılı trombositopeni tedavisinin temel dayanağıdır. Doğrulanmış veya olası antikoagülan intoksikasyonları K1 vitamini \pm bir plazma transfüzyonu (taze dondurulmuş veya saklanmış) ile tedavi edilebilir. Taze donmuş plazma transfüzyonu veya kriyopresipitat, von Willebrand hastalığına sahip olduğundan şüphelenilen veya doğrulanmış köpekler için uygun transfüzyon ürünleridir (Higgs ve ark., 2015 ; Allerton, 2019). *Angiostrongylus vasorum* durumlardan ise Fenbendazol, milbemisin oksim veya imidakloprid/moksidektin uygulanmalıdır (Di Cesare ve Traversa, 2014).

Akciğer lobu torsiyonu veya torakal maligniteleri olan hastalar göğüs cerrahisi gerektiren bazı cerrahi işlem yapılmalıdır. Özellikle göğüs duvarı tümörlerinin prognozu histopatolojik sonuçlara bağlı olarak bazı vakalarda rezeksiyon küratif olabilir veya uzun süreli remisyonla sonuçlanabilir (Allerton, 2019).

KAYNAKLAR

- Allerton, F. (2019). Diagnosing and treating haemothorax in dogs and cats. *In Practice*, 41(8), 349-60.
- Boysen, S.R., Lisciandro, G.R. (2013). The use of ultrasound for dogs and cats in the emergency room: AFAST and TFAST. *Veterinary Clinics: Small Animal Practice*, 43(4), 773-797.
- Day, S.L. (2014). Thoracostomy tube placement, drainage and management in dogs and cats. *Veterinary Nursing Journal*, 29(2), 42-46.
- Fossum, T.W. (1998). Pleural effusion: recent advances in diagnosis and treatment. *Veterinary Quarterly*, 20(sup1), 9-10.
- Hackner, SG (1995). Emergency management of traumatic pulmonary contusions. *Comp. Cont. Educ. Pract. Vet.*, 17: 677-686.
- Higgs, V.A., Rudloff, E., Kirby, R., Linklater, A.K. (2015). Autologous blood transfusion in dogs with thoracic or abdominal hemorrhage: 25 cases (2007–2012). *Journal of Veterinary Emergency and Critical Care*, 25(6), 731-738.
- Murphy, K., Papasouliotis, K. (2011). Pleural effusions in dogs and cats: 1. Diagnostic investigation. *In Practice*, 33(9), 462-469.
- Nakamura, R.K., Rozanski, E.A., Rush, J.E. (2008). Non-coagulopathic spontaneous hemothorax in dogs. *Journal of Veterinary Emergency and Critical Care*, 18(3), 292-297.
- Parlak, K., Zamirbekova, N., Uzunlu, E. O., Ayol, E.T., Yavru, N. (2021). Comparison of the focused assessment with sonography for trauma protocol and animal trauma triage scoring system in traumatized dogs. *Kafkas Univ Vet Fak Derg* 27 (4): 439-444.
- Pelosi, A; Hauptman, JG; Eyster, GE; Beal, MW; Anderson, LK, Olivier, NB (2008). Myocardial perforation by a stick foreign body in a dog. *J. Vet. Emerg. Crit. Care*. 18: 184-187.
- Salci, H (2003a). Thoracic trauma in cats and dogs I: etiology, incidence and pathophysiology. *J. Turkish Vet. Surg.*, 9: 78-82.
- Salci, H (2003b). Thoracic trauma in cats and dogs II: clinical findings, diagnosis and treatment. *J. Turkish Vet. Surg.*, 9: 71-80.
- Salci, H (2004). Tube thoracostomy and thoracic drainage in dogs and cats. *J. Turkish Vet. Surg.*, 10: 38-46.
- Salci, H; Bayram, AS and Gorgul, OS (2009a). Outcomes of Heimlich valve drainage in dogs. *Aust. Vet. J.*, 87: 148-151.
- Salci, H; Cecen, G; Gorgul, OS and Akin, I (2009b). Multiple thoracic and thoracoabdominal trauma: case report. *J. Fac. Vet. Med., University of Kafkas*. 15: 473-476.
- Scott JA. (2003). Canine pyothorax: pleural anatomy and pathophysiology. *Compend Contin Educ Pract Vet*. 25(3):172–179.

- Di Cesare, A., Traversa, D. (2014). Canine angiostrongylosis: recent advances in diagnosis, prevention, and treatment. *Veterinary Medicine: Research and Reports*, 181-192.
- Stillion, J.R., Letendre, J.A. (2015). A clinical review of the pathophysiology, diagnosis, and treatment of pyothorax in dogs and cats. *Journal of Veterinary Emergency and Critical Care*, 25(1), 113-129.
- Walters, A.M., O'Brien, M.A., Selmic, L.E., Hartman, S., McMichael, M., O'Brien, R.T. (2018). Evaluation of the agreement between focused assessment with sonography for trauma (AFAST/TFAST) and computed tomography in dogs and cats with recent trauma. *Journal of Veterinary Emergency and Critical Care*, 28(5), 429-435.

HAYVAN SAĞLIĞINDA SELENYUM ÖNEMİ

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Özet

Selenyum, insanların ve evcil hayvanların beslenmesinde önemli bir eser elementtir. Vücutta önemli bir rol oynayan 30'dan fazla selenoprotein bir bileşendir. Selenoproteinler, hücreleri birçok kronik hastalığın nedeni olan serbest radikallerin neden olduğu hasarlardan korur. Bunlara ek olarak tiroid hormonlarının metabolizmasına katılmakta, üreme fonksiyonlarını kontrol etmekte ve nöroprotektif etkiler göstermektedir. Ayrıca anti-proliferatif ve antiinflamatuar özelliklerinin yanı sıra bağışıklık sisteminde uyarmaktadır. Bu araştırmada selenyum iz elementinin evcil hayvanlardaki önemi hakkında bilgi verilecektir.

Anahtar kelimeler: Selenyum, hayvan, etki, önem

THE IMPORTANCE OF SELENIUM IN ANIMAL HEALTH

Abstract

Selenium is an essential trace element in the diet of humans and domesticated animals. It is a component of more than 30 selenoproteins that play an important role in the body. Selenoproteins protect cells from damage caused by free radicals, which are the cause of many chronic diseases. In addition to these, it participates in the metabolism of thyroid hormones, controls reproductive functions and shows neuroprotective effects. In addition to its anti-proliferative and anti-inflammatory properties, it also stimulates the immune system. In this study, information will be given about the importance of the trace element selenium in domesticated animals.

Keywords: Selenium, animal, effect, importance

GİRİŞ

Selenyum

Selenyum (Se), antioksidan aktivite, antiinflamatuvar, antimutajenik, antikanserojenik veya kemopreventif, antiviral, antibakteriyel, antifungal ve antiparaziter etkiler gösteren temel bir eser elementtir (Hosnedlova ve ark., 2017). Selenyum (Se), memeli biyolojisi için gereklidir; çünkü önemli enzimatik fonksiyonlu selenosistein gibi pek çok selenoproteinlerin bir bileşenidir (Kozat, 2006). Selenyum içeren peroksidazlar (Glutathion Peroksidaz (GPx)) sınırlandırıldığında (selenyum noksanlığına bağlı olarak) dokularda serbest radikallerin düzeyleri artar ve dokularda hasarlara neden olur (Tórtora-Pérez, 2010). Dokulardaki peroksidasyon reaksiyonlarını sonlandırmak ve dokuları peroksidasyona karşı korumak için vitamin E ve Bakır-Çinko superoksit Dismutaz (Cu-Zn SOD) ve Mangan superoksit Dismutaz (MnSOD), Katalaz, Glutathionsulfur- transferaz gibi enzimler tarafından paylaşılır (Tórtora-Pérez, 2010). Ayrıca selenyum selenoenzimeler tip I ve hormon 3,3',5 tri- iyodthironin (T₃) üretim için önemli iyodthironin deiodinaz tip II işlevleri için gereklidir (Hosnedlova ve ark., 2017).

Selenyumun Vücuttaki Rolü

Selenyum, antioksidan savunma, tiroid hormonlarının oluşumu, DNA sentezi, doğurganlık ve üreme gibi birçok biyolojik fonksiyonda önemli rol oynayan selenoproteinlerin temel bir bileşenidir. Selenyum organizmada çeşitli metabolitlere dönüştürülebilir. Metilselenol gibi bazıları kanserin önlenmesinde rol oynar. Selenyum, E vitamininin yanı sıra dayanıklılık ve iyileşmeyi iyileştirerek ve yaşlanma sürecini yavaşlatarak kas fonksiyonunda da rol oynar (Mehdi ve ark. 2013).

Gastrointestinal Sistemine Etkisi

Selenyum (Se), hayvanların çok çeşitli fizyolojik aktivitelerde rol oynadığı için hayvan yeminde daha küçük konsantrasyonlarda zorunlu olarak gerekli olan önemli bir mikro besin elementidir (Khan ve ark., 2006). Geviş getiren hayvanların gastrointesitnal sistemi, çok kompartmantlı midelerin (özellikle rumen) ardından ince ve kalın bağırsakların varlığıyla karakterize edilir. Rumen ve kalın bağırsak (özellikle kolon ve sekum) kısa zincirli yağ asitleri (SCFA) üretilir. Geviş getiren hayvanların vücut kondisyonu, büyüme ve üretim için ihtiyaç duyduğu enerji ihtiyacının yaklaşık % 90'ını üretilen kısa zincirli yağ asitlerinden karşılamaktadır (Malhi ve ark., 2013). Bir hayvanın büyüme ve üretim performansı, besinlerin sindirim sistemi boyunca etkili bir şekilde sindirilmesi, emilmesi ve uygun kullanım için emilen besinlerin verimli periferik akışı gerekir. Sindirim organlarının büyümesi, vücut büyümesinin

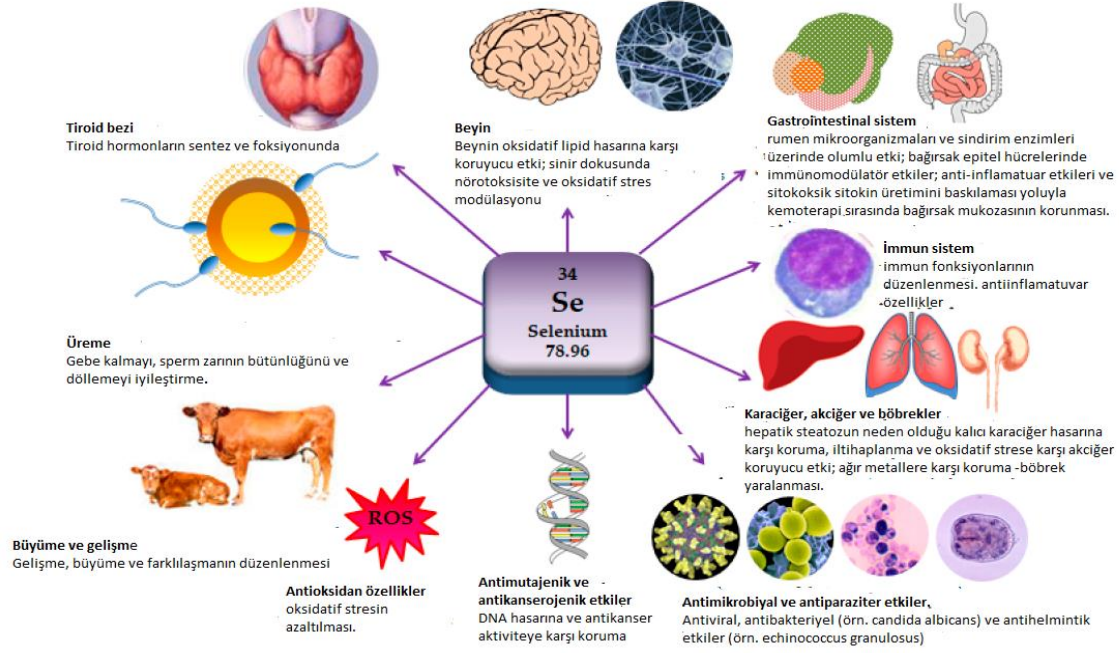
önemli bir göstergesi olup ve besin kullanım miktarını temsil etmektedir (Johnson ve ark., 1990). Hayvan rasyonlarına selenyum başka olmak üzere iz minerallerin rasyona eklenmesi gastrointestinal sistemin gelişimine ve besin sindirilebilirlik oranlarını etkilediği belirtilmektedir. Hayvan rasyonuna 0.2 – 0.6 mg/kg oranında eklenen inorganik Se, selenat veya selenit formları yüksek konsantrasyonla beslenen koyunlarda gastrointestinal sistemin sindirilebilirliğini artırırken (Del Razo-Rodriguez ve ark., 2013), düşük konsantrasyonla beslenen koyunlarda hiçbir etki gözlenmediği rapor edilmiştir.

Antioksidan Etkisi

Oksidasyon reaksiyonları, et ürünlerinin besleyici değerini ve tatlarını olumsuz etkiler ve glutatyon peroksidazın (GSHPx) antioksidan özelliği ile önlenir (DeVore ve ark., 1983; Gatellier ve ark., 2004). Oksidasyondaki azalma, ette bir antioksidanın mevcudiyetini gerektiren et kalitesini korur (Samo ve ark. 2018).

Glutatyon Peroksidaz (GPx)

Glutatyon peroksidazlar (GPx), antioksidan enzimlerin bir ailesidir. Başlıca işlevleri, hücre içi ve hücre dışı bölmelerdeki hidrojen peroksit ve organik hidroperoksitleri nötralize etmektir. Yakın tarihli bir derlemede, Brigelius ve ark. (2013), glutatyon peroksidazların çeşitli yönleriyle ilgili en son bilgileri özetledi. Benzer özelliklerle karakterize edilen sekiz GPx formu vardır. Farklı modları, etki yerleri ve farklı kimyasal formları vardır. E vitamini ile sinerji içinde hücreleri H₂O₂ veya organik hidroperoksitlerin birikmesinden korurlar ve hücre zarlarının sürekli bütünlüğünü sağlarlar. Enzimatik aktiviteleri, nötralizasyon gerçekleştirmek için özellikle selenyuma bağımlı olan 1 ila 4 formları için selenyum alımıyla doğru orantılıdır. Bu nedenle selenyum eksikliği ile oksidatif stres arasında güçlü bir bağlantı vardır (Ducros ve Favier, 2004).



Şekil 1.: Selenyumun fizyolojik etkileri (Hosnedlova ve ark., 2017). Selenyum, antioksidan, antitumör ve antikarsinojenik özellikleriyle bilinir, ayrıca parazitlerin yanı sıra mikroplara karşı da etki eder ve antiinflamatuar etkilere sahiptir, metabolizmayı, büyümeyi ve gelişmeyi sağlar, organları oksidatif stresten korur, bağışıklık fonksiyonunu etkiler ve doğurganlığı artırır.

Tiroid Bezi

İyodotironin deiyodinazlar ayrıca tiroksinin (T4) metabolik olarak aktif bir tiroid hormonu olan 3,5,3'-triyodotironine (T3) veya ters 3,5,3'-triyodotironine dönüşümünü düzenleyen önemli bir selenoenzim grubudur. Tip 1 5'-iyodotironin deiyodinaz, tiroid bezi gibi T3 hormonu üreten karaciğer ve böbreklerde bulunur. Geviş getiren hayvanlarda beyinde ve hipofiz bezlerinde de varlığı kaydedilmiştir (Zarczynska ve ark., 2013).

Selenyumun Bağışıklık Sistemi Üzerindeki Etkisi

Selenyum bağışıklık sistemini etkiler ve selenyum bileşikleri humoral bağışıklık mekanizmalarını etkileyerek tip M immünoglobulin düzeylerini artırır (Maggini ve ark., 2007). Hayvan yemine selenyum takviyesi, antikör düzeylerini artırır, nötrofil granüositleri ve makrofajların fagositik aktivitesini artırır ve miyojenlerle uyarıldığında T lenfosit sayısını artırır (Kamada ve ark., 2007).

Antiparaziter ve antimikrobiyal etki

Selenyum (Se), antioksidan aktiviteyi, antiinflamatuvar, antimitojenik, antikanserojenik veya kemopreventif özellikleri gösteren temel bir iz elementtir. Bunun yanı sıra antiviral, antibakteriyel, antifungal ve antiparazitik etkilere sahiptir

Noksanlık

Bütün dokular gelişimleri süresince oksidaz strese duyarlıdır. Çiftlik hayvanlarında antioksidan selenyum' un azalışına bağlı olarak çok çeşitli klinik belirtiler görülür. Selenyum noksanlığına bağlı olarak buzağılarda, kuzularda, oğlaklarda, taylarda ve eşeklerde beyaz kas hastalığı (WMD) veya beslenme kas distrofisidir (NMD) hastalıklar oluşmaktadır (Millar ve ark. 1986; Underwood, 1997; Tórtora-Pérez, 2010; Hosnedlova ve ark., 2017).

Selenyum Konsantrasyon Düzeyinin Ölçümü

Organizmadaki selenyum durumu, selenyum içeriğinin belirlenmesine dayalı olarak doğrudan veya selenyum bağımlı glutasyon peroksidaz aktivitesine dayalı dolaylı yöntem kullanılarak değerlendirilebilir (Hosnedlova ve ark., 2017).

Tablo1. Sığırlarda Selenyum düzeyleri (Kincaid, 1999).

	Selenyum		
	Tam kan ng/ml	Karaciğer µg/g DM (yetişkin)	Karaciğer µg/g DM (genç)
Ciddi derecede eksik	< 60	0.1 -0.5	< 1.1
Marjinal olarak yetersiz	60- 200	.6 - 1.25	1.1- 2.2
Yeterli	210-1200	1.25 - 2.5	2.3 - 8.0
Yüksek Yeterli	> 1.200	> 2.5	
Toksik			

KAYNAKLAR

- Brigelius-Flohé, R., & Maiorino, M. (2013). Glutathione peroxidases. *Biochimica et Biophysica Acta (BBA)-General Subjects*, 1830(5), 3289-3303.
- Davis, C.D.; Tsuji, P.A.; Milner, J.A. (2012). Selenoproteins and cancer prevention. *Annu. Rev. Nutr.* 32, 73–95.
- Del Razo-Rodriguez, O.E., Ramirez-Bribiesca, J.E., Lopez-Arellano, R., Revilla-Vazquez, A.L., Gonzalez-Munoz, S.S., Cobos-Peralta, M.A., Hernandez-Calva, L.M. and McDowell, L.R. (2013). Effects of dietary level of selenium and grain on digestive metabolism in lambs. *J. Anim. Sci.*, 58: 253-261.
- DeVore, V.R., Colnago, G.L., Jensen, L.S. and Greene, B.E. (1983). Thiobarbituric acid values and Glutathione peroxidase activity in meat from chickens fed a selenium supplemented diet. *J.Food. Sci.*, 48: 300-301.
- Ducros, V.; Favier, A. (2004). Selenium metabolism. *EMC Endocrinol. Nutr.* 1, 19–28
- Finch, J.M.; Turner, R.J. (1996). Effects of selenium and vitamin E on the immune responses of domestic animals. *Res. Vet. Sci.* 60, 97–106.
- Gatellier, P., Mercier, Y., Juin, H. and Renerre, M. (2004). Effect of finishing mode (pasture- or mixed –diet) on lipid composition, colour stability and lipid oxidation in meat from Charolais cattle. *Meat Sci.*, 69: 175-186.1147.
- Graham, T.W. (1991). Trace element deficiencies in cattle. *Vet. Clin. North. Am. Food Anim. Pract.* 7, 153–215.
- Guyot, H.; Rollin, F. (2007). The diagnosis of selenium and iodine deficiencies in cattle. *Le diagnostic des carences en sélénium et iode chez les bovins* 151, 166–191.
- Hefnawy A.E.G; Tórtora-Pérez J.L. (2010). The importance of selenium and the effects of its deficiency in animal health. *Small Rumin. Res.* 89, 185–192.
- Hosnedlova, B., Kepinska, M., Skalickova, S., Fernandez, C., Ruttkay-Nedecky, B., Malevu, T. D., ... & Kizek, R. (2017). A summary of new findings on the biological effects of selenium in selected animal species—a critical review. *Int. J. Mol. Sci.* 18(10), 2209.
- Johnson, D.E., Lee, P.L., Lu, J. and Williams, L.T. (1990). Diverse forms of a receptor for acidic and basic fibroblast growth factors. *Mol. Cell. Biol.*, 10: 4728- 4736.
- Kamada, H., Nonaka, I., Ueda, Y., Murai, M. (2007). Selenium addition to colostrum increases immunoglobulin G absorption by newborn calves. *Journal of Dairy Science*, 90(12), 5665-5670.
- Khan, Z., Hussain, A., Ashraf, M. and McDowell, L. (2006). Mineral status of soils and forages in Southwestern Punjab-Pakistan: Micro-minerals. *Asian-Aust. J. Anim. Sci.*, 19: 1139
- Maggini, S., Wintergerst, E. S., Beveridge, S., Hornig, D. H. (2007). Selected vitamins and trace elements support immune function by strengthening epithelial barriers and cellular and humoral immune responses. *British journal of nutrition*, 98(1), 29-35.
- Malhi, M., Gui, H., Yao, L., Aschenbach, J.R., Gäbel, G. and Shen, Z. (2013). Increased papillae growth and enhanced short-chain fatty acid absorption in the rumen of goats are associated with transient increases in cyclin D1 expression after ruminal butyrate infusion. *J. Dairy Sci.*, 96: 7603-7616

- Mehdi, Y., Hornick, J. L., Istasse, L., & Dufrasne, I. (2013). Selenium in the environment, metabolism and involvement in body functions. *Molecules*, 18(3), 3292-3311.
- Papp, L.V.; Holmgren, A.; Khanna, K.K. (2010). Selenium and selenoproteins in health and disease. *Antioxid. Redox Signal.* 12, 793–795.
- Samo, S. P., Malhi, M., Gadahi, J., Lei, Y., Kaciwal, A. B., & Soomro, S. A. (2018). Effect of Organic Selenium Supplementation in Diet on Gastrointestinal Tract Performance and Meat Quality of Goat. *Pakistan Journal of Zoology*, 50(3).
- Schrauzer, G.N. (2000). Selenomethionine: A review of its nutritional significance, metabolism and toxicity. *J. Nutr.* 130, 1653–1656.
- Sordillo, L.M. (2013). Selenium-dependent regulation of oxidative stress and immunity in periparturient dairy cattle. *Vet. Med. Int.* 2013, e154045.
- Spears, J.W.; Weiss, W.P. (2008). Role of antioxidants and trace elements in health and immunity of transition dairy cows. *Vet. J.* 176, 70–76.
- Zarczynska, K., Sobiech, P., Radwinska, J., Rekawek, W. (2013). Effects of selenium on animal health. *Journal of Elementology*, 18(2). 329–340.

PERINATAL VE NEONATAL DÖNEMDE BUZAĞI KAYIPLARININ ÖNLEME STRATEJİLERİ

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Özet

Perinatal mortalite, en az 260 günlük gebelik döneminden sonra, fetüsün veya buzağının doğumdan önce, buzağılama sırasında veya doğumdan sonraki 48 saat içinde görülen kayıpları (ölümleri) tanımlarken, neonatal ölümü ise doğumun başlangıcından doğum sonraki otuz ikinci güne kadar ki periyottaki buzağı ölümü tanımlamaktadır. Süt sığırcılığında buzağı verim kaybı ve ölümleri yaklaşık % 60'ı iki dönem içerisinde meydana gelmektedir Sütçü inek işletmelerinde hem biyolojik hem de ekonomik verimliliği etkileyen en önemli faktörler üreme performansı, ölüm oranının azalış ve yavrunun büyüme hızıdır. Bu araştırmada buzağılama dönemlerimde yaygın görülen ve buzağılarda verim ve ölüm neden olan durumlar hakkında bilgi verilmiştir.

Anahtar Kelimeler: Buzağı, perinatal, neonatal, periyot

PREVENTION STRATEGIES FOR CALF LOSS IN PERINATAL AND NEONATAL PERIOD

Abstract

Perinatal mortality defines losses (deaths) of the fetus or calf before birth, during calving or within 48 hours after birth, after a gestation period of at least 260 days, while neonatal death defines calf death in the period from the onset of birth to the thirty-second day after birth. Approximately 60% of calf yield loss and death in dairy cattle breeding occur in two periods. The most important factors affecting both biological and economic efficiency in dairy cow farms are reproductive performance, decrease in mortality rate and growth rate of offspring. In this study, information was given about the conditions that are common in my calving periods and that cause yield and death in calves.

Keywords: Calf, perinatal, neonatal, period

GİRİŞ

Sütçü inek işletmelerinde hem biyolojik hem de ekonomik verimliliği etkileyen en önemli faktörler üreme performansı, ölüm oranının azalış ve yavrunun büyüme hızıdır (Drennan ve Berry, 2006). Perinatal mortalite, en az 260 günlük gebelik döneminden sonra, fetüsün veya buzağının doğumdan önce, buzağılama sırasında veya doğumdan sonraki 48 saat içinde görülen kayıpları (ölümleri) tanımlarken (Jawor ve ark., 2021), neonatal ölümü ise doğumun başlangıcından doğum sonraki otuz ikinci güne kadar ki periyottaki buzağı ölümlerin tanımlamaktadır. Süt sığırcılığında buzağı verim kaybı ve ölümleri yaklaşık % 60'ı iki dönem içerisinde meydana gelmektedir. Doğum süreci bir buzağının hayatında travmatik ve tehlikeli bir olayların görüldüğü bir kaotik süreçtir. Bu sürecin etiklenmesi, fetal kortizolün yükselmesiyle başlar, ardından annede uterus kasılmalarına, serviksin genişlemesine, fetüsün doğumu ve son olarak plasentanın atılmasına yol açan endokrin olayları kapsamaktadır (Senger, 1999). Ancak bazen pek çok farklı faktör, doğumla ilgili fetal veya maternal sistemleri bozabilir ve distosi ile sonuçlanabilir (Breazile ve ark., 1988; Murray and Leslie, 2013). Yeni doğan memelilerin doğumdan sonra hayatta kalması, belirli bir davranış modelinin hızlı bir şekilde ifade edilmesine bağlıdır. Bu davranışlar; ayakta durma, yürüme, emzik arama ve kolostrum ve süt emmeyi içerir (Holdsworth ve ark. 2022). Büyük ölçekli, çoklu çiftlik çalışmalarında perinatal dönemde süt buzağılarının %2.4-9.7'sinin çok çeşitli nedene bağlı olarak öldüğü veya %6.2 oranında ise düşük canlı ağırlıklı oldukları rapor edilmektedir (Fourichon ve ark., 2001; Ghavi Hossein-Zadeh ve ark., 2008; Cuttance ve ark., 2019). Perinatal ölüm (PÖ) için önemli risk faktörleri arasında ilk buzağılama yaşı (Chassagne ve ark., 1999), annenin cinsi, üreme yöntemi, buzağılama yönetimi, fetomaternal sağlık durumu, gebelik süresi (López Helguera ve ark., 2016), gebelik beslenmesi, buzağı cinsiyeti ve tohumlamada kullanılan boğanın ırkı (Mee ve ark., 2014) yer alır. Perinatal ölüm (PÖ) için birçok risk faktörü yönetimin kontrolü altında olmasa da (doğum yılı, doğum ayı, ikiz doğum, primiparite, önceki perinatal mortalite ve fetal cinsiyet) değiştirilebilir (Mee ve ark. 2013). Eğer doğumdan hemen sonra bu hayatta kalmayla ilgili davranışların modellerinde herhangi bir bozulma saptanırsa yeni doğan buzağın canlılık değerlendirilmesi ise 'düşük (zayıf) canlılık' olarak nitelendirilir (Tuchscherer ve ark., 2000). Perinatal mortalite, genç süt hayvanlarının başarılı yönetiminde önemli bir sorun olup ve süt üretimini, üremeyi ve annenin sağlığını olumsuz etkiler (Mee, 2008; Mee ve ark. 2013; Mee, 2013; Mee, 2023). Yeni doğan buzağın canlılık değerlendirme kriterleri tablo 1'de özetlenmiştir.

Tablo 1. Yeni doğan buzağı canlılığının değerlendirilmesi

Kriter	İyi Canlılık	Zayıf Canlılık
Solunum	50-75 bpm ve göğüs solunumu	Nefes nefese kalma, primer apne, düzensiz, abdominal solunum, uğultu ve sekonder apne
Vücudu kaplayan kıl görünümü	Plasenta sıvısı kaplı	Mekonyum lekeleri mevcut
Periferik ödem	Yok	Baş, dil veya ayaklarda ödem
Mukoza membranları	Pembe ve normal kapiller dolun süresi	Siyanotik, soluk ve yavaş kapiller dolun süresinde uzama
Refleks stimülasyonuna yanıt	Güçlü kafa sallama, güçlü kornea, emme veya pedal çevirme refleksi	Zayıf veya yanıt yok
Kas tonusu	Birkaç dakika içinde kafayı doğrultarak aktif hale getirme	Hareketsizlik ve sarkık kas yapısı
Nabız	100-150 bpm ve düzenli	> 150 bpm'yi takiben bradikardi (<80 bpm) ve düzensiz, azalan bir hız
Rektal sıcaklık	Doğumda 39-39.5°C, doğumdan sonra 38.5-39°C düşer. 1 saat ve kararlı	Doğumda 39.5-40°C, buzağılama sonrası düşüş <38.5°C ve 1 saatte ve azalır
Sternal yaslanma	5 dakika içinde ulaşılır	Uzun süreli yan yatma
Ayağa kalkma girişimleri	15 dakika içinde ayağa kalkmaya çalışmak 1 saat içinde ayakta durmak	Gecikmeli veya ayağa kalkma girişimi yok
Emzirme refleksi	2 saat içinde başlar	Emzirme girişiminde gecikme veya hiç girişimde bulunmama

Perinatal Hipotermi

Buzağılar prekocal termoregülasyonla doğmasına rağmen, ılıman bir ortamda genç buzağuların dörtte birine kadarında birincil hipotermi (rektal sıcaklık 98.6°F, <37°C) meydana gelebilir. Perinatal hipotermi, ayağa kalkma süresinin uzaması, kolostral immünoglobulinlerin geç emilimi gibi durumlarda sıkça görülen klinik bir tablodur. Doğumda, buzağın rektal sıcaklığı anneninkinden daha yüksek olup ve beden sıcaklığı 38.5 ve 40.0°C arasında değişir. Distosiye maruz kalan buzağuların vücut ısıları doğumda ötosiyal buzağılara göre daha yüksekken, doğumdan sonra daha fazla vücut ısıyı kaybederler. Bu artan ısı kaybı ve azalan termojenez, distosiyal buzağılarda asidoz ve hipotiroksinemiden kaynaklanmaktadır. Neonatal hipotermiye katkıda bulunan diğer faktörler arasında rüzgarlı ortam, buzağı derisi üzerindeki plasental sıvıların kurutulmaması (temizlenmemesi veya ıslaklığın yaygın olması), ıslak yatak takımların kullanılması ve açlık çamur veya yağmur yer almaktadır. Termoregülasyon, başlangıçta doku

substratlarının katabolizması ile ayakta durmaya çalışmak gibi aktivite; anne tarafından yalama ve piloereksiyon titremeyen termojenez ile elde edilebilir. Buzağı rektal sıcaklığı doğumdan hemen sonra 37°C'nin altına düşerse, yalamayı teşvik etmek için buzağın kafasını ineğin kafasına doğru çevirmek, buzağıyı samanla kurutmak ve erken yeterli kolostrum alımını sağlamak gibi ısıtma prosedürleri uygulanmalıdır. Bu, ilk günden sonra ısı üretiminin devam etmesi için gereklidir. Şiddetli, uzun süreli soğuk stresli buzağuların önerilen tedavisi, kızılötesi lamba, saç kurutma makinesi, ısı yastığı veya ılık su ile yeniden ısıtma yanısıra glukoz solüsyonu (3-4 ml/kg %10'luk solüsyon IV) parenteral uygulamalıdır (Kozat, 2018).

Göbek Bakımı

Göbek kordonunun kendiliğinden yırtılması meydana gelir buzağılama sırasında veya hemen sonrasında, buna bağlı olarak buzağılamada inek ayakta mı yoksa yatıyor mu ve ne kadar canlı buzağı doğumdan hemen sonradır. Kordon koptuktan sonra, urakus ve damarlar normalde karın içine çekilir, böylece çevresel kirlenmeden korunurlar. Yardımlı buzağılamalarda, buzağıyı oturtmak için hemen kordon kopartılmalı ve annenin yalaması için buzağın kafası anneye doğru çevrilmelidir. Buzağularla ilgili araştırmalar sınırlı olmakla birlikte, bir çalışmada omfalit veya göbek hastalığı, 76'nın %5 ila %15'inde görüldüğü rapor edilmektedir. Genellikle tedavi edilmediği için büyümenin yavaşlamasına, eklem hastalıklarına ve diğer sekellere neden olmaktadır. Göbek hastalığının önlenmesinde buzağı bakımı, doğumhane hijyeni, kalma süresinin azaltılması ve sağlıklı olmayan analık bölmelerindeki buzağuların, kaliteli kolostrum ve göbek deliğinin yeterli erken alımını sağlaması ve antiseptik solüsyon uygulaması gibi önlemler önemli rol oynayan faktörlerdir. Göbek antisepsisine atfedilen faydalar arasında buzağı morbidite ve mortalitesinin azalması ve solunum yolu hastalıklarında azalma yer almaktadır.

Tablo 2. Yeni doğan buzağı bakımında yapılması ve yapılmaması gerekenler

Dönem	Yap	Yapma
Buzağılama öncesi	Buzağılama öncesi inekleri doğum ünitesine taşıyın.	Buzağılamanın birinci aşamasında inekleri hareket ettirilmesi
Buzağılama	<ul style="list-style-type: none">✓ Bireysel olarak gebe ineğe derin saman yatakları sağlayın✓ Buzağılamanın I. aşamasının başlamasından sonra her 3-6 saatte bir inekleri izleyin.✓ Buzağılamanın II. evresinin başlangıcından en az 2 saat sonra müdahale edin.	<ul style="list-style-type: none">• Gebe ineklerin kalabalık grup halinde doğum bölmelerine alınması• Buzağılamanın 1. veya 2. aşamasında inekleri gereksiz yere rahatsız edilmesi• Gebe düvenin buzağılama sırasında yardımcı olmamak
Buzağılama sonrası	<ol style="list-style-type: none">1. Buzağılamadan sonra buzağın hayati belirtilerini hemen değerlendirin2. Resüsitasyon yardımcılarını edinin ve personeli resüsitasyon tekniklerinin kullanımı konusunda eğitin.3. Göbek antisepsisi uygulayın.	<ul style="list-style-type: none">✓ Göbek kordonunu kesin veya zamanından önce yırtın.✓ Zayıf bir buzağının sonunda yeterince emeceğini düşüncesinde olmak✓ Paratüberkülozlu sürülerde buzağıyı anayla birlikte bırakın.

Günümüzde süt buzağularının yönetimi ve barındırılması ilgili olarak birçok ilerlemeye sağlanmasına rağmen, halen ABD’de süt emme döneminde 10 buzağıda 1 nin öldüğü bildirilmektedir. Morbidite ve mortalite riskini azaltmak için buzağuların stres faktörlerine karşı fizyolojik ve davranışsal tepkilerine katkıda bulunan iç ve dış uyaranların daha iyi anlaşılması gerekmektedir (Hulbert ve Moisés, 2016).

Fiziksel resüsitasyon

Perinatal döneminde işletme yöneticisi/ bakıcısı risk altındaki buzağularla uğraşırken fiziksel resüsitasyonun öncelik sırasını bilmelidir. Resüsitasyonun 'ABC'si olarak solunum yolunun açık olması, solunum stimülasyonu, Dolaşım desteğinin sağlanması olarak tanımlanır. Resüsitasyon, buzağı hala doğum kanalındayken başlayabilir ve yaşamsal belirtiler normale dönene kadar (örneğin duruş, aktivite, solunum fonksiyonu, rektal sıcaklık) veya kalp atışı mevcut olana kadar devam eder. Resüsitatif ilk yardım prosedürleri, buzağının göğüs kafesi inekten çıktıktan sonra kalça kilidi sayesinde buzağı yerinde kalsa bile nefes alabilir. Resüsitasyon problemlili bir buzağılama sırasında buzağının nazal reseptörlerinin saman veya

parmak (veya oksijen tedavisi mevcutsa burun içi tüp) ile uyarılmasıyla başlanmalıdır. Doğumdan hemen sonra, buzağı kısa bir süre baş aşağı asılmalıdır. Bu prosedür, pulmoner sıvıların postüral drenajını kolaylaştırır ve pulmoner gaz değişimi, mikst asidozun düzeltilmesi ve ardından kolostral immünoglobülinlerin emilimi üzerinde olumlu bir etkiye sahiptir. Buzağıdan drene olan sıvının çoğunun abomasal olmasına rağmen bu faydalar artar Hava yollarının temizlenmesi, bir aspiratör pompası kullanılarak faringeal ve nazal aspirasyon ile başlayabilir. Genellikle sadece küçük bir sıvı hacmi (<10ml) atılsa da, prosedür, pulmoner gaz değişimi ve asit-baz dengesine önemli ölçüde fayda sağlar.

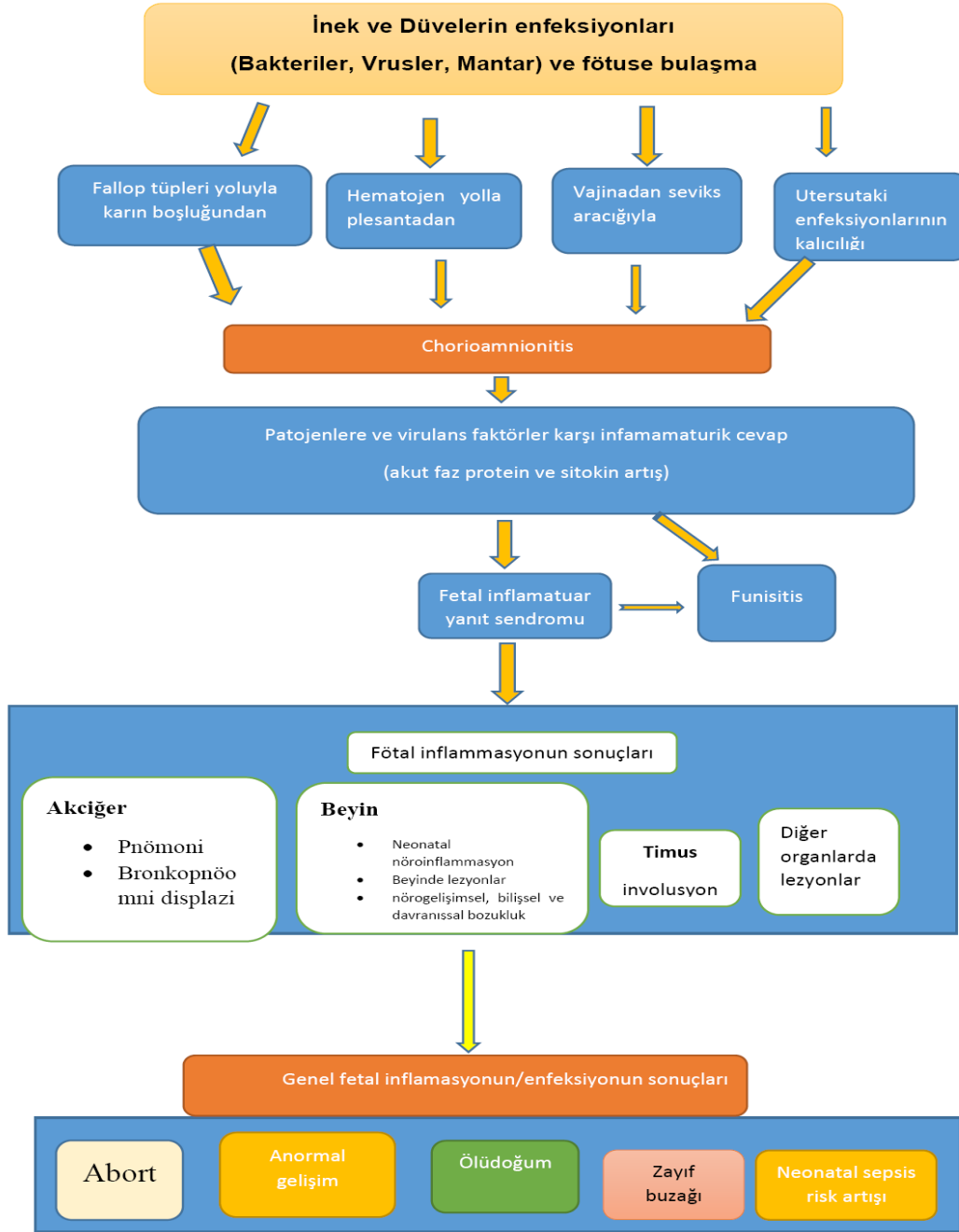
Kolostrum Alımı

İlk kolostrum, yenidoğan buzağıyı bulaşıcı hastalıklara karşı koruyan, annenin lökositlerini de içeren önemli bir besin kaynağı, immunoglobulinler ve diğer önemli bağışıklık faktörlerini de içeren bir özelliğe sahiptir (Kozat, 2019). İlk ağız sütünün (Kolostrum) buzağı verilmesi başarılı pasif transfer mortalite ve morbidite riskini azalttığı için çok önemlidir ((Hulbert ve Moisés, 2016). Buzağı ayağa kalkmama ve zayıf emme motivasyon mevcutsa zayıf canlılık olarak tanımlanır. Yeni doğmuş bir buzağıya, normal serum immunoglobulin G seviyesi 10 g/L olacak şekilde ilk iki saat içinde en az 2 litre (120 g immunoglobulin'e eşdeğer miktarda), ilk 12 saat içinde ise en az 6 litre olarak almalı ve bu miktarın alındığından emin olunmalıdır (Furman-Fratczak ve ark., 2011).

Ölüdoğuma neden olan Enfeksiyözlerin teşhisi

Amerika Birleşik Devletleri, Kanada ve Avustralya da dahil olmak üzere birçok ülkede süten kesim öncesi buzağı morbidite ve mortalite risklerinin yüksek olduğu (yaklaşık %23-35 morbidite ve %3,5 %10,5 mortalite) bildirilmiştir. İshal veya pnömoni gibi bulaşıcı hastalıklar, süten kesim öncesi buzağı ölümlerinin çoğundan sırasıyla %56,5 ve %22,5 oranında sorumlu olduğu rapor edilmiştir (Abuelo, 2020). Perinatal dönemdeki buzağı ölüm nedenlerinin teşhisi oldukça zordur. Ölü doğuma neden enfeksiyöz etkenlerin teşhisi uzman(lar)ının yeteneklerine ve deneyimine ve mevcut laboratuvar desteğine ve diğer birçok faktöre bağlı olarak ölüm nedenlerinin oranı değişir. Yapılan birçok araştırmalarda perinatal ölüm vakalarının yaklaşık üçte biri ile yarısında ölüm nedeni saptanmadığı rapor edilmektedir (Berglund ve ark., 2003; Jawor ve ark., 2021). Nedeni bilinmeden buzağuların ölüm nedenlerinin araştırılmasında tanı konulamayan vakalar ciddi bir sorundur. Çünkü nedeni bilinmeden gelecekteki kayıpların önlenmesi mümkün değildir (Khodakaram-Tafti ve ark., 2005; Sac 2009; Jawor ve ark., 2021). En basit haliyle, PÖ'de enfeksiyonun rolü veya fetüsün pronasyonu yavru ölümüne sebep

olabilir. Bununla birlikte, öldürücü olmayan enfeksiyon ve dolaylı olarak ölüm riskini artıran (örneğin, kısalmış gebelik veya intrauterin gelişme geriliği (Mee ve Szenci, 2012) ile canlı doğumla sonuçlanan durumların yanı sıra canlı ve yaşayabilir ancak geçici veya kalıcı olarak enfekte buzağılar (örn. BVDV veya *N. caninum* enfeksiyonu) ve cansız buzağılar (abort) (örn., adenovirüse bağlı zayıf buzağı sendromu) gibi durumlar özetlenebilir. Smyth ve ark. (1999), plasentasında leptospiral antijen bulunan ineklerin, plasentasında antijen olmayan ineklere göre ortalama 6 ila 10 kg kadar daha hafif fetüslere sahip olduğu ve gebeliğin 100. günde BVDV enfeksiyonundan kurtulan buzağuların intrauterin büyüme geriliği gebelik süresi de bildirilmiştir. Bu nedenle pre veya perinatal enfeksiyonun etkileri perinatal dönemin ötesine geçebilir. Anneden fetüse bulaşma yolları, karın boşluğundan fallop tüpleri yoluyla migrasyon, plasenta yoluyla hematogen yayılım ve vajinadan serviks yoluyla geçişi içerir. Ek olarak, bazı bakteriler için (*Trueperella pyogenes* ve *Campylobacter fetus*), gebelikten önce uterusda kalıcılık meydana gelebilir (Jawor ve ark., 2021). Anderson (2012), sığırlarda hematogen yolun en önemli gibi görüldüğünü öne sürmüştür. Gebeliğin erken döneminde maternal immünsüpresyon, sığırlarda başarılı bir gebeliğe yol açan Th1 sitokinlerinin (IFN- γ ve IL-2) aşağı ekspresyonu ve Th2 sitokinlerinin yukarı ekspresyonu yoluyla düzenlenebilir. Th1 sitokinleri genellikle gebeliğin sürdürülmesinde zararlıdır, oysa Th2 sitokinleri hümmoral yanıtı ve başarılı gebeliği desteklemektedir. Hücre aracılı immün yanıtın bu inhibisyonu, inekten fetüse enfeksiyon bulaşma riskinin artmasına neden olabilir. *N. caninum*'a karşı etkili immün yanıt, parazit çoğalmasını kontrol etmek için IFN- γ içeren bir Th1 sitokin yanıtı gerektirir, ancak plasentada aşırı IFN- γ , gebelik için zararlı etkilere sahip olabilir ve fetal canlılığı tehlikeye atabilir (Regidor-Cerrillo ve ark., 2014).

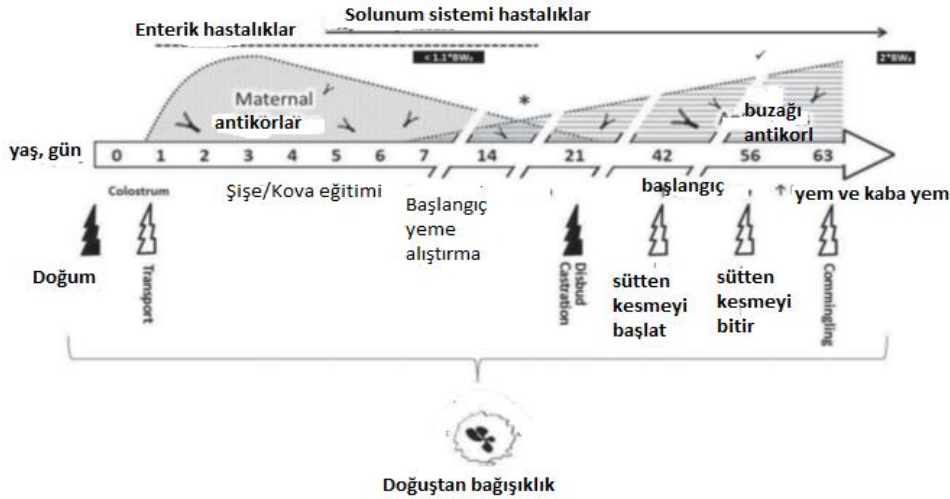


Şekil 3. İnsan ve hayvan çalışmalarına dayalı olarak sığırlarda intrauterin enfeksiyonun olası sekelleri (Jawor ve ark., 2021)

İmmunitenin Güçlendirilmesi

Bağışıklık, potansiyel olarak zararlı mikroplara ve parazitlere karşı kendini savunma yeteneği olarak tanımlanır. Zararlı etkeni; engelleme, gözetleme, savaş, kontrol ve dokümantasyon dahil olmak üzere çeşitli sistemler bağışıklık yeterliliği ile ilgilidir. Bariyerler arasında cilt ve mukozal bariyerler (örneğin, solunum yolu ve sindirim sistemi) bulunur. Bu bariyerler komensal mikrobiyota ile oluşturulur. Bağışıklık sisteminin gözetleme ve savaşma kanadı,

fagositik ve granülositik hücreler (örn. makrofajlar, nötrofiller, eozinofiller ve bazofiller) gibi yerleşik lökositleri içerir; bakteri kaynaklı mikrobiyal ilişkili moleküler modellere (MAMP) maruz kalmadan önce tamamen işlevseldirler (Kampen ve ark., 2006). Yenidoğan buzağlarda kısmi ve tam olarak şekillenen kolostral immünoglobulin yetersizliğine neonatal buzağlarda oldukça sık rastlanmakta ve yüksek mortaliteyle seyretmektedir. Bu tabloya mahruz kalan buzağı (ları) anadan temin edilemeyen pasif immüniteyi sağlamak, bağışıklık mekanizmasını uyarmak, belli bir etkene karşı spesifik antikor sağlamak, genel direnci artırmak ve antibiyotiklerin etkisini kuvvetlendirilmelidir. Bu amaçla; 1) Ana kanı nakli (150-300 ml, IV), 2) Buzağı septisemi serumu (koruyucu olarak 15 ml, sağaltıcı 30-40 ml, SC) ve 3) Kolostrum serumları (50-150 ml, SC) uygulanmaları buzağı sağlığı açısından ve buzağın hayatta kalma şansını artırmak açısından oldukça önemlidir



Şekil 4. Buzağı stresi, bağışıklığı ve yönetim zaman çizelgesi

Gelişmekte olan, elle beslenen süt buzağları için potansiyel inflamatuvar (siyah cıvata) ve psikolojik (beyaz cıvata) stresörler kaçınılmazdır. Doğum, bir buzağının hayatındaki ilk doğrudan stres etkenidir, ancak doğum öncesi ortam fetal stres eksenini etkileyebilir. Buzağılara maternal antikorların (Y) pasif transferini sağlamak için kolostrum sağlanmalıdır. Güç doğan buzağların pasif transfer yetmezliği (FPT) olma olasılığı daha yüksektir. İlk doğum (düve) yapandan doğan yavru yüksek bir FPT oranına sahiptir. Gebe hayvanın transportu bir stres etkenidir. Doğum ve taşıma stresi buzağların biberon eğitimini etkileyebilir.

Koruyucu Aşılamalar

Yenidoğan buzağuları viral ve bakteriyel hastalıklarda korumak için mutlak olarak koruyucu aşılama programları uygulanmalıdır. Amerikada üreticilerin %60'dan fazlası buzağularını süttten kesmeden önce bazı klostridiyal hastalıklara karşı aşılamaktadırlar. Büyük işletmelerde koruyucu aşılanma oran %91'e kadar çıkmaktadır. Dünya genelinde klostridiyal hastalıklara karşı kullanılan aşilar ruminant aşı grupları içerisinde ikinci sırada en fazla satılan aşı grubunu oluşturmaktadır. Gebe inekler genellikle doğuma 60 gün kala kuruya ayrılırlar. Gebe düveler ise henüz süt vermeye başlamadıklarından doğuma 45 gün kala mastitis aşısının tekrarı, pasteurella aşısı ile aşılanırken, buzağının korunması için ilk E. coli ve Klostridyum C aşısı da uygulanır. Doğumdan üç hafta önce ise ikinci E. coli, Klostridyum C aşısı, mastitis aşısının tekrarı, leptospirosis ve viral solunum yolu enfeksiyonlarına karşı aşıların tekrarı ile aşılama programına devam edilir (Kozat, 2021). Bu dönemde bir A, D, E vitamin karması enjeksiyonu yapılması da yararlı olacaktır. Gebe düve ve ineklerde doğuma 2-6 hafta kala septisemi aşısı yapılmalı. Koruyucu aşı uygulamaları yanısıra doğuma 1 hafta kala, (doğumdan; 2-8 gün önce) yüksek dozlu D3 vitamini enjeksiyonu yapılmalıdır (Sancak, Gülhan, 2021).

KAYNAKLAR

- Abuelo, A. (2020). Symposium review: Late-gestation maternal factors affecting the health and development of dairy calves. *Journal of Dairy Science*, 103(4), 3882-3893.
- Anderson, M.L. (2012). Disorders of cattle. Kirkbride's diagnosis of abortion and neonatal loss in animals, 4, 13-48.
- Batchelder, C. A., Bertolini, M., Mason, J. B., Moyer, A. L., Hoffert, K. A., Petkov, S. G., Anderson, G. B. (2007). Perinatal physiology in cloned and normal calves: hematologic and biochemical profiles. *Cloning and stem cells*, 9(1), 83-96.
- Berglund, B.; Steinbock, L.; Elvander, M. (2003). Causes of stillbirth and time of death in Swedish Holstein calves examined post mortem. *Acta Vet. Scand.* 44, 111–120.
- Bozukluhan, K., Merhan, O., Gokce, H.I., Deveci, H.A., Gokce, G., Ogun, M., Marasli, S. (2017). Alterations in lipid profile in neonatal calves affected by diarrhea. *Veterinary world*, 10(7), 786.
- Browning, C.L., Rolland, R.M., Kraus, S.D. (2010). Estimated calf and perinatal mortality in western North Atlantic right whales (*Eubalaena glacialis*). *Marine Mammal Science*, 26(3), 648-662.
- Burns, B.M., Fordyce, G., Holroyd, R.G. (2010). A review of factors that impact on the capacity of beef cattle females to conceive, maintain a pregnancy and wean a calf—implications for reproductive efficiency in Northern Australia. *Animal Reproduction Science*, 122(1-2), 1-22.
- Carstens, G. E. (1994). Cold thermoregulation in the newborn calf. *Veterinary Clinics of North America: Food Animal Practice*, 10(1), 69-106.
- Chassagne, M.; Barnouin, J.; Chacornac, J.P. (1999). Risk factors for stillbirth in Holstein heifers under field conditions in France: Aprospective survey. *Theriogenology* 51, 1477–1488.
- Cuttance, E.; Laven, R. (2019). Perinatal mortality risk factors in dairy calves. *Vet. J.* 253, 105394
- Debnath, N. C., Taimur, M. J. F. A., Saha, A. K., Ersaduzaman, M., Helaluddin, M., Rahman, M. L., Islam, M. A. (1995). A retrospective study of calf losses on the central dairy cattle breeding station in Bangladesh. *Preventive Veterinary Medicine*, 24(1), 43-53.
- Drennan, M.J., Berry, D.P. (2006). Factors affecting body condition score, live weight and reproductive performance in spring-calving suckler cows. *Irish Journal of Agricultural and Food Research*. 45: 25-38.
- Furman-Fratczak K., Rzasa A., Stefaniak T., 2011. The influence of colostral immunoglobulin concentration in heifer calves' serum on their health and growth. *J Dairy Sci*, 94, 5536-5543.
- Ghavi Hossein-Zadeh, N.; Nejati-Javaremi, A.; Miraei-Ashtiani, S.R.; Kohram, H. (2008). An Observational Analysis of Twin Births, Calf Stillbirth, Calf Sex Ratio, and Abortion in Iranian Holsteins. *J. Dairy Sci.* 91, 4198–4205

- Holdsworth, S.E., Kells, N.J., Vallée, E., Ward, N., Mellor, D.J., Beausoleil, N.J. (2022). Evaluating the behavioural responses of healthy newborn calves to a thoracic Squeeze. *Animals*, 12(7), 840-56.
- Hulbert, L. E., Moisés, S. J. (2016). Stress, immunity, and the management of calves. *Journal of dairy science*, 99(4), 3199-3216.
- Jawor, P., Mee, J. F., Stefaniak, T. (2021). Role of Infection and Immunity in Bovine Perinatal Mortality: Part 2. Fetomaternal Response to Infection and Novel Diagnostic Perspectives. *Animals*, 11(7), 2102.
- Khodakaram-Tafti, A.; Ikede, B.O. A retrospective study of sporadic bovine abortions, stillbirths, and neonatal abnormalities in Atlantic Canada, from 1990 to 2001. *Can. Vet. J.* 2005, 46, 635–637.
- Kozat S. Ruminantlarda solunum sistem hastalıkları. *Medipres* 2021. Malatya
- Kozat, S. (2018). Hypothermia in newborn calves. *Journal of Istanbul Veterinary Sciences*, 2(1), 30-37.
- Kozat, S. (2019). Yenidoğan buzağlarda kolostrum yönetiminin önemi. *Atatürk Üniversitesi Veteriner Bilimleri Dergisi*, 14(3), 343-353.
- Larson, R. L., Tyler, J. W. (2005). Reducing calf losses in beef herds. *Veterinary Clinics: Food Animal Practice*, 21(2), 569-584.
- López Helguera, I.; Behrouzi, A.; Kastelic, J.P.; Colazo, M.G. (2016). Risk factors associated with dystocia in a tie stall dairy herd. *Can. J. Anim. Sci.* 96, 135–142.
- Manzoor, A., Nazir, T., Untoo, M., Fayaz, A., Zaffer, B., Afzal, I., Dar, Z.A. (2018). Calf scour: an obstacle in successful dairying. *Journal of Entomology and Zoology Studies*, 6, 2001-5.
- Mee, J. F. (2013). Why do so many calves die on modern dairy farms and what can we do about calf welfare in the future?. *Animals*, 3(4), 1036-1057.
- Mee, J. F. (2023). Impacts of dairy cow nutrition precalving on calf health. *JDS Communications*.
- Mee, J.F. (2008). Newborn dairy calf management. *Veterinary Clinics of North America: Food Animal Practice*, 24(1), 1-17.
- Mee, J.F., Grant, J., Sánchez-Miguel, C., Doherty, M. (2013). Pre-calving and calving management practices in dairy herds with a history of high or low bovine perinatal mortality. *Animals*, 3(3), 866-881.
- Mee, J.F.; Sánchez-Miguel, C.; Doherty, M. Influence of modifiable risk factors on the incidence of stillbirth/perinatal mortality in dairy cattle. *Vet. J.* 2014, 199, 19–23.
- Mee, J.F.; Szenci, O. (2012). Selected pathological causes of bovine stillbirth illustrated with photographic images. *Magy. Allatorvosok Lapja*, 134, 718–725.
- Merlot, E., Quesnel, H., Prunier, A. (2013). Prenatal stress, immunity and neonatal health in farm animal species. *Animal*, 7(12), 2016-25.

- Moore, D.P., Cantón, G.J., Louge Uriarte, E.L. (2021). Infectious diseases affecting reproduction and the neonatal period in cattle. *Frontiers in Veterinary Science*, 8, 679007.
- Murray, C.F., Leslie, K.E. (2013). Newborn calf vitality: Risk factors, characteristics, assessment, resulting outcomes and strategies for improvement. *The Veterinary Journal*, 198(2), 322-328.
- Mushtaq, H.M., Saleem, M.N., Ayyub, M.R., Khattak, I. (2013). Challenges due to early calf mortality in dairy industry of Pakistan and strategies for improvement. *Veterinaria*, 1(1), 13-17.
- Nagy, D. W. (2009). Resuscitation and critical care of neonatal calves. *Veterinary Clinics of North America: Food Animal Practice*, 25(1), 1-11.
- Parshin, P., Savrasov, D., Dorozhkin, V. (2020). Experience in treatment of comorbid pathologies in calves in the neonatal period. In *BIO Web of Conferences* (Vol. 17, p. 00102). EDP Sciences.
- Piccione, G., Casella, S., Giannetto, C., Vazzana, I., Niutta, P. P., Giudice, E. (2009). Influence of age on profile of serum proteins in the calf. *Acta veterinaria*, 59(4), 413-422.
- Regidor-Cerrillo, J.; Arranz-Solís, D.; Benavides, J.; Gómez-Bautista, M.; Castro-Hermida, J.A.; Mezo, M.; Pérez, V.; Ortega-Mora, L.M.; González-Warleta, M. (2014). *Neospora caninum* infection during early pregnancy in cattle: How the isolate influences infection dynamics, clinical outcome and peripheral and local immune responses. *Vet. Res.* 45, 10
- Sac Cvs Disease Surveillance Report Surveillance: Causes of abortion and stillbirth in cattle in Scotland. *Vet. Rec.* 2009, 165, 677–680.
- Sancak, S., Gülhan, T. (2021). Gebe sığırlarda inaktif escherichia coli aşısının kolostrum ve buzağı kan serumlarındaki ıgg seviyelerine etkileri. *Journal Of Anatolian Environmental And Animal Sciences*, 6(3), 318 – 324.
- Singh, D.D., Kumar, M., Choudhary, P.K., Singh, H. N. (2009). Neonatal calf mortality-An overview. *Intas Polivet*, 10(2), 165-169.
- Smith, D.R. (2021). Management to decrease neonatal calf loss in beef herds. *Bovine reproduction*, 897-908.
- Smyth, J.A.; Fitzpatrick, D.A.; Ellis, W.A. (1999). Stillbirth/perinatal weak calf syndrome: A study of calves infected with *Leptospira*. *Vet. Rec.* 145, 539–542.
- Szenci, O. (2023). Importance of Monitoring Fetal and Neonatal Vitality in Bovine Practices. *Animals*, 13(6), 1081.
- Tuchscherer, M.; Puppe, B.; Tuchscherer, A.; Tiemann, U. (2000). Early identification of neonates at risk: Traits of newborn piglets with respect to survival. *Theriogenology*, 54, 371–388.
- Uetake, K. (2013). Newborn calf welfare: A review focusing on mortality rates. *Animal Science Journal*, 84(2), 101-105.

- Vannucchi, C. I., Rodrigues, J. A., Silva, L. C. G., Lúcio, C. D. F., Veiga, G. A. L. D. (2015). Effect of dystocia and treatment with oxytocin on neonatal calf vitality and acid-base, electrolyte and haematological status. *The Veterinary Journal*, 203(2), 228-232.
- Voljč, M., Čepon, M., Malovrh, Š., Žgur, S. (2019). Risk factors and mortality rate of calves in the first month of life in Slovenian Holstein Friesian population. *Journal of Central European Agriculture*, 20(1), 25-30.

**Experimental Investigation Of The Behavior Of Modulated Kinetic Combustion
Strategy In A Diesel Engine At Different Engine Loads**

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Abstract

Nowadays, the harmful atmospheric effect of exhaust gases pollutants have reached critical level that creates serious problems. This raises the issue of limitations or restrictions the use of internal combustion engines. Diesel engines emit high amounts of NO_x and soot emissions, and continuous use of diesel engines is only possible if these two emissions are taken under control. Modulated kinetic (MK) combustion strategy aims to control NO_x and soot emissions in diesel engines by retarding combustion than conventional timing, with compromising engines effective power. In this study, the change trends of these two emissions were examined with MK strategy. In this study, the start of injection timing was changed with certain steps in certain range and injected fuel quantity (IFQ) were manipulated. Indicated engine torque, effective engine torque, in-cylinder peak pressure and heat release rate values were investigated under constant engine speed and rail pressure condition. In addition, carbon monoxide, unburned hydrocarbon, nitrogen oxide and soot emissions were evaluated. Also, specific emissions were included the study. According to the results from the study, when combustion was delayed, an increase were observed in carbon nonoxide and hydrocarbon emissions, but significant decrease was observed in nitrogen oxide emissions. In the soot emissions, a decrease was observed in the first zones where the MK strategy dominates the combustion, and then, as a result of the late combustion, the soot emissions started to increase again due to the negative impact of the poor atomization regime. With the increase in the IFQ, the changing ratio of different start of injection timing became more complex, the reduction in NO_x emission at high IFQ values also decreased to a narrower band, and a same trend wasn't observed for soot emission.

Keywords: Modulated Kinetic Combustion, Retarded Injection, NO_x Emission, Particle Matter

Introduction

Diesel engines are in an advantageous position not only for heavy-duty vehicles but also for light-duty vehicles, thanks to their high thermal efficiency, but particulate matter and NO_x emissions need to be controlled [1]. These two emissions are the most fundamental problems to be overcome in diesel engines. There is a trade-off between these two emissions when the diesel engine is operating conventionally. It is therefore difficult to control these two emissions at the same time. A lot of study has been carried out on this subject. However, both emissions cannot be controlled in the conventional operating range by only manipulating the combustion. On the other hand, after-treatment systems do not give healthy results in every working conditions. This makes it necessary to control these emissions, even partially, during combustion. Except from conventional diesel combustion, low temperature combustion strategies applied at partial loads are the combustion strategy applied to control both NO_x and soot emissions at the same time. Purpose of low temperature combustion (LTC) strategies, applied in diesel engines is to create a better macro scale mixture formation by extending the time from the start of fuel injection to ignition. Thus, combustion starts with a more dilute mixture and combustion temperatures decrease. This strategy allows NO_x emissions to fall to more reasonable levels. In LTC applications such as HCCI, PCCI, MK, the peak temperature during combustion is taken to the levels of 1600-1800K and NO_x emissions are controlled [2]. MK combustion strategy is carried out in areas where the start of injection (SOI) is close to the top dead center (TDC). Thus, the combustion largely shifts to the expansion stroke and the combustion temperatures decrease. This also reduces the average pressure rise rate [3]. Both prolongation of the ignition delay and the decrease in combustion temperatures also reduce the soot emissions. However, there is a limitation with the increase of soot emission at high engine loads [3].

Although there is a decrease in NO_x and soot in the LTC strategy, carbon monoxide (CO) and total hydrocarbon (THC) emissions increase due to the nature of the mixture formation. In addition, thermal efficiency and performance parameters such as mean indicated pressure (IMEP), brake mean effective pressure (BMEP), effective engine torque are adversely affected as a result of combustion moving away from the optimum point in terms of performance. Fang and Lee [1] worked at 1500 rpm engine speed, 1000bar injection pressure, 12.7 mg/st injected fuel quantity (IFQ). Start of injection, advance is at 2 °CA, 6.5 °CA and 8 °CA after TDC (ATDC). Efficiency of thermal value decreased with the distance from the 2 °CA ATDC spray advance.

Information on some studies in the literature on the modulated kinetics combustion strategy is as follows. Liu et al. [4] investigated the effects of different injection timings on NO_x , soot, THC, CO under constant engine load and IFQ. In the study, injection timing was experienced in a wide range from 70°CA before TDC (BTDC) to 10°CA ATDC. In the study in which the injection was performed as a single phase, it was seen that the range that should be evaluated for the MK strategy was between 20°CA BTDC and 10°CA ATDC. NO_x emission, which was around 1750ppm at the 20°CA BTDC SOI, decreased to around 1500ppm at 15°CA BTDC. It decreased to around 1250 ppm at the 10°CA BTDC. It decreased to around 500 ppm with the injection starting at TDC and to around 400 ppm with the injection starting at 5°CA ATDC. Soot emission was 0.35 FSN at 20°CA BTDC SOI and to 0.2 FSN at 15°CA BTDC. Soot was observed at 0.1 FSN value at TDC and decreased to much smaller values at 5°CA ATDC SOI condition. Buyukkaya and Cerit [5] investigated the change in specific NO_x emissions at three different injection advance values, keeping the injected fuel quantity constant at three different engine speeds. At all three engine speeds, reductions in specific NO_x emissions occurred as the SOI was delayed. Kim et al. [6] conducted an experimental study by deactivating 5 cylinders of a six cylinder diesel engine and acquired data from just single cylinder. In the study, the engine speed was selected as 1400 rpm, the injection pressure was 160 MPa, and a constant IFQ was 44.5 mg/st as single-phase injection. Three operating conditions were evaluated in the study. These are early injection, conventional injection and late injection. Among these three studies, the highest in-cylinder pressure observed at conventional injection. The lowest peak in-cylinder pressure was in the late injection. It should be clearly stated that the pressure values that occur in the late LTC application are quite low compared to the other two alternatives. Peak in-cylinder heat release rate values increased as we moved from conventional combustion to LTC applications, but this forced excess lasted for a very short time. Heat release rate profile that emerged in conventional combustion has a fuller character. In the study, the injection advance at the starting point of combustion was changed and as the combustion initiation shifted to expansion in the range of specific NO_x values between 9°CA BTDC and 7°CA ATDC, serious decreases occurred in specific NO_x emissions. Specific NO_x emissions, which were around 0.22 g/kWh in the use of conventional diesel under 9°CA BTDC conditions, decreased to about half of this value at 5°CA BTDC points. It decreased to about 0.08 g/kWh at TDC and then below 0.02 g/kWh at 7°CA ATDC. Fang et al. [7] conducted an experimental study on a single-cylinder, 16.8 compression ratio engine at 1450 rpm. Engine load was chosen as 0.3, 0.6 and 0.9 MPa BMEP. Single phase SOI was changed between 7.5°CA BTDC and 5°CA ATDC. In the specified range, the specific fuel consumption values increased regularly as the injection

was delayed at all engine loads. Depending on the injection timing change, differences between the extreme values decreased slightly at the beginning with the increase of the engine load from 0.3 MPa BMEP, and then to increase again. Between the two-end SOI timing, the ignition delay time increased by about 50%. More than 50% increment of the ignition delay time obtained at 7.5 °CA BTDC was observed at 5 °CA ATDC points. While the decrease in brake thermal efficiency due to delayed injection was more reasonable at low engine loads, the difference increased at higher engine loads. In NO_x emissions, the injection advance of 7.5 °CA BTDC was changed between 5 °CA ATDC. NO_x emissions decreased approximately 7 times at 0.3 MPa BMEP, similar trends were seen at the 0.6 MPa BMEP condition and at the 0.9 MPa BMEP condition. Smoke opacity values are very sensitive to advance at 0.3 MPa BMEP condition. At higher engine loads, however, the trend of change was not so high. In addition, unlike NO_x emissions, soot emissions increased up to a certain delay in advance, and then a downward trend started. On the other hand, Hydrocarbon emissions showed a regular decrease with delayed injection. At high engine loads, the difference between the first and last advance values doubled. CO and THC showed same behavior.

Experimental Procedure

During the experimental study, engine was braked with a 400 kW capacity dynamometer of AVL “DynoRoad 504/5”. AVL ConsysLube 25/50 is used for the engine oil system, heating capacity of the oil conditioner is 90 kW and it can condition the oil temperature between 70-140 °C. AVL 753CH M100 device is used for the fuel conditioner system, it can condition the fuel temperature between 10-80 °C. The sensitivity of the conditioner unit is 1 °C. AVL 753CH M100 device is used for the fuel consumption measurement system, the measurement accuracy of the device is 0.12%. For air conditioning system, AVL brand Consysboost 3000 device with a heat output capacity of 135 kW was used. Kistler brand 6045BU48-3-1 model piezoelectric pressure sensor was used for in-cylinder pressure measurement. 365C ANGLE ENCODER SET speed reader was used to measure engine speed. In-cylinder pressure and engine speed measurements were performed integrated with the AVL Indicom device.

During the experimental studies, an S8000 type 4-cylinder engine with a stroke volume of 3.9 liters, supercharged, common-rail injection system, produced by TUMOSAN, was used. In the experimental studies, the turbocharger unit was deactivated in order to keep the intake air flow rate under control. Commercial diesel with EN590 standard was used as fuel.



Figure 1. Engine Test Room

Results and Discussion

Experimental studies were carried out at 1750 rpm engine speed, 99.5 kPa intake pressure and an ambient temperature of 25 °C. Injected fuel quantity was selected as 20 mg/st, 25mg/st and 30 mg/st. SOI is determined by 2 °CA steps between -4 °CA ATDC (4 °CA BTDC) and 10 °CA ATDC. The injection pressure was kept constant at 1000 bar. The diverge of start of combustion from the timing value that will provide the maximum torque, adversely affect the performance parameters as expected. MK strategy occurs with lately injection timing than the advance value, which will realize the maximum torque. As can be seen at Figure 2., IMEP values decreased while the SOI timing was retarded. With the retarded SOI, IMEP values decreased regularly. When the IFQ value increases, an increase in the IMEP value is expected situation. The point to be noted here is that the sensitivity to the SOI is higher at higher engine loads.

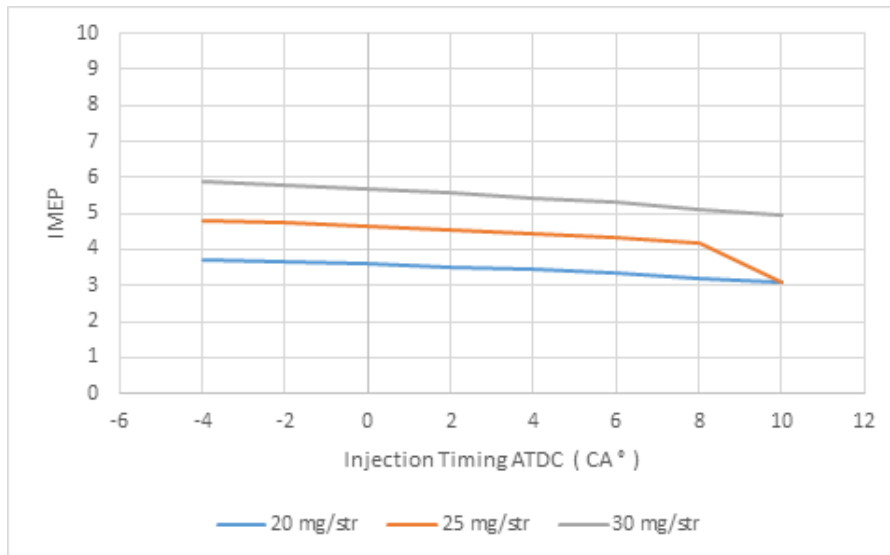


Figure 2. Mean indicated pressure values at different engine loads and injection timing

If SOI point occurs later, it reduces the combustion temperatures and causes a weaker flame propagation. At the same time, the increase in the ignition delay period also increases the actual combustion region volume, with a leaner mixture formation. Conclude of these two effects, an increase in CO emissions will occur under the conditions where the MK strategy dominates. Figure 3. shows the CO emissions according to the SOI timing values. At lower engine loads, higher CO emissions emitted due to the lower combustion temperature, and this trend was observed undisturbed for all SOI values. There were no significant change observed in CO emissions between -4°CA ATDC and 4°CA ATDC for all three different IFQ values. While the IFQ value was high, the difference remained within relatively predictable and acceptable limits, while at lower IFQ values, the difference reached unacceptable limits and dramatic increases were observed.

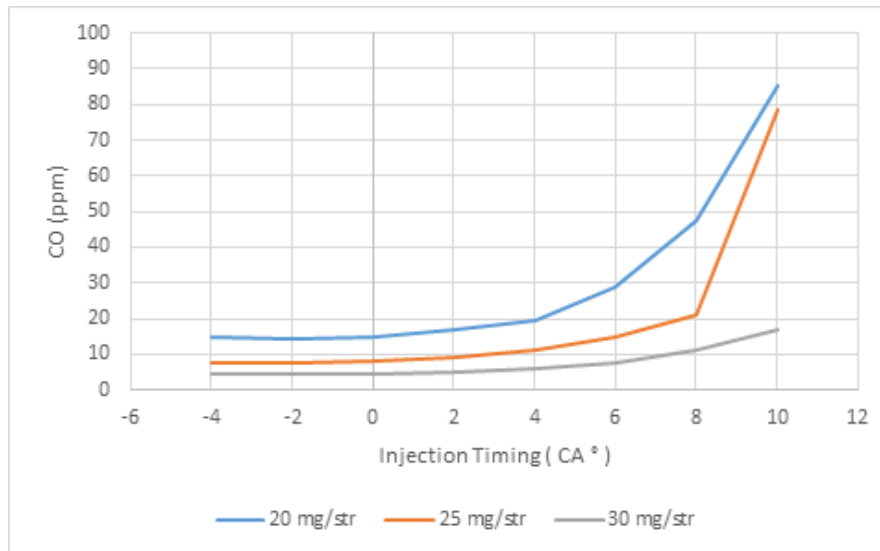


Figure 3. Carbon monoxide emissions at different engine loads and injection timing

THC emissions and CO emissions perform largely co-trend. Generally, an increase in one of these two emissions will result in an increase in the other. In this study, as can be seen from Figure 3., THC emissions showed a regular increase when the SOI timing retarded. In contrast to CO, remarkable differences emerged in all injection timing values and a relatively stable region could not be observed. Higher THC emissions emitted at lower engine loads, like CO.

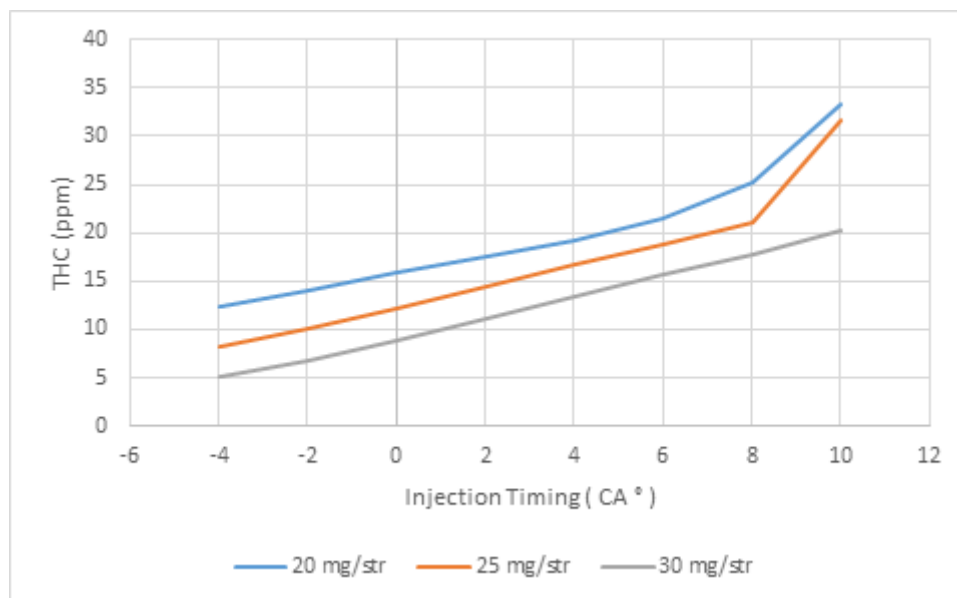


Figure 4. Total hydrocarbon emissions at different engine loads and injection timing

One of the main focuses of this study is to reveal the NO_x emission behavior. The decrease in combustion temperatures in the MK strategy will reduce the formation of NO_x . At the same time, the cooling rate that will occur during the expansion stroke will decrease to a lower level

together with the combustion postponed to the expansion. Depending on these two factors in the MK strategy, NO_x emissions decreased as seen in Figure 5. As the SOI was delayed, there was a steady decrease in NO_x emissions. This decrease, which appeared at the beginning, was realized with a fairly large gradient, and then a softer change trend emerged. When the IFQ value increases, NO_x values are observed to be higher, because of the higher heat release rate. However, with the so delayed injection, the difference has decreased to more acceptable levels. Between the two extreme SOI values, NO_x emissions differed more than 4 to 6 times. This can be considered a fairly good result, provided that other performance parameters are not deteriorated.

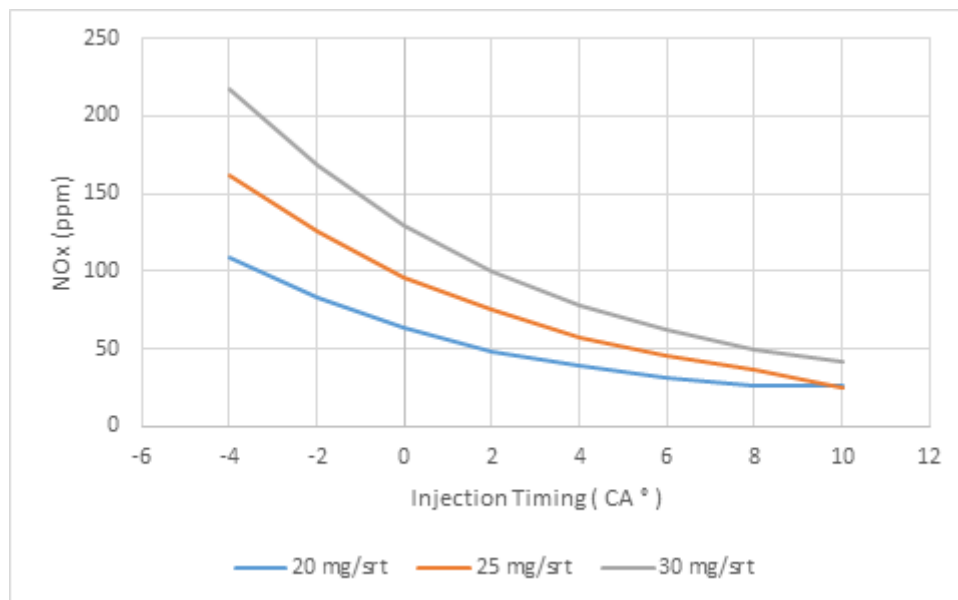


Figure 5. Nitrogen oxides emissions at different engine loads and injection timing

Soot has very complex relationships in terms of formation mechanism and, it's mechanism has not been fully theorized. However, it is clearly known that high temperature and locally rich zones trigger soot formation. Figure 6. shows the soot values for different SOI and IFQ values. A constant trend could not be obtained in soot emissions in contrast to other evaluated emissions. For 20 mg/st IFQ, soot emission raised up to the 4 °CA ATDC, after that a strong downtrend occurred. For 25 mg/st, the downward trend emerged at 8 °CA ATDC. However, no downward trend was observed for 30 mg/st. This can be explained by the fact that the IFQ value remains high in this SOI range for the soot decrease. The restriction in soot control that will occur in the MK strategy due to the increase in engine load has also been noted by Tang et al [MK2].

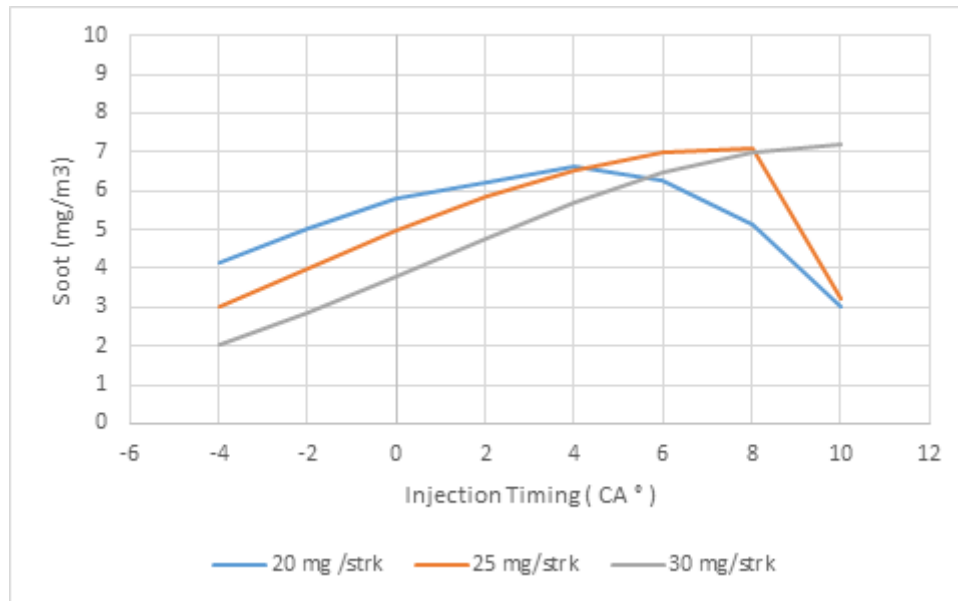


Figure 6. Soot emissions at different engine loads and injection timing

Conclusion

In this study, the results were obtained according to the data taken at three different engine loads and eight different levels SOI timing, between -4°CA ATDC and 10°CA ATDC. As SOI is delayed, IMEP values decrease and this decrease remains relatively more reasonable at low IFQ values. Initially, significant differences in CO emissions did not emerge. Afterwards, the increase reached a dramatic level especially at low loads. It exhibited similar trends in THC emissions to that of CO. However, with the delay of SOI, there was a noticeable increase in THC at each interval. Regular decreases occurred as the SOI of NO_x emissions lagged. Larger values of the NO_x reduction gradient occurred at higher engine loads. It has been observed that the downward trend starts after a point at low IFQ values in soot emissions, and as IFQ increases, the starting point of the downward trend is postponed and even no downward trend can be observed in increasing IFQ values.

References

- [1] Fang, T., & Chia-fon, F. L. (2011). Low sooting combustion of narrow-angle wall-guided sprays in an HSDI diesel engine with retarded injection timings. *Fuel*, 90(4), 1449-1456.
- [2] Goldsborough, S. S. (2009). A chemical kinetically based ignition delay correlation for iso-octane covering a wide range of conditions including the NTC region. *Combustion and Flame*, 156(6), 1248-1262.
- [3] Tang, Q., Liu, H., Ran, X., Li, M., & Yao, M. (2020). Effects of direct-injection fuel types and proportion on late-injection reactivity controlled compression ignition. *Combustion and Flame*, 211, 445-455.
- [4] Fang, Q., Fang, J., Zhuang, J., & Huang, Z. (2013). Effects of ethanol–diesel–biodiesel blends on combustion and emissions in premixed low temperature combustion. *Applied Thermal Engineering*, 54(2), 541-548.
- [5] Buyukkaya, E., & Cerit, M. (2008). Experimental study of NO_x emissions and injection timing of a low heat rejection diesel engine. *International journal of thermal sciences*, 47(8), 1096-1106.
- [6] Kim, K., Oh, S., Lee, Y., Lee, S., & Kim, J. (2015). Intake condition requirements for biodiesel modulated kinetic combustion concept to achieve a simultaneous NO_x and soot removal. *Energy Conversion and Management*, 103, 119-128.
- [7] Fang, Q., Fang, J., Zhuang, J., & Huang, Z. (2013). Effects of ethanol–diesel–biodiesel blends on combustion and emissions in premixed low temperature combustion. *Applied Thermal Engineering*, 54(2), 541-548.

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Özet

Bu araştırmada fen bilgisi öğretmen adaylarının çevresel davranış durumlarının belirlenmesi amaçlanmıştır. Araştırmada araştırma yöntemlerinden nicel araştırma, araştırma desenlerinden ise tarama modeli kullanılmıştır. Bir devlet üniversitesinin eğitim fakültesinde 2021-2022 eğitim-öğretim yılında lisans eğitimi almakta olan fen bilgisi öğretmen adayları araştırmanın örneklemini oluşturmaktadır. Araştırmaya 1., 2., 3. ve 4. sınıflardan 181 kadın ve 43 erkek öğretmen adayı katılmıştır. Araştırmada Timur ve Yılmaz tarafından uyarlanan 20 madde ve 6 alt boyuttan oluşmuş, cronbach alpha güvenirlik katsayısı 0,903 olan Çevre davranış ölçeği kullanılmıştır. Araştırmada elde edilen bulgular doğrultusunda fen bilgisi öğretmen adaylarının çevreye yönelik davranışları ve alt boyutlara göre değişimi incelenmiştir.

Anahtar Kelimeler: Çevresel Davranış, Öğretmen Adayları, Fen Bilgisi

**ENVIRONMENTAL BEHAVIORAL STATUS OF PRE-SERVICE SCIENCE
TEACHERS**

Abstract

In this study, it was aimed to determine the environmental behavior status of science teacher candidates. Quantitative research, one of the research methods, and scanning model, which is one of the research designs, were used in the research. In the 2021-2022 academic year, science teacher candidates studying at the faculty of education of a state university constitute the sample of the research. 181 female and 43 male teacher candidates from 1st, 2nd, 3rd and 4th grades participated in the research. The Environmental Behavior Scale, which consists of 20 items and 6 sub-dimensions, adapted by Timur and Yılmaz, and has a cronbach alpha reliability coefficient of 0.903, was used in the study. In line with the findings obtained in the research, the behavior of the pre-service science teachers towards the environment and their changes according to the sub-dimensions were examined.

Keywords: Environmental Ethics, Pre-service Teachers, Science

GİRİŞ

Çevre sorunlarının yerel değil küresel olması en büyük özelliğidir. Çevre sorunları dil, din, ırk, cinsiyet, köylü-şehirli, zengin-fakir, genç-yaşlı, fen bilgisi veya okul öncesi öğretmeni, sınıf öğretmeni, biyoloji öğretmeni, matematik veya kimya öğretmeni gibi hiç bir ayırım olmaksızın herkesi etkiler. Bu sebepten çevreyi korumak yalnızca çevrecilerin görevi değildir. Aynı çevrenin korunması sadece bireyin değil de toplumunda görevi olduğu gibi çevre eğitimi de sadece çevre eğitimcilerinin vermesi gereken görev değildir. Verilen eğitimlerde çevrenin korunması arasında ilişki kurulmalıdır (Erten, 2004).

Çevre eğitimi, toplumu oluşturan bireylerin çevreye karşı davranış ve düşüncelerini belirleyerek bireylerde doğru bir çevre anlayışının oluşmasını sağlayabilecektir (Sancar, 2005). Çevrenin hızla kirlenmesi günümüzden çok gelecek kuşakları daha çok etkilemektedir. Çevre kirliliğini azaltılması, oluşacak çevre kirliliğini engellenmesi ve çevre tahribatlarının azaltılması için çevre gönüllüleri ve bilim adamları çevreci fikirler ortaya atmışlardır. Bu çevreci fikirler etik değerler çerçevesinde tartışılmaya başlanmıştır (Görmez, 2003).

Yapılan literatür incelemesi sonucunda çeşitli seviyelerde farklı branşlarda çevresel davranış durumu ile ilgili yapılan bir çok araştırma bulunduğu tespit edilmiştir (Duru, 2021; Güngör, 2019; Özgün, 2019; Temiz ve Karakuyu, 2019).

Bu araştırmanın amacı fen bilimleri öğretmen adaylarının çevresel davranış durumlarının belirlenmesidir.

YÖNTEM

Araştırma Modeli

Yapılan araştırma da, fen bilgisi öğretmenliğinde öğrenim görmekte olan farklı sınıf seviyelerindeki öğretmen adaylarının çevresel davranış durumlarını belirlemek için nicel araştırma yöntemlerinden tarama modeli kullanılmıştır. Genel bir yargıya varmada genel tarama modeli kullanılırken konunun derinlemesine incelemede ise örnek olay tarama modeli kullanılmaktadır (Karasar, 1984).

Çalışma Grubu

Araştırmanın çalışma grubunu 2021-2022 eğitim-öğretim yılında Ankara ilinde bir devlet üniversitesinin eğitim fakültesinde Fen Bilgisi Öğretmenliği programında 1., 2., 3. ve 4. Sınıfta öğrenim gören 224 Fen bilgisi öğretmen adayı (181 kadın ve 43 Erkek) oluşturmaktadır (Tablo 1).

Tablo 1. Sınıf seviyesine göre cinsiyet dağılımı.

Cinsiyet	Sınıf Seviyeleri									
	1.Sınıf		2.Sınıf		3.Sınıf		4.Sınıf		Toplam	
	N	%	N	%	N	%	N	%	N	%
Kadın	8	21,0	51	28,2	56	30,9	36	63,2	181	100
Erkek	9	20,9	10	23,3	3	7,0	21	36,8	43	100
Toplam	47	21	61	27,2	59	26,3	43	19,2	224	100

Veri Toplama Aracı

Yapılan bu araştırmada Timur ve Yılmaz (2013) tarafından yapılan uyarlama sonucundaki Çevre Davranış Ölçeği kullanılmıştır. Ölçek 20 maddeden ve 6 alt boyuttan oluşmaktadır. Ölçeğin alt boyutları; kişinin ekonomik yararına olan kaynak koruma aktiviteleri (KEYOKKA), çevreye duyarlı tüketici (ÇDT), doğa ile ilgili boş zaman aktiviteleri (DİİBZA), geri dönüşüm çabaları (GDÇ), sorumlu vatandaşlık (SV) ve çevre eylemciliği (ÇE)'dir. Çevre Davranış Ölçeği 5'li Likert tipi şeklindedir ve öğretmen adayları görüşlerini her bir madde için Hiçbir zaman(1), Nadiren(2), Bazen(3), Genellikle(4), Her zaman(5) olmak üzere 5 farklı dereceden biriyle değerlendirmesi gerekmektedir. Çevre davranış ölçeğinin Timur ve Yılmaz (2013)'ın uyarlama çalışmasında cronbach alpha güvenirlik katsayısı 0,903 olarak tespit edilmiştir.

Verilerin Analizi ve Kullanılacak İstatistiksel Teknikler

Veri analizi, verilerin toplanması, toplanan verilerin düzenlenmesi ve istatistiksel işlemler yapılarak anlamlı kararlara ulaşma ve geçerli sonuçlar çıkarabilmek amacıyla yapılan işlemler süreci olarak tanımlanabilir (Büyüköztürk, 2014). Yapılan bu araştırmada gerekli olan veriler katılımcılara uygulanan ilgili ölçek ile toplanmıştır. Toplanan veriler ise istatistiksel analiz programlarından SPSS programında analiz edilerek ve çözümlenerek tablolar haline getirilmiştir. Çevre Davranış Ölçeği Hiçbir zaman(1), Nadiren(2), Bazen(3), Genellikle(4), Her zaman(5) şeklinde 5'li Likert tipi ölçek şeklinde değerlendirilmesi gerekmektedir. Ölçeklerin puanlarının değerlendirilmesinde öğretmen adaylarının işaretlediği yanıtlara göre 1 ile 5 aralığında puanlanması sonucu aldıkları ortalama puanlar kullanılmıştır. Ayrıca yapılan araştırmada elde edilen veriler istatistiksel analiz sonuçları frekans (f) ve yüzde (%) analizi kullanılmıştır.

BULGULAR VE SONUÇ

Araştırmada yer alan fen bilimleri öğretmen adaylarının “Çevre Davranış Ölçeği” ne ilişkin Aldıkları Puanların Frekans, Yüzde Değerleri Tablo 2’de görülmektedir.

Tablo 2. Öğretmen Adaylarının Çevre Davranış Ölçeği’ne İlişkin Aldıkları Puanların Frekans, Yüzde Değerleri

Maddeler	Hiçbir Zaman		Nadiren		Bazen		Genellikle		Her Zaman	
	n	%	n	%	n	%	n	%	n	%
E1. Çevresel sorunları yetkililere bildiririm.	10	4,5	37	16,8	97	44,1	59	26,8	17	7,7
E2. Gazete ve plastik şişe gibi atıkları geri dönüşüm toplama noktalarına götürürüm.	4	1,8	19	8,6	73	33,2	87	39,5	37	16,8
E3. Medyaya çevresel sorunlar hakkında mektuplar gönderirim.	135	61,4	43	19,5	24	10,9	16	7,3	2	0,9
E4. Depozitosu olan meşrubat şişelerini geri veririm.	38	17,3	45	20,5	47	21,4	61	27,7	29	13,2
E5. Kullanılmış kâğıtları müsvedde kağıdı olarak yeniden kullanırım.	3	1,4	6	2,7	23	10,5	104	47,3	84	38,2
E6. Daha önceden alışveriş poşeti olarak kullanılmış naylon poşetleri tekrar kullanırım.	1	0,5	2	0,9	13	5,9	76	34,5	128	58,2
E7. “Çevre dostu” ürünleri satın alırım(ozon dostu spreyleyler, geri dönüşüm paketi olan ürünler ve ekonomik boy ürünler).	2	0,9	26	11,8	70	31,8	74	33,6	48	21,8
E8. Halka açık yerlerin korunması ve temizlenmesi için kampanyalara katılırım.	53	24,1	68	30,9	53	24,1	27	12,3	19	8,6
E9. Kullanılmayan elektrikli cihazları ve ışıkları kapatarak enerji tasarrufu sağlarım.	1	0,5	3	1,4	14	6,4	86	39,1	116	52,7
E10. Evde su tasarrufu yaparım (dişlerimi fırçalarken veya bulaşıkları yıkarken musluğu kapatırım vb.).	0	0,0	3	1,4	13	5,9	78	35,5	126	57,3
E11. Halka açık alanlara çöp atan veya zarar veren insanları uyarırım.	7	3,2	23	10,5	63	28,6	75	34,1	52	23,6
E12. İnsanların, halka açık yerlere attıkları çöpleri toplayıp çöp kutusuna atarım.	21	9,5	38	17,3	70	31,8	54	24,5	37	16,8
E13. Kullanılmış pilleri çöp kutusu yerine piller için uygun toplama kutularına koyarım.	9	4,1	27	12,3	46	20,9	74	33,6	64	29,1
E14. Odadan çıkarken klima vb. cihazları açık bırakırım.	16	7,3	10	4,5	17	7,7	56	25,5	121	55,0
E15. Dışarıdayken kuş seslerini, hayvanları ve çiçekleri fark ederim.	1	0,5	1	0,5	21	9,5	96	43,6	101	45,9
E16. Çevre kirliliğini önlemek için düzenlenen kampanyalarda görev alırım.	54	24,5	78	35,5	45	20,5	27	12,3	16	7,3
E17. Bir çevre organizasyonunda aktif olarak görev alırım.	73	33,2	76	34,5	36	16,4	22	10,0	13	5,9
E18. Günlük gazete veya dergilerdeki çevre konularıyla ilgili makaleleri okurum.	41	18,6	65	29,5	63	28,6	34	15,5	17	7,7
E19. Çevre ve doğa ile ilgili televizyon programlarını izlerim.	16	7,3	37	16,8	79	35,9	62	28,2	26	11,8
E20. Doğa yürüyüşü ve geziler yaparım.	11	5,0	30	13,6	60	27,3	69	31,4	50	22,7

Çevre Davranış Ölçeği’ne verilen cevaplar incelendiğinde elde edilen bulgulara göre;

- Fen Bilgisi öğretmen adaylarının çoğunluğunun kullanılmış pilleri pil toplama kutusuna genellikle koydukları, geri dönüşüm atıklarını geri dönüşüm toplama noktalarına götürdüğü ve deponosunu olan meşrubat şişelerini nadir olarak geri verdiği,
- Fen Bilgisi öğretmen adaylarının büyük bir çoğunluğunun kullanılmış kâğıtları müsvedde kâğıt olarak yeniden kullandıkları ve daha önceden alışveriş poşeti olarak kullanılmış naylon poşetlerin tekrar kullandıkları görülmektedir. Son zamanlarda alışveriş poşetlerinin ücretlendirilmesi bu davranışı olumlu yönde etkilediği,
- Fen Bilgisi öğretmen adaylarının Çevre Davranış Ölçeği'ne verdikleri cevaplara göre alışveriş yaparken çevre dostu ürünler almaya dikkat ettikleri,
- Fen Bilgisi öğretmen adaylarının büyük çoğunluğunun verdikleri cevaplara göre odadan çıkarken elektrikli cihazları açık bırakmadıkları, kullanılmayan cihazları ışıkları, kapatarak enerji ve su tasarrufu yaptıkları,
- Fen Bilgisi öğretmen adaylarının büyük çoğunluğunun halka açık alanlara çöp atmaları veya çevreye zarar verenleri genellikle uyardıkları ve çevredeki çöpleri toplayıp çöp kutusuna bazen attıkları,
- Fen Bilgisi öğretmen adaylarının büyük çoğunluğunun çevresel sorunları yetkililere bazen bildirdikleri, medyaya çevresel sorunlarla ilgili mektuplar göndermediği ve halka açık yerlerin korunması, temizlenmesi ve çevre kirliliğini önlemek için düzenlenen kampanyalara çok sık katılım sağlamadığı ayrıca Fen Bilgisi öğretmen adaylarının çevre organizasyonlarında çok sık aktif görev almadıkları,
- Fen Bilgisi öğretmen adaylarının büyük çoğunluğunun gazete ve dergideki çevre ile ilgili makaleleri çok fazla okumadıkları fakat çevre ile ilgili televizyon programlarını bazen izlediği,
- Fen Bilgisi öğretmen adaylarının büyük bir çoğunluğunun doğa yürüyüşü, geziler yaptığı ve dışarıdayken insan dışındaki canlıların farkında olduğu söylenebilir.

KAYNAKLAR

- Büyüköztürk, Ş. (2014). *Bilimsel araştırma yöntemleri*. Ankara: Pegem Akademi.
- Duru, B. (2021). *Okul öncesi öğretmenlerin çevresel etik anlayışları ile sorunlu çevresel davranışları arasındaki ilişkinin incelenmesi*. Yüksek Lisans Tezi, İstanbul Aydın Üniversitesi Lisansüstü Eğitim Enstitüsü, İstanbul.
- Ertan, B. (2004). 2000'li yıllarda çevre etiği yaklaşımları ve Türkiye. *Yönetim Bilimleri Dergisi*, 93-108.
- Görmez, K. (2003). *Çevre sorunları ve Türkiye* (3 b.). Ankara Gazi.
- Güngör, E. (2019). *Okul öncesi öğretmen adaylarının çevre etik tutumları ile sorumlu çevresel davranışları arasındaki ilişki*. Yüksek Lisans Tezi, Kastamonu Üniversitesi Sosyal Bilimler Enstitüsü, Kastamonu.
- Karasar, N. (1984). *Bilimsel araştırma yöntemi*. Ankara: Hacettepe-Taş.
- Özgün, G. (2019). *Ortaokul öğrencileri için çevresel davranış ölçeğinin geliştirilmesi ve çevresel davranışlarının cinsiyet ve sınıf düzeylerine göre incelenmesi*. Yüksek Lisans Tezi, Muğla Sıtkı Kocaman Üniversitesi Eğitim Bilimleri Enstitüsü, Muğla.
- Temiz, A. ve Karakuyu, A. (2019). Üniversite öğrencilerinin çevre etiği farkındalıklarının çevresel davranışlarına katkısı. *International Social Sciences Studies Journal*, 5(51), 6849-6853.
- Timur, S. ve Yılmaz, M. (2013). Çevre davranış ölçeğinin Türkçe'ye uyarlanması. *Gazi Üniversitesi Eğitim Fakültesi Dergisi*, 33(2), 317-333.

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Özet

Bu araştırmada fen bilgisi öğretmen adaylarının çevre etiği farkındalıklarının belirlenmesi amaçlanmıştır. Araştırmada, araştırma yöntemlerinden nicel araştırma desenlerinden ise tarama modeli kullanılmıştır. Yapılan araştırma 2021-2022 eğitim-öğretim yılında Ankara ilinde bir devlet üniversitesinin eğitim fakültesinde Fen Bilgisi Öğretmenliği programında 1., 2., 3. ve 4. Sınıfta eğitim gören 224 Fen bilgisi öğretmen adayı (181 Kadın ve 43 Erkek) ile yürütülmüştür. Araştırmada fen bilgisi öğretmen adaylarının çevre etiği farkındalıklarını belirlemek amacıyla Özgür ve Keleş'e ait "Çevre Etiği Farkındalık Ölçeği" kullanılmıştır. Araştırmada yer alan alt boyutlara ait sorulara fen bilgisi öğretmen adaylarının verdikleri cevapların yüzde ve frekans dağılımları incelenmiş ve fen bilgisi öğretmen adaylarının çevre etiği farkındalık durumları ortaya konulmuştur.

Anahtar Kelimeler: Çevre Etiği, Öğretmen Adayları, Fen Bilgisi

**ENVIRONMENTAL ETHICS AWARENESS OF PRE-SERVICE SCIENCE
TEACHERS**

Abstract

In this study, it was aimed to determine the environmental ethics awareness of science teacher candidates. In the research, one of the research methods and one of the quantitative research designs, the scanning model was used. The research was carried out with 224 science teacher candidates (181 Female and 43 Male) from the 1st, 2nd, 3rd and 4th grades of Science Teaching at the education faculty of a state university in the province of Ankara in the 2021-2022 academic year. In the study, the "Environmental Ethics Awareness Scale" of Özgür and Keleş was used to determine the environmental ethics awareness of teacher candidates. The percentage and frequency distributions of the answers given to the questions related to the sub-dimensions by the pre-service science teachers in the research were examined and the environmental ethics awareness of the pre-service science teachers was revealed.

Keywords: Environmental Ethics, Pre-service Teachers, Science

GİRİŞ

Canlıların birbirleriyle etkileşim halinde olduğu yaşam ortamına çevre olarak tanımlanır (Doğan, 2019). Çevrenin genel olarak tanımı yapılacak olursa “organizmanın içinde bulunduğu alan” denilebilir. İnsanların etkisinin olmadığı alanlara doğal çevre olarak adlandırılırken insan etkisiyle değiştirilmiş alanlara ise yapay çevre olarak adlandırılır (Doğan, 2019). Çevresel değerler kapsamında çevre etiği “iyi ve kötü çevrecilik” kavramlarının ne olduğuna dair cevap arar. Aynı zamanda çevre etiği insan davranışları ile direkt olarak ilişki içerisindedir (Frankena, 2007).

Yapılan literatür incelemesi sonucunda çeşitli seviyelerde farklı branşlarda çevre etiği ile ilgili yapılan bir çok araştırma bulunduğu tespit edilmiştir (Altın, 2022; Duru, 2021; Tekiroğlu, 2021; Güngör, 2019; Gürüçin, 2019; Deniz, 2019; Temiz ve Karakuyu, 2019; Sönmez, 2018; Karademir, 2017).

Bu çalışmanın amacı “Fen bilimleri öğretmen adaylarının çevre etiği farkındalıkları” nı belirlemektir.

YÖNTEM

Araştırma Modeli

Yapılan araştırma da, fen bilgisi öğretmenliğinde öğrenim görmekte olan farklı sınıf düzeyinde öğretmen adaylarının çevre etiği farkındalık durumlarını belirlemek amacıyla nicel araştırma yöntemlerinden tarama modeli kullanılmıştır. Mevcut veya geçmişteki bir durumu olduğu gibi tanımlayan araştırma yaklaşımına tarama modeli olarak tanımlanır. Bu modelde genel ve örnek olay tarama modeli olmak üzere iki yaklaşım bulunmaktadır (Karasar, 1984).

Çalışma Grubu

Yapılan araştırma 2021-2022 eğitim-öğretim yılında Ankara ilinde bir devlet üniversitesinin eğitim fakültesinde Fen Bilgisi Öğretmenliği programında 1., 2., 3. ve 4. Sınıfta öğrenim gören 224 Fen bilgisi öğretmen adayı (181 kadın ve 43 Erkek) ile yürütülmüştür (Tablo 1).

Tablo 2. Çalışma grubunun sınıf seviyesine göre cinsiyet dağılımı

Cinsiyet	Sınıf Seviyeleri									
	1.Sınıf		2.Sınıf		3.Sınıf		4.Sınıf		Toplam	
	N	%	N	%	N	%	N	%	N	%
Kadın	8	21,0	51	28,2	56	30,9	36	63,2	181	100
Erkek	9	20,9	10	23,3	3	7,0	21	36,8	43	100
Toplam	47	21	61	27,2	59	26,3	43	19,2	224	100

Veri Toplama Aracı

Araştırmada kullanılan veri toplama aracı “Çevre Etiği Farkındalık Ölçeği” Özer ve Keleş (2013) tarafından geliştirilmiştir. Öğretmenlerin çevre etiğine yönelik farkındalıklarının belirlenmesi amacıyla geliştirilmiş olan bu ölçek, 23 maddeden ve 4 boyuttan oluşmaktadır. Çevre etiği farkındalık ölçeğin boyutları; çevre etiğinin tanımı, çevre etiğinin ortaya çıkış nedeni, çevre etiğinin amacı ve çevre etiğine yönelik önlemler şeklindedir. Özer ve Keleş (2016) tarafından ölçeğin geneli için Cronbach Alpha güvenilirlik katsayısını 0,95 olarak tespit edilmiştir.

Verilerin Analizi ve Kullanılacak İstatistiksel Teknikler

Veri analizi, verilerin toplanması, toplanan verilerin düzenlenmesi ve istatistiksel işlemler yapılarak anlamlı kararlara ulaşma ve geçerli sonuçlar çıkarabilmek amacıyla yapılan işlemler süreci olarak tanımlanabilir (Büyüköztürk, 2014). Toplanan veriler istatistiki analiz programlarından SPSS programında analiz edilerek fen bilimleri öğretmen adaylarının sorulara verdikleri cevapların ortalama, sapma, frekans (f) ve yüzde (%) dağılımları verilmiştir.

BUGULAR VE SONUÇ

Araştırmada kullanılan 4 boyutu bulunan Çevre etiği farkındalık ölçeğin alt boyutları; çevre etiğinin tanımı, çevre etiğine yönelik alınacak önlemler, çevre etiğinin ortaya çıkış nedeni ve çevre etiğinin amacı şeklindedir. Araştırmaya katılan fen bilgisi öğretmen adaylarının çevre etiğinin tanımı alt boyut puanlarının frekans ve yüzde değerleri Tablo 2’de verilmiştir.

Araştırmada yer alan fen bilimleri öğretmen adaylarının çevre etiğinin tanımı alt boyutuna ilişkin aldıkları puanlar incelendiğinde en yüksek puan ortalamasına S1 in, en düşük ortalamaya ise S7’nin sahip olduğu belirlenmiştir (Tablo 2). Araştırmada yer alan öğretmen adaylarının çevre etiği tanımına ilişkin puan ortalamalarına bakıldığında iyi durumda oldukları söylenebilir

Tablo 2. Çevre etiğinin tanımı alt boyutuna ilişkin aldıkları puanların frekans, yüzde değerleri

Maddeler	Kesinlikle Katılmıyorum		Katılmıyorum		Kararsızım		Katılıyorum		Kesinlikle Katılıyorum		\bar{x}	S
	N	%	N	%	N	%	N	%	N	%		
	S1	2	0,9	1	0,4	-	-	47	21	174		
S2	3	1,3	1	0,4	3	1,3	54	24,1	163	72,8	4,665	,663
S3	2	0,9	-	-	2	0,9	50	22,3	170	75,9	4,723	,572
S4	2	0,9	-	-	2	0,9	49	21,9	171	76,3	4,728	,570
S5	2	0,9	1	0,4	1	0,4	56	25,0	164	73,2	4,692	,598
S6	2	0,9	-	-	9	4,0	74	33,0	139	62,1	4,554	,661
S7	2	0,9	5	2,2	14	6,3	68	30,4	135	60,3	4,469	,786

Tablo 3. Çevre etiğine yönelik alınacak önlemler alt boyutuna ilişkin aldıkları puanların frekans, yüzde değerleri

Maddeler	Kesinlikle Katılmıyorum		Katılmıyorum		Kararsızım		Katılıyorum		Kesinlikle Katılıyorum		\bar{x}	S
	N	%	N	%	N	%	N	%	N	%		
	S8	6	2,7	15	6,7	45	20,1	73	32,6	85		
S9	3	1,3	2	0,9	12	5,4	88	39,3	119	53,1	4,420	,753
S10	2	0,9	5	2,2	12	5,4	75	33,5	130	58,0	4,455	,774
S11	5	2,2	7	3,1	18	8,0	78	34,8	118	51,8	4,308	,913
S12	1	0,4	2	0,9	1	0,4	58	25,9	162	72,3	4,688	,577
S13	2	0,9	1	0,4	6	2,7	52	23,2	163	72,8	4,665	,642
S14	2	0,9	2	0,9	5	2,2	67	29,9	148	66,1	4,593	,670
S15	2	0,9	1	0,4	6	2,7	69	30,8	146	65,2	4,590	,657

Araştırmada yer alan fen bilimleri öğretmen adaylarının, çevre etiğine yönelik alınacak önlemler alt boyutuna ilişkin aldıkları puanlar incelendiğinde en yüksek puan ortalamasına S12'in, en düşük ortalamaya ise S8'nin sahip olduğu belirlenmiştir (Tablo 3). Araştırmada yer alan öğretmen adaylarının çevre etiğine yönelik alınacak önlemlere ilişkin puan ortalamalarına bakıldığında iyi durumda oldukları söylenebilir.

Araştırmada yer alan fen bilimleri öğretmen adaylarının, çevre etiğinin ortaya çıkış nedenleri alt boyutuna ilişkin aldıkları puanlar incelendiğinde en yüksek puan ortalamasına S20'in, en düşük ortalamaya ise S17'nin sahip olduğu belirlenmiştir (Tablo 4).

Araştırmada yer alan öğretmen adaylarının çevre etiğinin ortaya çıkış nedenleri ilişkin puan ortalamalarına bakıldığında iyi durumda oldukları söylenebilir.

Tablo 4. Çevre etiğinin ortaya çıkış nedenleri alt boyutuna ilişkin aldıkları puanların frekans, yüzde değerleri

Maddeler	Kesinlikle Katılmıyorum		Katılmıyorum		Kararsızım		Katılıyorum		Kesinlikle Katılıyorum		\bar{x}	S
	N	%	N	%	N	%	N	%	N	%		
	S16	2	0,9	3	1,3	5	2,2	90	40,2	124		
S17	1	0,4	5	2,2	31	13,8	84	37,5	103	46,0	4,26	,813
S18	2	0,9	6	2,7	15	6,7	106	47,3	95	42,4	4,28	,778
S19	3	1,3	3	1,3	25	11,2	87	38,8	106	47,3	4,29	,822
S20	2	0,9	1	0,4	6	2,7	64	28,6	151	67,4	4,61	,653

Araştırmada yer alan fen bilimleri öğretmen adaylarının, çevre etiğinin amacı alt boyutuna ilişkin aldıkları puanlar incelendiğinde en yüksek puan ortalamasına S21'in, en düşük ortalamaya ise S23'nin sahip olduğu belirlenmiştir (Tablo 5). Araştırmada yer alan öğretmen adaylarının çevre etiğinin amacına ilişkin puan ortalamalarına bakıldığında iyi durumda oldukları söylenebilir.

Tablo 5. Çevre etiğinin amacı alt boyutuna ilişkin aldıkları puanların frekans, yüzde değerleri

Maddeler	Kesinlikle Katılmıyorum		Katılmıyorum		Kararsızım		Katılıyorum		Kesinlikle Katılıyorum		\bar{x}	S
	N	%	N	%	N	%	N	%	N	%		
	S21	2	0,9	1	0,4	1	0,4	50	22,3	170		
S22	2	0,9	-	-	4	1,8	50	22,3	168	75,0	4,71	0,594
S23	2	0,9	1	0,4	4	1,8	53	23,7	164	73,2	4,68	0,624

Araştırmada kullanılan 4 boyutu bulunan Çevre Etiği Farkındalık ölçeğinin alt boyutları; çevre etiğinin tanımı, çevre etiğine yönelik alınacak önlemler, çevre etiğinin ortaya çıkış nedeni ve çevre etiğinin amacı şeklindedir. Araştırmada elde edilen veriler değerlendirildiğinde fen bilimleri öğretmen adaylarının Çevre Etiği Farkındalıklarının tüm alt boyutlarda yüksek olduğu belirlenmiştir (Tablo 2- 5).

Çevre Farkındalık Ölçeği'ne verilen cevaplar incelendiğinde elde edilen bulgulara göre;

- Fen bilgisi öğretmen adaylarının yaşadıkları dünyayı gelecek kuşaklarla paylaşmak zorunda olduklarını ve çevreye bıraktıkları izlerin sadece bugünkü kuşakları değil gelecek kuşakları da etkilediğinin farkında olduğu,
- Fen Bilgisi öğretmen adaylarının insan refahı ve mutlu bir hayat için çevreyi korumaları gerektiğinin farkında olduğu,

- Fen Bilgisi öğretmen adaylarının çevredeki her şeye ahlaki açıdan da değer verdiği ve çevreyi korudukları,
- Fen Bilgisi öğretmen adaylarının çoğunluğunun teknolojisiz bir hayatta canlı cansız varlıkların değerini daha fazla anlayacaklarının farkında olsalar da bu konuda kararsız olan ve bu görüşe katılmayan öğretmen adayları da çok fazla olduğu,
- Fen Bilgisi öğretmen adayları hukuk kurallarının insanlar üzerinde etkisinin çok olduğunu ve hukuk kuralları olursa çevre sorunlarının azalacağını veya ortadan kalkacağını düşündüğü ve bu nedenle hükümetlerin çevreye yönelik yasaklamaları ve tedbirleri olması gerektiğini düşündüğü,
- Fen Bilgisi öğretmen adaylarının doğal kaynakların tüketilmesinde adalet ve hukuk çerçevesinde olmasına önem verdiği, çevreyi korumanın ahlaki kural olduğunu ve bu kurala uyulması gerektiğini düşündüğü,
- Fen Bilgisi öğretmen adaylarının doğal dengenin bozulmasının tüm canlıları etkileyeceğinin farkındadırlar. Bu nedenle çevrede bulunan canlılara karşı sorumlu ve doğaya karşı ahlaki sorumluluklarının olduğunu farkında olduğu,
- Fen Bilgisi öğretmen adayları canlı-cansız varlıklara saygının yolu eğitim olduğunu ve ekoloji sorunlarının ortadan kaldırılması için eğitimin yapılandırılması gerektiğini düşündüğü belirlenmiştir.

KAYNAKLAR

- Altın, M. (2022). *Okul öncesi öğretmenliği öğrencilerinin çevre eğitimine ilişkin öz-yeterlik ve çevre etiği farkındalık algılarının ekolojik vatandaşlık düzeylerine etkisi*. Yüksek Lisans Tezi, Çanakkale Onsekiz Mart Üniversitesi Lisansüstü Eğitim Enstitüsü, Çanakkale.
- Büyüköztürk, Ş. (2014). *Bilimsel araştırma yöntemleri*. Ankara: Pegem Akademi.
- Deniz, S. (2019). *Öğretmen adaylarının çevre etiği farkındalığı ile fen ve teknoloji okuryazarlığı arasındaki ilişkinin incelenmesi*. Yüksek Lisans Tezi, Siirt Üniversitesi Fen Bilimleri Enstitüsü, Siirt.
- Doğan, F. (2019). *Ortaokul ve lise öğrencilerinin çevre farkındalık ve davranış düzeylerinin belirlenmesi*. Yüksek Lisans Tezi, Mersin Üniversitesi Eğitim Bilimleri Enstitüsü, Mersin.
- Duru, B. (2021). *Okul öncesi öğretmenlerin çevresel etik anlayışları ile sorunlu çevresel davranışları arasındaki ilişkinin incelenmesi*. Yüksek Lisans Tezi, İstanbul Aydın Üniversitesi Lisansüstü Eğitim Enstitüsü, İstanbul.
- Frankena, W. (2007). *Etik* (1 b.). (A. Aydın, Çev.). İstanbul: İmge.
- Güngör, E. (2019). *Okul öncesi öğretmen adaylarının çevre etik tutumları ile sorumlu çevresel davranışları arasındaki ilişki*. Yüksek Lisans Tezi, Kastamonu Üniversitesi Sosyal Bilimler Enstitüsü, Kastamonu.
- Güriçin, C. (2019). *Öğretmen adaylarının çevre etiğine yönelik farkındalık durumlarının incelenmesi*. Yüksek Lisans Tezi, Düzce Üniversitesi Fen Bilimleri Enstitüsü, Düzce.
- Karademir, Y. (2017). *Öğretmen adaylarının doğaya bağlılık düzeyleri ve etik tutumları*. Yüksek Lisans Tezi, Muğla Sıtkı Kocaman Üniversitesi Fen Bilimleri Enstitüsü, Muğla.
- Karasar, N. (1984). *Bilimsel araştırma yöntemi*. Ankara: Hacettepe-Taş.
- Özer, N., & Keleş, Ö. (2016). Çevre etiği farkındalık ölçeği geliştirme çalışması. *Fen Bilimleri Öğretimi Dergisi*, 4(1), 47-64.
- Sönmez, D. (2018). *Farklı fakültelerde öğrenim gören yükseköğretim öğrencilerinin çevre etiği farkındalık düzeylerinin incelenmesi*. Sütçü İmam Üniversitesi Fen Bilimleri Enstitüsü, Kahramanmaraş.
- Tekiroğlu, A. (2021). *Sosyal bilgiler öğretmenlerinin çevre etiği farkındalıkları ve sürdürülebilir çevreye yönelik tutumları arasındaki ilişkinin çeşitli değişkenler açısından incelenmesi*. Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul.
- Temiz, A., ve Karakuyu, A. (2019). Üniversite öğrencilerinin çevre etiği farkındalıklarının çevresel davranışlarına katkısı. *International Social Sciences Studies Journal*, 5(51), 6849-6853.

ESTABLISHMENT OF FOOTBALL TURF

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ABSTRACT

The importance of turfgrass among ground cover crops has been increasing in recent years. Turfgrasses, sports fields, parks and gardens etc. It is an important cover plant in areas. Among these areas, especially sports fields have started to attract more attention as the competitions become more professional and their popularity increases. Nowadays, football is the most striking sport among sports competitions. Football fields are one of the important factors that indirectly affect the visual satisfaction in the competition, the performance of the athlete, the quality of the game and the injuries of the football players. For these factors to be in the desired order, the cutting height should be kept short, the turfgrass density should be minimum 80%, frequent monitoring of irrigation and sun control for plant health and many other parameters. These fields, the use of which varies in intensity on a weekly or monthly basis, are the fields that need to be followed up seriously considering all these uses and seasonal conditions, and maintenance must be done in the same discipline throughout the year to maintain the same order in every competition. However, surface care alone is not enough for a successful field. For this reason, the field infrastructure must be provided in order for the maintenance operations to be more efficient. Football field infrastructure; hybrid content, heating, cooling, drainage layer, etc. of factors. All this structure directly affects the entire maintenance process. Especially, while the hybrid turf system affects the cover plant and the plant root system, the under-site heating and cooling systems affect the plant growth in harsh climatic conditions that have intense summer or winter seasons. This study aimed to discuss in detail the selection and maintenance of turfgrasses used in the construction of football fields and the importance of field infrastructure.

Keywords: Turfgrass, football field, establishment, hybrid

INTRODUCTION

Turfgrasses; It is one of the most important species in the cover crops plant group. Due to the density cover, sports fields, parks, gardens, hotel gardens, road slopes, etc. It is preferred as a cover crops in areas. Football the most attention in this regard among sports fields. Football is in more and more demand in our country and in the world, and for this reason, new stadiums are being built. These built areas are organized according to the standards set by FIFA (Fédération Internationale de Football Association), which is responsible for football management around the world. Turfgrass football fields (pitch), which are the main areas of use for athletes and the basic visual of football, are the most basic part of the facilities within football (Icoz et al.,2009; Puhalla et al., 2020). All stadium fields are built within certain order and quality elements, and the following process proceeds accordingly. Football fields, where national or international matches are played, are one of the areas of the facility that should be given high priority both visually and in terms of condition. Football field; It directly affects factors such as visual, tactical application, athlete injuries and game quality. Football field according to Performance Quality Standards; It should have adequate drainage, none weeds, uniform, leveled and dense cover. In order to provide all of these, the necessary infrastructure, sufficient equipment, knowledgeable personnel for the equipment and the right irrigation system are required (Cockerham 2008, FIFA 2011).

Football fields are divided into two as natural and synthetic (artificial) turfgrass fields according to the characteristics of the ground. While synthetic pitches are generally preferred in local pitches, natural turfgrass pitches are preferred more than artificial ones in terms of the health and playing quality of football players in top league football clubs. Frequency of use of natural fields, excess of surface impact in a competition, etc. For these reasons, it is one of the most difficult areas to maintain. These fields are established in 4 different ways. These are roller grass, vegetative planting, sowing and hydroseeding methods. Although these areas contain surface maintenance differences within themselves, maintenance is generally carried out on the same foundation (Hocaoğlu and Bingöl, 2022). Turfgrass fields in football; It is evaluated in terms of surface hardness, tearing, drainage level, root strength and visual order. If all these details, which can be improved in a certain discipline with the right care, are not taken into account, athlete's injury etc. can cause serious problems. For this reason, all factors from the grass plant selected for the surface coating to the choice of the machine to be used in the care of the plant and the personnel to use the machine should be carefully selected and the applications should be done correctly.

Although the turfgrass types preferred in football fields differ in terms of care, the turfgrass types used basically in all are classified as cool season turfgrasses (C3) and warm climate turfgrasses (C4) according to the climatic conditions of the field. C3 cool climate turfgrasses such as *Lolium perenne* (Perennial ryegrass), *Festuca arundinacea* (Tall fescue), *Festuca rubra* (Red fescue), *Poa pratensis* (Kentucky bluegrass) and *Cynodon dactylon* (Bermudagrass), which is also preferred in sports fields. (Alkan et al. 2019). *Paspalum vaginatum* (Seashore paspalum). In addition, two other warm-season turfgrass species, *Buchloe dactyloides* (Buffalograss) and *Zoysia japonica* (Zoysiagrass), are sometimes used for sports turf but infrequently (Beard, 1973; Avcioglu, 2014; Puhalla et al., 2020)

These types, which are known as the strongest grass types in terms of root structure and plant growth characteristics, are preferred primarily in areas where surface pressure and surface injuries such as rupture and tearing are high, especially in football fields. Among these plants, the cool climate turfgrasses *Lolium perenne*, *Poa pratensis* and *Festuca* sp. The most preferred are known as turfgrass species. Especially *Lolium perenne* plays an important role in football fields due to its high germination and growth rate. Bermudagrass is the most widely used turfgrass type in warm climate turfgrasses. It is the most preferred hot climate plant due to its strong stolon structure, tillering speed and impact resistance. Inter-planting is done with *Lolium perenne* in the autumn months in football fields covered with Bermudagrass. This; It provides the support of *Lolium perenne*, which has high germination power and durability, to the Bermudagrass turfgrass, which weakens during the transition period, and to extend the use of the ground, and to quickly repair the damages that occur in the competitions (Beard, 1973; Avcioglu, 2014; Puhalla et al.,2020).

ESTABLISHMENT OF FOOTBALL FIELD

The football field contains layers that support the mechanical maintenance made from the surface on the underground foundation. These are from the top ground to the deepest layer; turf surface, root zone, drainage gravel, geotextile, drainage pipe, semi-permeable soil. Each of these layers consists of hybrid root strengthening system, drainage gravel, permeable sand layer etc. All of these ingredients are of great importance both for the care process of the plant and for the success of the game and the athlete.

Turfgrasses used in football fields are plants that must be maintained depending on the competition time. From time to time, this requires the cool climate plant to survive in hot weather conditions and the warm climate plant to survive in cool weather conditions. Since this is not possible with natural roads, football fields should have a full-capacity infrastructure in

order to achieve this.(Avcioğlu, 2014). This infrastructure, from the top to the deepest layer, respectively; Turf surface, root zone, drainage gravel, geotextile, drainage pipe, semi-permeable soil. All elements in this infrastructure are built to ensure that the football field floor is of the same visual and quality throughout the year, despite seasonal differences. One of the most important layers is the underfloor heating/cooling system, which ensures the survival of cool climate and hot climate turfgrasses in non-living seasons. Underground heating and ventilation systems are systems used to bring the underground temperature to the desired temperature according to the seasonal conditions of the plant. For example, in order to prolong the dormancy period in grass plants that show stolon spread rapidly when dormancy loses its temperature, such as Bermudagrass (*Cynodon dactylon*), at the same time, an under-field aeration system is used to extend the survival time of *Lolium perenne*. In addition, the same system can be used to minimize the surface freezing of heating systems in regions with a harsh winter climate and high risk of frost due to snow and cold. (Alkan et al., 2019)

The most intense period of the competitions is usually the rainy winter months, so another important element is the field drainage system. Subsurface drainage systems are composed of conventional drainage pipes and vertical discharge gravel-sand mixture. Field drainage provides surface water control by preventing ponding etc. On the surface. This affects both the water saturation level of the plant and the game quality and player health. In the fields where drainage cannot be provided, serious problems such as muddying of the soil structure, excessive water saturation of the turfgrasses, difficulty in ball control during the game, deterioration of the visual of the field, the player's slip and the increase in the risk of player injury due to falling. In order to support surface drainage in heavy rainy areas where the correct drainage system cannot be established in the field infrastructure or where the drainage is not sufficient, an average of 1.5% slope is given to the field along the long line passing from the midfield level. With this slope, the water going to the edge of the field flows into the basins located 4m-6m from the touch line.

One of the most important sources of providing surface water control in turf fields is field irrigation systems. These systems are provided with sprinklers placed on the field surface. Each sprinkler is placed on the field with a certain math (Esin, 2006). Sprinklers are placed in a geometry on the field by determining the rotation angle and maximum reaching point on its own axis, and the pressure settings are adjusted according to the field dimensions. Sprinklers, which are not arranged in a correct mathematics, will prevent the equal amount of watering of

every point of the field, thus causing regional plant losses and indirectly visual deterioration. (Puhalla et al. 2010).

Football players make moves that require resistance during the match or experience involuntary falls that require resistance. It can be soft, muddy, lost its turfgrass texture locally or widely, or excessively covered, etc. The fields directly affect the field resistance. For example, although the dense and dense appearance of the turfgrass texture on the surface is visually beautiful, it prevents drainage in the fields where stolon growing turfgrasses such as Bermudagrass are dense and indirectly prevents the resistance of the field by creating a spongy soft field. For this reason, surface care to be applied in the fields is also very important.

The density of the grass plant may decrease due to the season or due to the increase in the intensity of the competition, and field injuries due to the same reasons increase and are dragged into the negative in terms of affecting both visual and performance. In order to maintain these problems throughout the year with the least impact, the strength of the root zone of the plant is a priority in the year-round maintenance (Özdemir, 2017).

For this, turfgrass root strengthening systems (hybrid turfgrass) are used in football fields. Hybrid turfgrasses are classified as rololer hybrid, sowing (stitched) and fiber hybrid. Stitched (sowing) hybrids; Synthetic material called polypropylene, with the use of computer-directed electrical machines with laser precision control facility, on the previously established or newly built field, approximately 9-18 cm of the surface. Carried out by placing it in the up to part of it. (Hocaoğlu and Bingöl, 2022). Roller hybrids; It is placed by knitting or weaving on a special support material that is partially biodegradable in nature, developed to ensure the deep and rooted growth of natural grass. Finally, a fiber mixture is used in fiber-reinforced root hybrids. Fiber hybrids are a direct root zone consolidation system, unlike the other two hybrid systems.

MAINTENANCE ON FOOTBALL FIELD

Maintenance operations on turfgrass fields; The type of turfgrasses, the season of the region, the infrastructure conditions of the field are taken into consideration. The most important after the infrastructure establishment in the field facility is equal and correct insemination to the entire field. Seed sowing, which is applied with tractor type machines or manual tools, is carried out in a way to ensure homogeneity in the whole field (Hocaoğlu and Bingöl, 2022). After the turfgrasses growth process is completed on turfgrass fields that have been planted in a homogeneous way, the shaping process plays a very important role in creating a visual feast of the field. In addition to the turfgrass, the arrangement and arrangement of the existing machinery also creates an effect. For example, the sharpness of the blades of the machines used

during shaping creates a direct visual effect. If the machine blade has lost its sharpness, it causes the plant to tear the surface part of the plant instead of cutting it, which causes the remaining part to die and turn yellow and the field visual to deteriorate.

After the match played on the field, especially in the periods when the root strength of the plant decreases, the turfgrass breaks off from the field and accumulates on the field surface. This both accumulates plant residues on the field surface and creates open areas without grass texture in the ruptured areas. All residues on the surface are cleaned with vacuum mowers or rakes, etc., depending on their density. Cleaned with hand tools. The bare areas are filled with local sandblasting and if necessary, they are repaired by seeding from place to place (Cereti et al., 2004; Emmons and Rossi, 2015).

Turf height in football fields is made within certain standards. This standard; creating a visually measured pattern, the rate of effect of the speed of the ball on the field, the comfort of the football player on the field, etc. consists of factors (Demiroglu Topcu and Ozkan, 2018). One of the other factors affecting the comfort of the athletes is the hardness of the floor. Since very hard floors will directly affect the field resistance, it increases the risk of injury during the fall of the football player. In order to control this situation, it is the process of drilling the field evenly with machines with 8-10 cm iron bars, called ventilation (Beard, 1973). This process not only brings the hardness of the field to the desired level, but also helps to increase the root strength of the plant by aeration of the plant roots.

Although the grass plants, which are sustained by the underfloor heating/cooling system on the field surface outside the seasonal normal, seem to be a very useful and sustainable system, many problems arise along with it. The most important of these is that the plants require more or less water than usual, especially during the season transition or intermediate planting periods, and this causes problems that will affect the plant and soil health and field quality in the long run (Hocaoğlu and Bingöl, 2022). Due to the architecture of the grass field facilities, the fact that a certain facade of the turfgrass fields is always shaded and the water ratio is high causes the part of the irrigation water that cannot be absorbed by the soil and the plant to remain in the top soil layer without evaporation due to shadow. In line with all these factors, a moss layer is formed that creates a slippery ground in the fields and closes the soil surface at a dangerous level if it is not controlled. While the moss layers affect the living conditions negatively by covering the plant and the soil, they create a slippery ground in the field and may create risky situations such as the slipping of the football players. Considering the plant health as a priority, the struggle of moss layers can be achieved by machines or sandblasting (Özdemir, 2017). Depending on the density level of the algae layer, this layer can be destroyed by local shredding

from the surface with unirake machines, with dense rakes or hand-held harrows, or it can be combated with a local or general sandblasting.

Another problem caused by the shadow areas in the stadium architecture is the inability to provide the sunlight and temperature that the plant desires. Main problems such as visibly thinning of plant density, color differences, weak root development are seen especially in the areas that do not receive sunlight. In some stadium architectures, the parts of the roof that are reflected on the field are built using semi-permeable glasses and the field can benefit from sunlight, albeit minimally (Özdemir, 2017). However, artificial daylight is used in all shaded areas since sufficient benefit cannot be provided. These lights are used in the shadow areas of the grass field when the underfloor heating cannot be turned on or is insufficient.

CONCLUSION

Football; It is one of the most popular sports fields due to its popularity. For this reason, football turf fields attract direct attention. From the spectators who come to the stadium to watch the match to the spectators watching on the digital screen, the first area that attracts everyone's attention is the turfgrass fields. For this reason, its image should always be neat. However, more importantly, the health of the football players who are direct users of the field, their comfort on the field, and the quality of the game they play have a very high impact on the field. In order for these effects to remain in the desired order, football fields should be formed in a way that complements each other from the foundation to the surface.

REFERENCES

- Ak K.M., Ögçe H., 2018, Investigation of Hybrid Turf Application Method in Football Field Example, *Düzce University Journal of Science and Technology*, 6 (2018) 1000-1009s
- Alkan Y., Sağlık A., Kelkit, A., Gür, E., Sağlık, E., 2019. Determination of Performance of 4 Different Cool Climate Turfgrass Seeds Commonly Used in Landscape Applications in Different Environments, *Bartın Faculty of Forestry Journal*, 21(3): 644-654 pp.
- Aslan Ş.T., 2014, Football Fields in Terms of Construction and Management: Applications from Turkey, Akdeniz University Graduate School of Sciences, Master Thesis, Antalya.
- Avcioğlu, R. 2014. Turf, Establishment, Maintenance. Ege University Press, Faculty of Agriculture Publication No: 574, Turkey, 332p.
- Beard JB, 1973. Turfgrass Science and Culture. New Jersey; USA: Englewood Cliffs Prentice Hall.
- Baker, S.W. 2004. Construction Methods For Public Sector And Professional Sports Pitches: A Review. I. International Conference On Turfgrass Management And Science For Sports Fields. *Acta Horticulturae*, 661:117-121pp.
- Cereti, C.F., Reyneri, A., Bruno, G., Leto, A., Maggiore, T., Martiniello, P., Ziliotto, U., Volterrani, M. (2004). An Italian Survey of Pitches for Soccer. *Acta Horticulturae* 661, 117-121.
- Cockerham, S.T. 2008. Culture Of Natural Turf Athletic Fields, In: M. Pessaraki (Ed.), *Handbook Of Turfgrass Management And Physiology*, Taylor&Francis Group, Pp. 151-167, Boca Raton, FL, USA.
- Demiroğlu Topçu, G., Özkan, Ş.S. 2018. Mowing Techniques and Patterns in Turf Areas. 2nd International Vocational Science Symposium, 26-28 April 2018, Abstract Book, Pp:201, Antalya/Turkey
- Emmons, R., Rossi, F. 2015. *Turfgrass Science & Management (5th Edition)*. Cengage Learning, 608p.
- Esin A.İ., 2006, Irrigation of Football Fields and Irrigation of Football Fields in Istanbul and Checking the drainage, Forest engineering Master's thesis in the Department of Forestry Construction and Transport.
- FIFA, 2011. *Futball Stadiums Technical Recommendations And Requirements*. Federation Internationale De Football Association Zurich, Switzerland, 418 p.
- FIFA, 2011. *Quality Concept Handbook Of Requirements For Football Turf*. Federation Internationale De Football Association Zurich, Switzerland, 39 p.
- Hocaoğlu T., Bingöl B., 2022. Investigation of Hybrid Turf Use in Football Fields, *International Journal Of Eastern Anatolia Science Engineering And Design*, Issn: 2667-8764, 4(1), 53-66 pp.
- Icoz O., Gunlu E., Oter Z. 2009, Sport Tourism Destinations as Brand and Factors Affecting Destination Choices of Soccer Teams, 5th International Conference on Business Management and Economics, Book of Selected Proceedings Vol. 1, pp. 385-398 Izmir, Turkey, Valparaiso University, USA.

- Puhalla, J., Krans, J.V. And Goatley, J. 2010. Sports Fields, Design, Construction and Maintenance. John Wiley And Sons Inc, Hoboken, Nj, Canada, 516 p.
- Puhalla J, Krans JV, Goatley J, 2020. Sports Fields: design, construction and maintenance. 3rd ed. NJ: John Wiley & Sons, Inc.
- Özdemir Işık B., 2017. The Application of the Hybrid Turf Method in Football Fields, Artium Research Article, Vol. 5, No.2, 1-10 pp.
- Reynerı, A. and Bruno, G. 2004. Effects Of Wear And Turf Properties On Playing Quality For Soccer. In P. A. Nectarios Ed. I. International Conference On Turfgrass Management And Science For Sports Fields. Acta Horticulturae, 661:295-299 pp.

**THE EFFECT OF DIFFERENT FOLIAR FERTILIZER APPLICATIONS ON
COTTON YIELD AND FIBER QUALITY PROPERTIES**

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ABSTRACT

This study was carried out to determine the effect of different foliar fertilizer application on cotton yield, yield components, plant development and fiber technological characteristics. The experiment was conducted as randomized complete block design with four replications in 2018. Stoneville 468 cotton variety was used as plant material. In the study 5 different organic fertilizer (Control, Fullexan, Cifamin BK, Cifoumic, Sinergon 2000, Macys BC 28) were used. All of the foliar fertilizers used are organic fertilizer and applied as foliar fertilization during flowering period of plants. In the study seed cotton yield ranged between 352,58 and 419,91 kg da⁻¹, plant height ranged between 76,86 and 83,81 cm, the number of monopodial branches ranged between 1,79 and 2,43 number/plant, number of sympodial branches ranged between 10,96 and 14,46 number/plant, the number of first vegetative branch's node 5,28 to 5,78 number/plant, number of nodes 16,74 to 19,06 number/plants, height/node ratio 4,29 and 4,75 number/plant, boll number 13,41 to 22,29 number/plant, boll weight 6,12 to 6,37 g, seed cotton boll weight 4,57 to 4,91 g, 100 seeds weight 9,00 to 9,44 g and first picking percentage ranged between 90,11 to 94,84%. It has been determined that the application of foliar fertilizers does not make a significant statistical difference on all agronomic and fiber technological properties examined. It was concluded that the use of foliar fertilizers may be beneficial in case of plant nutrient deficiency symptoms. It is thought that foliar fertilizer applications should be supported with different varieties and studies to be carried out for longer years and it would be more appropriate to repeat the applications more than once.

Keywords: Cotton, Foliar Fertilizer, Application, Yield, Fiber Quality Properties

Introduction

The cotton plant is a product of great economic importance for humanity with its widespread and compulsory use, and for the producing countries with the added value and employment opportunities it creates. Approximately 432 thousand hectares of cotton farming is done in Türkiye and a total 832 thousand tons of fiber cotton is produced from these areas (Anonymous, 2022). Cotton production of country is located in Aegean, Mediterranean and Southeastern Anatolia Region. The Southeastern Anatolia Region, where the GAP (Southeastern Anatolia Project) dam is located, meets 60% of the country's cotton production.

Türkiye has developed infrastructure and facilities in the textile industry and has a suitable ecology in cotton agriculture. However, because the local cotton lint production is not sufficient to meet the ever increasing demands of textile industry, Türkiye imports about 1.000.000 tons of cotton lint per year. The only way to meet the increasing consumption and prevent fiber imports is to increase productivity in cotton, to prevent stress conditions that cause yield loss and to produce more economically. The rapid increase in the world population has brought with it efforts to increase productivity in plants. To get the highest efficiency from the unit area in order to meet the increasing consumption and fiber imports, to minimize the biotic and abiotic stress factors that cause yield loss, and to be more sensitive to nature and the environment while doing this.

Timely and appropriate dosage of macro and micro plant nutrients during plant development is a way to increase productivity. Macro plant nutrients (N, P, K, Ca, Mg and S) and micronutrients (Fe, Zn, Mn, Cu, Mo, B and Cl) are important for plant growth and metabolism (Karaman, 2012). In the absence of sufficient amount of plant nutrients in the environment, plant development and metabolism are adversely affected and the plant cannot complete its normal development. In the case of plant nutrient deficiency, vegetative and generative development in plants cannot be fully completed, which leads to the deterioration of the balance between vegetative and generative development of plants. Fertilizers contain plant nutrients required to generate yield or higher biomass. Plant nutrients are found in fertilizers in the form of different chemical compounds and are taken up by plants either directly or after chemical change by roots or leaves after dissolving with water. Hodges and Constable, 1991 stated that any stress factor in the plant will affect the uptake of plant nutrients.

Fertilizers applied by spraying to plants in the form of foliar fertilizer are taken into the plant body by entering through the cuticle and pores of the leaves. Oosterhuis, 2007, reports that when foliar fertilizers are used for deficiency symptoms of plant nutrients, the plant responds quickly, deficiency symptoms are eliminated more quickly, the use of foliar fertilizers

in small quantities is advantageous and has a lower cost, leaves do not burn, yield and fiber quality parameters can be improved. It has been reported that the absorption rate of plant nutrients from the leaves of plants is lower than the roots, and the mechanisms of taking nutrients from the leaves of the plants are similar to those in the roots.

This study was carried out in Siirt University Faculty of Agriculture in 2018 in order to determine the effects of different organic foliar fertilizer applications on yield, yield components, plant growth and fiber quality characteristics in cotton.

Material and Methods

The experiment was carried out at the Siirt University, Faculty of Agriculture, Department of Field Crops's experimental area during 2018 cotton growing season in Siirt, Turkey. Stoneville 468 cotton varieties and 5 different leaf fertilizers (Sinergon 2000, Cifamin BK, Cifoumic, Macys BC 28 and Fullexan) were used as material in the study. The experiment was carried out according to the randomized completely blocks design with 4 replications and 6 different applications (Control, SINERGON 2000, CIFAMIN BK, CIFOUMIC, MACYS BC 28, FULLEXAN) were included in the experiment.

Each plot consisted of four rows of 12 m in length, between and within row spacing were 0.70 m and 0.15-0.20 m, respectively. Seeds were planted on 4 May, 2018 by planting machine. Plants were grown under recommended cultural practices for commercial production. Soil analyzes were made by taking soil samples from the experimental area and the amount of fertilizer needed by the plant was determined.

Table 1. Main properties of the soil

Specification	Value
Clay (%)	43.51
Sand (%)	47.99
Silt (%)	8.49
pH	6.89
Electrical conductivity (mS cm ⁻¹)	463
Lime (%)	0.50
Organic matter (%)	1.02
Available phosphorus, P ₂ O ₅ (kg ha ⁻¹)	22
Available potassium, K ₂ O (kg ha ⁻¹)	860

*: Siirt University, Science and Technology Application and Research Center, Siirt

Half of the nitrogen needed during planting and all of the phosphorus (8 kg da⁻¹ N, 8 kg da⁻¹ P₂O₅) were applied to the band in the form of 20-20-0 compound fertilizer, and the second half of the remaining nitrogen (6 kg da⁻¹ N) was applied before the first irrigation (about 45 days after sowing) as ammonium nitrate (33%). In addition, foliar fertilizers were applied to the experimental plots with a back sprayer. Foliar fertilizer applications were made by spraying

the leaves during the flowering period of the plant, and the prospectus in the fertilizers was taken into account in the applications.

Experimental plots were irrigated with drip irrigation method, which started to before flowering and given up at 10% boll opening stage. Harvesting was done by hand and completed twice. The first harvest was made when 60% of the bolls were opened, and the remaining product was collected at the second-hand harvest. The first-hand harvest was made on October 3, 2018, and the second-hand harvest was made on November 1, 2018. The crops collected at the first and second hand harvest were weighed separately and then converted into total yield. Observations and measurements were taken from 10 randomly selected plants. Fiber technological properties were determined by using HVI 1000 devices. Statistical analysis was performed using JMP 5.0.1 statistical software (<http://www.jmp.com>) and the means were grouped with LSD_(0.05) test.

Results and Discussion

The differences between investigated agronomic traits are given in Table 2-3. The statistical analysis indicated that the differences between treatments for seed cotton yield was non-significant. The seed cotton yield ranged from 352.58 to 419.91 kg da⁻¹. The highest yield was obtained from MACYS BC 28 (419.91 kg da⁻¹) and the lowest yield was obtained from FULLEXAN foliar fertilizer (352.58 kg da⁻¹). It was observed that foliar fertilizers did not have a significant effect on seed cotton yield. Similar findings are also reported by Heitholt 1994, Edmisten et al., 1994, Bednardz et al., 1998, Haliloğlu et al. (2006). The results of the research differ with those who reported that Foliar Fertilizer applications have a significant effect on the seed cotton yield (Howard et al., 1998, Temiz and Gençer, 1999, Brar and Brar, 2004, Rathika et al., 2013). This may be due to the differences in the cotton type used as material in the study, fertilizer form, application methods, application times, fertilizer level in the soil, and climate and maintenance conditions.

Table 2. Average values of the investigated traits

Treatment	Seed Cotton Yield (Kg da ⁻¹)	Plant Height (cm)	Monopodial Branches (number plant ⁻¹)	Sympodial Branches (number plant ⁻¹)	Node Number of First Fruiting Branches (number plant ⁻¹)	Number of Nodes (number plant ⁻¹)
1. Control	392,67	83,81	1,83	14,46	5,66	17,69
2. SINERGON 2000	386,01	80,51	1,79	11,11	5,36	17,36
3. CIFAMIN BK	396,69	78,84	2,10	11,06	5,78	16,74
4. CIFOUMIC	377,55	79,66	2,28	12,39	5,28	17,74
5. MACYS BC 28	419,91	83,08	2,43	13,22	5,78	19,06
6. FULLEXAN	352,58	76,86	1,84	10,96	5,30	17,93
Mean	387,57	80,46	2,05	11,70	5,53	17,75
CV (%)	14,92	6,08	30,24	14,47	10,31	7,32
LSD (0.05)	ns	ns	ns	ns	ns	ns

*, **; Significant at $p \leq 0.05$ and $p \leq 0.01$, respectively

Plant height ranged between 76.86 and 83.81 cm, but the differences between treatments were non-significant. The highest value was obtained from Control (83.81 cm) and the lowest value was obtained from Fullexan (76.86 cm). Research findings showed parallelism with those (Temiz and Gençer., 1999, Gençsoylu 2016), who stated that foliar fertilizer application did not have a significant effect on plant height. On the other hand, the findings differ with Haliloğlu et al., 2006 and Ogan 2019, who stated that foliar fertilizer application has a significant effect on plant height.

As shown in Table 2, number of monopodial branches ranged between 1.79 and 2.43 number/plant, but the differences between treatments were non-significant. The highest value was obtained from MACYS BC 28 (2.43) and the lowest value was obtained from SINERGON (1.79). Research findings are similar to those of (Temiz and Gençer., 1999) who stated that foliar fertilizer application did not have a significant effect on the number of monopodial branches.

Number of sympodial branches ranged between 10.96 and 14.46 number/plant, but the differences between treatments were non-significant. The highest value was obtained from Control (14.46) and the lowest value was obtained from FULLEXAN (10.96). Similar findings were also reported by Temiz and Gençer., 1999; Karademir et al., 2005 and Ogan 2019.

Depending on the applications, it can be observed that the average values of the node number of first fruiting branch vary between 5.28 and 5.78, and the general average of the

experiment is 5.53 units/plant. Although there is no significant difference between the applications in terms of the number of nodes on the first fruiting branch, the CIFOUMIC fertilizer gave the lowest value in the number of nodes on the first fruiting branch (5.28 units/plant), while the applications of CIFAMIN BK and MACYS BC 28 showed the highest value (5.78).

Number of nodes is an indicator of plant growth ranged between 16.74 and 19.06 number/plant, but the differences between treatments were non-significant. The highest value was obtained from MACYS BC 28 (19.06) and the lowest value was obtained from CIFAMIN BK (16.74).

Table 3. Average values of the investigated agronomic traits

Treatment	Height/ Node Ratio (num/plant)	Boll Number (num/plant)	Boll Weight (g)	Seed Cotton Weight Per Boll (g)	100 Seed Weight (g)	First Picking Percentage (%)
1. Control	4,75	15,87	6,24	4,75	9,00	93,03
2. SINERGON 2000	4,65	16,01	6,13	4,63	9,30	90,11
3. CIFAMIN BK	4,72	16,75	6,15	4,69	9,44	92,14
4. CIFOUMIC	4,49	16,31	6,12	4,57	9,30	94,40
5. MACYS BC 28	4,36	22,29	6,13	4,68	9,09	92,20
6. FULLEXAN	4,29	13,41	6,37	4,91	9,37	94,84
Mean	4.54	16,77	6,20	4.70	9,24	92,79
CV (%)	6,38	23,85	5,38	6,59	4,33	2,62
LSD (0.05)	ns	ns	ns	ns	ns	ns

*, **; Significant at $p \leq 0.05$ and $p \leq 0.01$, respectively

As shown in Table 3, Height/Node ratio ranged between 4.29 and 4.75 number/plant, but the differences between treatments were non-significant. The highest value was obtained from Control (4.75) and the lowest value was obtained from FULLEXAN (4.29).

Boll number ranged between 13.41 and 22.29 number/plant, but the differences between treatments were non-significant. The highest value was obtained from MACYS BC 28 (22.29) and the lowest value was obtained from FULLEXAN (13.41). Similar findings reported by Temiz and Gençer., 1999 who stated that foliar fertilizer application has no effect on the number of bolls. There are also research results indicating that it contributes positively to the number

of bolls (Brar and Brar, 2004, Dordas, 2006, Haliloğlu et al., 2006, Sawan et al., 2009, Yaseen et al., 2013).

Boll weight ranged between 6.12 and 6.37 g, but the differences between treatments were non-significant. The highest value was obtained from FULLEXAN (6.37) and the lowest value was obtained from CIFOUMIC (6.12). The results of Sawan et al., 2009 confirmed this findings.

Seed cotton weight per boll ranged between 4.57 and 4.91 g, but the differences between treatments were non-significant. The highest value was obtained from FULLEXAN (4.91 g) and the lowest value was obtained from CIFOUMIC (4.57). Research findings are similar to those (Temiz and Gençer, 1999; Ogan, 2019), who reported that foliar fertilizer applications did not have a significant effect on seed cotton weight per boll. Dordas, 2006, Rashidi and Gholami, 2011, Hosamani et al, 2013, Abdel-Aal, 2018 reported that the effect of foliar fertilizers on seed cotton weight per boll was significant. This may be due to the differences in the cotton type used as material in the study, the fertilizer form, application methods, the amount of nutrients in the soil, and the climate and maintenance conditions.

100 seed weight ranged between 9.00 and 9.44 g, but the differences between treatments were non-significant. The highest value was obtained from CIFAMIN BK (9.44 g) and the lowest value was obtained from Control (9.00). Similar findings were also reported by (Temiz and Gençer, 1999, Ogan, 2019) and showed parallelism with research findings. Research findings differ from those (Haliloğlu et al., 2006), who reported that foliar fertilizers contributed positively to the weight of 100 seeds.

The statistical analysis indicated that no significant differences between treatments for first picking percentage. Value ranged from 90.11 to 94.84%. The highest value was obtained from FULLEXAN (94.84%) and the lowest value was obtained from SINERGON (90.11%).

Table 4. Average values of the fiber quality traits

Treatment	Mic.	Fiber Length (mm)	Fiber Strength ⁻¹ (g tex)	Fiber Elong. (%)	Fiber Unif.	Short Fiber Index	Yellow (+b)	Reflec (Rd)	SCI
1. Kontrol	4,97	27,73	30,80	6,15	84,07	6,00	8,65	78,72	137,00
2. SINERGON 2000	4,70	28,59	32,17	6,15	84,65	5,67	8,85	79,30	139,00
3. CIFAMIN BK	4,45	28,62	29,22	6,37	84,52	5,67	8,60	78,92	138,75
4. CIFOUMIC	4,76	28,38	32,17	6,52	84,87	5,75	9,15	79,10	146,75
5. MACYS BC 28	4,61	28,55	30,00	6,77	84,82	5,45	8,60	78,75	140,75
6. FULLEXAN	4,87	27,95	30,17	6,35	84,10	5,77	8,77	79,52	137,50
Mean	4,72	28,30	30,36	6,39	84,67	5,72	8,77	79,05	139,96
CV (%)	5,35	2,61	7,81	5,25	1,44	14,99	4,92	1,54	8,15
LSD (0.05)	ns	ns	ns	ns	ns	ns	ns	ns	ns

*, **, Significant at $p \leq 0.05$ and $p \leq 0.01$, respectively

In the research, it is seen that foliar fertilization does not have a significant effect on fiber quality traits, but highest value was obtained from CIFOUMIC and MACYS BC 28. Temiz and Gencer (1999) stated that foliar fertilizer had no effect on fiber fineness, fiber length and fiber strength. However, Ogan, 2009 revealed that foliar fertilizer had a significant effect of fiber fineness. Sankaranarayanan et al. (2010) reported that foliar fertilizer had a positive effect on fiber uniformity.

Conclusion

The findings obtained from the study showed that no statistically significant difference could be obtained between foliar fertilizer applications in terms of all of the investigated properties. All of the foliar fertilizers used as material in the study were organic leaf fertilizers, and the green part was applied once during the blooming period of the plant. The instructions in the fertilizer leaflet were taken into account as the application amount. In the study, it was determined that the number of bolls increased slightly with the application of MACYS BC 28, but this did not lead to a significant difference in terms of both bolls count and seed cotton yield traits, but highest value was obtained from CIFOUMIC and MACYS BC 28.

Since only one variety was used in the study, foliar fertilizer applications were applied once, and the research findings were obtained from one-year field trials, it is thought that these results will not be sufficient to give advice and suggestions to the producers in cotton production areas. There is an impression that more reliable findings can be reached with studies to be carried out for two or three years with different varieties. It is understood from many literature reports that the effect of organic foliar fertilizers in the study is not significant and may be related to the amount of nutrients in the soil. It is known that foliar fertilization should be applied only when certain plant nutrient deficiency symptoms are observed in the cotton plant.

For this reason, foliar fertilization can be recommended against plant nutrient deficiency symptoms in production areas. In the study, seed cotton yield values varying between 352.58 kg/da and 419.91 kg/da were obtained. Although there is no significant statistical difference between foliar fertilizers, the highest value was obtained from MACYS BC 28 fertilizer. This fertilizer led to a slight increase in the seed cotton yield.

It was observed that there was an increase in yield of 27.24 kg/da when compared with the control application. Although it does not lead to a significant increase in yield, the low cost of using foliar fertilizers can be considered as an advantage. It was determined that foliar fertilizers did not have a significant effect on all fiber quality characteristics. It was determined that different organic foliar fertilizers in cotton did not have a significant effect on plant yield,

yield components, plant growth and fiber quality characteristics. In the study, foliar fertilizers were used in addition to normal fertilization.

It is thought that the nutrient deficiency in the plant is eliminated due to the base and top fertilizer used. It has been understood that the use of foliar fertilizers would be more appropriate in case of symptoms of plant nutrient deficiency. Before applying foliar fertilizers, it is thought that it will be useful to determine the deficiency of plant nutrients by making leaf analyzes. However, it is understood that there is a need for studies to be conducted for longer years, since the study includes the findings of a 1-year study.

REFERENCES

- Anonymous, 2022. <https://www.tarimorman.gov.tr/BUGEM/Belgeler/B%C3%BCItenler/MAYIS%202022/Pamuk%20%20May%C4%B1s%20B%C3%BCIteni.pdf>
- Abdel-Aal, A. S., 2018. Effect of Foliar Application with Micronutrients under Different Fertilizer Levels on Cotton Cultivar Giza 94. *Journal of Plant Production*, Mansoura University, 9 (12): 1115- 1120.
- Brar, M. S., Brar, A. S., 2004. Foliar nutrition as a supplement to soil fertilizer application to increase yield of upland cotton (*Gossypium hirsutum*). *Indian Journal of Agricultural Sciences*, 74 (9), 472-475.
- Edmisten, K. L., Wood, C. W., Burmester, C. H., 1994. Effects of early-season foliar fertilization on cotton growth, yield, and nutrient concentration. *Journal of Plant Nutrition*, 17 (4), 683-692.
- Bednarz, C. W., Hopper, N. W., Hickey, M. G., 1998. Effects of foliar fertilization of Texas Southern high plains cotton: Leaf nitrogen and growth parameters. *Journal of Production Agriculture* 11(1):80-84.
- Dordas, C., 2006. Foliar boron application affects lint and seed yield and improves seed quality of cotton grown on calcareous soils. *Nutrient Cycling in Agroecosystems*, 76: 19-28
- Gencsoylu, I. 2009. Effect of plant growth regulators on agronomic characteristics, lint quality, pests, and predators in cotton. *J Plant Growth Regul.*, 28:147–153.
- Haliloğlu, H., Yılmaz, A., Beyyavaş, V., 2006. Pamukta (*Gossypium hirsutum*) farklı dönemlerde yaprak gübresi uygulamalarının bitkisel lif ve lif teknolojik özelliklerine etkisi. *Tarım Bilimleri Dergisi* 12: 17.
- Heitholt, J. J. 1994. Comparison of adjuvant effects on cotton leaf potassium concentration and lint yield. *Journal of Plant Nutrition* 17(12): 2212-2223.
- Hodges, S. C., Constable, G., 2010. Plant responses to mineral deficiencies and toxicities. *Physiology of Cotton*, 142-161.
- Hosamani, V., Halepyati, A.S., Vinodakumar, S.N. 2013. Yield and yield components, quality parameters, uptake of nutrients and economics of irrigated Bt cotton (*Gossypium hirsutum* L.) as influenced by macro nutrients and liquid. *Ecology, Environment and Conservation*, 19, 4, 1189-1193.
- Howard, D., Gwathmey, C.O. ve Sams, C. E., 1998. Foliar Feeding of Cotton: Evaluating Potassium Sources, Potassium Solutions Buffering, and Boron. *Agronomy Journal*, 90: 740-746.
- Karademir, Ç., Karademir, E., Doran, İ., Altıkat, A. 2005. Farklı azot ve fosfor dozlarının pamuğun verim verim bileşenleri ve bazı erkencilik kriterlerine etkisi. *Tarım Bilimleri Dergisi*, 2006, 12(2)121-129.
- Karaman, M. R., 2012. Bitki Besleme. *Gübretaş Rehber Kitaplar Dizisi*:2
- Ogan, D., 2019. Yarı kurak iklim koşullarında bazı yaprak gübrelere pamuğun (*Gossypium hirsutum* L.) verim ve verim unsurlarına etkisi, Harran Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, Şanlıurfa.
- Oosterhuis, D., Foliar fertilization: Principals and Practices, University of Arkansas, <https://www.agry.purdue.edu/CCA/2007/2007/Proceedings/Derrick%20Oosterhuis.pdf>
- Radhika, K., S Hemalatha, S Praveen Katharine, S Maragatham and A Kanimozhi, 2013. Foliar Application of Micronutrients in Cotton - A Review. *Research & Reviews: Journal of Agriculture and Allied Sciences*.
- Rashidi, M., Gholami, M., 2011. Nitrogen and boron effects on yield and quality of cotton (*Gossypium hirsutum* L.). *International Research Journal of Agricultural Science and Soil Science* 1 (14), 118-125.

- Sankaranarayanan, K., Praharaj, C.S., Nalayini, P., Bandyopadhyay, K. K., Gopalakrishnan, N. 2010. Effect of magnesium, zinc, iron and boron application on yield and quality of cotton (*Gossypium hirsutum*), *Indian Journal of Agricultural Sciences*, 80, 8, 699-703.
- Sawan, Z. M., Ashraf, H. F., Serag E. Y. 2009. Direct and residual effects of nitrogen fertilization, foliar application of potassium and plant growth retardant on Egyptian cotton growth, seed yield, seed viability and seedling vigor. *Acta Ecologica Sinica*, 29(2): 116-123.
- Temiz, M. ve O. Gençer. 1999. Diyarbakır koşullarında farklı dönemlerde uygulanan yaprak gübresinin pamuğun (*Gossypium hirsutum* L.) tarımsal ve teknolojik özelliklerine etkisi. Türkiye 3. Tarla Bitkileri Kongresi. 15-18 Kasım 1999. Cilt II. Endüstri Bitkileri, s. 297-302, Adana.
- Yaseen, M., Ahmed, W., Shahbaz, M., 2013. Role of foliar feeding of micronutrients in yield maximization of cotton in Punjab. *Turkish Journal of Agriculture and Forestry*, 37: 420-426.

**ASSESSING THE UNDERLYING STRATEGIES FOR EFFECTIVE MANAGEMENT
OF JOB-STRESS IN NIGERIAN CONSTRUCTION PROJECTS**

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Abstract

Stress is as an adverse reaction people have due to too much pressure or other types of demand placed on them. Several strategies have been proposed by researchers across the globe. However, the menace still persists in construction projects. Therefore, this study investigated the underlying strategies for effective management of Job-stress in Nigerian construction projects. The necessary data for the study was obtained through questionnaire survey. The questionnaire was designed using the information obtained in the literature on the subject matter. Findings of the study show that construction professionals experience work stress on a daily basis. It was also discovered that workload, job complexity, and personal trait are the main causes of job-stress in construction projects. Death is the major impact of stress on construction workers. The study concludes that workers in the construction industry need effective communication between them and the management for effective reduction of stress during construction activities. Premised on the conclusion, the study recommends that construction workers should embrace the use of software in project planning and management for effective stress reduction.

Keywords: Construction, Effective, Management, Strategies, Job-stress,

1.0 Background of the Study

Stress is neither a simple nervous tension that can result from damage, nor necessarily something to be avoided (Wahab, 2010). From the Health and Safety Executive (HSE, 2007), It is a neurotic human response to psychological, social, job and environmental pressures. This implies that stress is as an adverse reaction people have due to too much pressure or other types of demand placed on them. Some of the causes of stress encountered by professionals in the construction industry are handling of multiple construction projects at a time, poor planning, poor health condition of an individual, poor site condition, large volume of work, ambitious deadline (Leung *et al.*, 2005). Others are workload that employees' cannot cope with, lack of or inadequate consultation by managers with employees regarding their work, communication and negative relationship issues (Leung *et al.*, 2010). It is essential to note that the various causes of stress encountered by professionals in the construction industry can be categorized into physical work environment stressors, organizational related stressors, work demand stressors and job role stressors.

The consequence of stress to employees and organizations across the globe cannot be over emphasized. It could lead to inefficiency, low productivity, abandonment of project, delay in project delivery, depression, anxiety, health related issues such as high blood pressure; headache; body pains; slump or even death of an employee (Leung *et al.*, 2005; Wahab, 2010). The literature exists on stress and its causes in construction project. Also, there are previous studies on the effects of job-stress on employees' and organizations. However, as at when this study was conducted, there seems to be scarce literature on the underlying Strategies for Effective Management of Job-stress in Nigerian Construction Projects

Therefore, this study was conducted to assess the various forms of stress experienced by workers during construction activities. The causes of the various stresses, the impacts of the stress on employees' and organizations as well as the strategies that can be adapted to reduce or overcome the stress were investigated in this study.

2.0 Literature review

2.1 Over view of construction industry

The construction industry is known to be a complex industry in terms of the managerial skills needed and standards to be met, and it is also characterized by numerous elements that differentiate it from other known business sectors of the economy like the manufacturing, banking, oil & gas, services and the likes (Ozaki, 2003). Despite its complexity, the industry contributes about 10% of Gross Domestic Product in a country (Navon, 2005). The technology used in the construction industry has always been known to be flexible due to the fact that

construction processes take place at the location of consumption (Tukel & Rom, 2001). Therefore, high demand for labour mobility, low capital intensity and high entrepreneurial risks continue to affect the performance of construction industry across the globe (Vouzias, 2004). In Nigeria, the construction industry is known by small, medium and large scale local investors (contractors), which in most cases deals with commercial, industrial and residential projects (Dantata, 2008).

2.2 The concept of job-stress

The term stress is used to refer to hardship, strain, adversity or affliction. It was used in the eighteenth and nineteenth centuries to denote force, pressure, strain, or strong efforts relating to an object or person (Somerfield & McCrae 2000). A study by Aitken and Crawford (2007) revealed that the concept of job-stress originated with the research of Selye in 1978. Schuler, (2014) affirmed that stress as a pathological human response to psychological, social, occupational and/or environmental pressures. Melia and Becerril (2007) on the other hand pointed out that stress is an experience expressed in one's feeling of being strained while the Health and Safety Executive (HSE, 2007) defined stress as the adverse reaction people have due to too much pressure or other types of demand placed on them. Put differently, (Lath, 2010) was of the opinion that every person including a child, an adult, employed or unemployed faces stress in his/her everyday life.

2.3 Causes of stress in construction projects

The main cause of stress in construction projects is as a result of factors that negatively arise from the project, and hence makes desired goal unattainable (Kenneth, 2005). Hence, work overloads, working long hours and role ambiguity are known to be leading causes of stress amongst professionals in construction industry (Sutherland & Davidson, 2012). Srivastava, (2005) asserted that multilevel subcontracting, time pressure; constant worker rotation and unstable work due to temporary contracts can contribute to psychosocial stress among workers. Others are inadequate room for innovation, unsatisfactory remuneration, and ambiguity of job requirement, inadequate knowledge of project objectives, long working hours, tight schedules and unfavourable working conditions (Leiter, 2012; Campbell, 2006).

2.4 Impacts of stress on employees' and organizations

The consequences of stress could be divided into 3 categories: effect on health, effect on personal characteristics, and effect on employees' working efficiency. The most common appearing health problems caused by stress are high blood pressure, elevated cholesterol and blood fats, adult-onset diabetes or high blood sugar, obesity, poor fitness, and inflammatory illness (Buchan *et al.*, 2008). Therefore, it is imperative to prevent any stress at work and by

adapting any stress management program or tool rather than to spend money on workers' treatment or replacement (Ben, 2006).

2.5 Stress management strategies in construction projects

Akubue (2000) stated that stress management strategies are referred to as the methods organizations employed to deal with stressful or disturbing situations. These includes the use of advanced project management software's such as primavera, Microsoft project manager among others in projects execution, adequate time management, conducive site office, well ventilated environment, clarity of job role by creating a work schedule, maximization of break time, proper feeding, reduction of work load by employing the different professionals, building interpersonal relationship skills, adequate funding, adoption of appropriate job design practices and education of professionals in stress management. All these strategies will reduce the incidence of stress among professionals in the building industry.

3.0 Research methodology

3.1 Research Design

Research design is the overall design for obtaining answers to the questions being studied and for handling some difficulties encountered during the course of the research (Jeanne, 2011). Field survey research proposed by Griffith (2014) was adopted in this study. Questionnaire was the instrument used for data collection in the survey research design.

3.2 Questionnaire survey

The questionnaire was designed using the information obtained in the literature on the subject matter. It was distributed directly to the study respondents (professionals in construction firms in the study context). The professionals are Architects, Civil engineer, Builder, Quantity Surveyor, Project Manager and Site Supervisor, which were randomly selected from randomly selected firms. The academic qualifications of the professionals range from PhD to Higher National Diploma (HND). The professionals have been working in construction industry for more than 5 years, and have executed different projects ranging from small to large. Before the distribution of questionnaires, a formal approval was obtained from the management of all the selected construction firms in Federal Capital Territory, Abuja. The question in the questionnaire was based on a 5 point likert scale. These enabled respondents express their level of agreement or disagreement with the information in the questionnaire form strongly agrees (5), to strongly disagree (1). A total of 150 questionnaires were distributed out of which only 119 (88%) were returned back and were used for the study. The data obtained through the questionnaire was analysed using descriptive statistics such as mean item score (MIS) and standard deviation (SD) (Digital Bridge Institute, 2018).

4.0 Results and discussion

4.1 Demographical information of the respondents

Table 1 presents the general information on the qualification, years of experience and job position on site of participants of the study. As earlier stated, total of 150 questionnaires were randomly administered to construction professionals in the construction firms in Abuja. Out of the total distributed, 119 responses were obtained, which represents 88.1% of the total distributed.

Table 1: Questionnaires administered /returned

Questionnaire	Number	Percentage (%)
Number distributed	150	100
Number received	119	79.3
No response	31	20.7

Table 2: Demographical information of the respondents

Qualification	Frequency	Percentage (%)
PhD	6	5.0
M.Tech / MSc	18	15.1
B.sc	68	57.1
HND	24	20.2
Total	119	100
Experience		
1-5 Years	59	49.6
6-10 Years	31	26.1
11- 15 Years	21	17.6
16-20 Years	2	1.7
> 20 years	6	5.0
Total	119	100
Designation		
Project managers	31	26.1
Resident builders	28	23.5
Architects	13	10.9
Quantity surveyors	15	12.6
Civil engineers	17	14.3
Contractor	8	6.7
Others	7	5.9
Total	119	100

4.2 Causes of stress in construction projects

Table 3: Main causes of job-stress in construction projects

Causes of stress	SD	MIS	Rank
Bullying by senior colleagues	0.66	1.45	25
Handling more than one project at a time	0.91	1.94	24
Conflict co-worker or labourer	1.03	3.42	19
Ambiguous deadline	0.96	3.21	23
Role ambiguity	1.22	3.25	22
Job complexity	1.15	3.81	2
Poor ventilation in site office	1.03	3.68	9
Too much noise on site	1.04	3.68	9
Poor lighting	1.22	3.76	5
Lack of safety outfit	1.10	3.74	7
Poorly design office space	1.11	3.67	11
Lack of privacy	1.24	3.71	8
Inadequate machinery and equipment	1.19	3.60	13
Resources constraint	1.09	3.37	21
Changes in organization level	1.06	3.76	5
Poor organizational structure	1.26	3.50	17
Inadequate staffing	1.01	3.38	20
Conflict with artesian	4.78	3.52	16
Poor relationship with superior	1.15	3.56	15
Lack of communication skill	1.12	3.58	14
Conflict with co-workers on site	1.16	3.77	3
Work over load	1.04	3.97	1
Unfortunate life event	1.07	3.63	12
Heath condition	1.18	3.43	18
Personal trait	1.13	3.77	3

In order to ascertain the causes of stress encounter by professionals in construction site, not less than 25 causes of stress were identified from literature. Respondents were asked to indicate the one mostly encounter during construction activities. The results obtained revealed that work overload with MIS of 3.97 is the most cause of job-stress in construction projects, followed by job complexity. To be precise, with the exception of bullying by senior colleagues and handling more than a project at a time, all other causes of stress identified in the literature were rated to be very significant by the participants of the study. This implies that 23 of the 25 causes of stress identified in the existing literature in the subject matter are the main causes of stress in construction projects. This is similar to findings of Aryal *et al.* (2017), Xing, *et al.* (2020) on the causes of fatigue among employees' during daily activities.

4.3 Impacts of stress in construction projects

In order to evaluate the impacts of stress on construction workers, nine parameters (impacts of stress) were identified from the literature. Respondents were then requested to indicate their agreement on the identified parameters. The outcomes of this section of the questionnaire study are presented in Table 4.

Table 4: Impacts of job-stress on construction workers

Stress impacts	SD	MIS	Rank
Abandonment of project	1.01	3.30	3
Delay in project delivery	0.77	2.68	7
Low productivity of workers	0.87	2.58	8
Negative impact on health of workers	0.96	2.94	6
Building failure due to bad design	0.95	3.39	2
Cost overrun	1.01	3.22	4
Death	1.05	3.42	1
Poor projects performance	0.85	3.02	5

It is obvious from the results presented in Table 4 that the greatest impact of stress on construction workers is death with a mean score of 3.42 followed by building failure due to bad design (MIS=2.39). This is synonymous to the opinion of Okafor and Okafor (2006) on the impact of stress on employees' in construction projects. In a nutshell, the results presented in

Table 4 show that virtually all the impacts of stress identified in the literature are highly significant factors. Hence, strategies that can be used to overcome stress in projects need to be continuously investigated by researchers across the globe.

4.4 Strategies for stress minimization in construction projects

Table 5 presents possible organizational strategies for stress minimization in construction projects.

Table 5: Stress minimization strategies

Possible stress minimization strategies	SD	MIS	RANK
Proper project management plans	0.86	2.83	10
Adequate funding	0.79	2.97	9
Encouraging decentralized organizational structure	0.83	2.98	8
Provision of machineries and equipment	0.90	3.02	7
Provision of conducive site office (well ventilated and adequate lighting)	0.90	3.24	5
Effective time management schedule	0.88	3.11	6
Employing enough staff to reduce workload	1.17	3.29	4
Provision of necessary safety gadgets	0.97	3.35	3
Encouraging effective interpersonal relationships / communication between the management and employees	1.18	3.40	1
Providing seminars and workshops for employees to expose them to new technologies in the construction industry	0.94	3.40	1

In order to establish the various organizational strategies that can be adopted to reduce workers stress in construction projects, 10 strategies were identified from the existing literature. Respondents were then requested to indicate the extent of their agreement on each strategy based on their experience. Encouraging effective interpersonal relationships/ communication between the management and employees and providing seminars and workshops for employees to expose them to new technologies in the construction industry were ranked first by the participants of the study, followed by provision of necessary safety gadgets. To be precise, the MIS of all the identified strategies are above 2.5 and can be adopted for stress reduction in construction projects (Digital Bridge Institute, 2018).

5.0 Conclusion and recommendations

Based on the findings of this study, it is clear that construction professionals experience work stress on a daily basis. It can also be concluded that workload, job complexity, and personal trait are the main causes of job-stress in construction projects. Death is the major impact of stress on construction workers. Other organizations impacts are projects delay/poor projects delivery, low productivity of workers, and abandonment of projects. For effective reduction of stress in construction projects, employees need for effective communication between management and workers. Construction firms also need to introduce workplace wellness schemes. Allow flexible time for workers and encourage effective interpersonal relationships between the management and employees.

Premised on the above conclusion, the study recommends that construction workers should embrace the use of software in project planning and management such as MS project planner, primavera project planner, Orion, and the use of Microsoft spreadsheet. Management should also ensure that workers are not overworked / overloaded with work and their roles in daily activities should be clearly stated. It is also advisable that site offices should be made comfortable and properly ventilated for effective flow of work. The study further recommends that further research should be conducted to determine the level of effectiveness of the identified strategies on stress reduction in construction projects.

References

- Akubue, P. I. (2000). Health checks and health promotion: *Your personal guide to living active life*. Enugu: Snap press limited.
- Aitken, A., and Crawford, L. (2007) coping with stress: Dispositional coping strategies of project managers', *International Journal of Project Management*, 25, 666-673.
- Aryal, A., Ghahramani, A. & Becerik-Gerber, B. (2017) Monitoring fatigue in construction workers using physiological measurements. *Automation in Construction*, 82, 154-165.
- Buchan, J, O'May, F.& Little, L. (2008) Review of models of employment for nursing roles which bridge practice and education. *A report for NHS Education for Scotland Queen Margaret University*.
- Campbell, F. (2006) Occupational Stress in the Construction Industry, Berkshire, UK: Chartered Institute of Building.
- Dantata, S.A., (2008) General Overview of the Nigerian Construction Industry. *Master's Thesis Massachusetts Institute of Technology, USA*.
- Digital Bridge Institute (2018), Data Analysis Using SPSS 23. *Statistical Package for Social Science*, Nigerian Communication Commission, Abuja, Nigeria.
- Griffith, J.(2014) "survey research in military settings" in *routledge handbook of research methods in military studies* edited by Joseph Soeters, Patricia Shields and Seibastaain Reijens, pp179-193. New York: Routledge.
- Jeanne, Z. (2011) *Research methods in psychology* (9th ed.). New York, NY: [McGraw Hill](#). pp. 161–175.
- Health and Safety Executive (2007) *Tackling Work Related Stress: A Manger's Guide to Improving and Maintaining Employee Health and Well-Being*, Sage Publisher.
- Kenneth, H.R. (2005) *Project Quality Management – Why, What and How*, E-books on-line, J.R. publishing.
- Lath, S.K. (2010) 'A Study of the occupational stress among teachers', *International Journal of Education Administration*, 2 (2), 421-432.
- Leiter, M. P. (2012) 'Coping Patterns as Predictors of Burnout: The Function of Control and Escapist Coping Patterns', *Journal of Organisational Behavior*, 12 (2), 123-144.
- Leung, M. Y., Ng, S. T., Skitmore, M. and Cheung, S. O. (2005) 'Critical stressors influencing construction estimators in Hong Kong', *Construction Management and Economics*, 23, pp. 33-43.
- Leung, M.Y., Chan Y.S. and Yuen K.W. (2010) 'Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong'. *Journal of Construction Engineering and Management*, ASCE, 136 (10), pp. 1093-1103.
- Melia, J.L. and Becerril, M. (2007) 'Psychological sources of stress and burnout in the construction sector: *A structural equation model*', *Psicothema*, 19 (4), 679-686.
- Navon R. (2005) Automated project performance control of construction projects. *Automation in Construction*, 14, pp. 467-476.
- Okafor, J. O., & Okafor, R. U. (2006) *Emotional and mental health*, Nsukka: Ralja publishers.
- Ozaki, R. (2003); Customer-focused Approaches to Innovation in House Building. *Journal of Construction Management and Economics*, pp. 557- 564.
- Schuler., R.S. (2014) "Definition and conceptualization of stress in organizations", *Organizational Behaviour and Human Resource* 24: pp.115-130.
- Srivastava, S. K. (2005) *Organizational Behaviour and Management*, Sarup and Sons, New Delhi, pp.274-276.
- Sutherland, V and Davidson, M. (2012) 'Stress among construction site managers – a preliminary study', *Stress Medicine*, 5, 221-235

- Tukel, O. J & Rom, W. O (2001); An Empirical Investigation of Project Evaluation Criteria, *International Journal of Operations and Production Management*, pp. 400 - 416.
- Vouzas, F. (2004) HR Utilization and Quality Improvement. *The Total Quality Management Magazine*, pp. 125 - 135.
- Wahab, A. B (2010) 'Stress management among artisans in construction industry in Nigeria', *Global Journal of Researches in Engineering*, 10 (1) 93-103.
- Xing, X., Zhong, B., Luo, H., Rose, T., LI, J. & Antwi-afari, M. F. (2020) Effects of physical fatigue on the induction of mental fatigue of construction workers: A pilot study based on a neurophysiological approach. *Automation in Construction*, 120, 103381.

**KALSİYUMUN FARKLI UYGULAMALARININ PAMUKTA VERİM VE LİF
KALİTE ÖZELLİKLERİNE ETKİSİ**

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ÖZET

Bu araştırma farklı kalsiyum (Ca) uygulamalarının pamukta verim, verim bileşenleri ve lif kalite özelliklerine etkisini belirlemek amacıyla 2021 yılında yürütülmüştür. Deneme tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak yürütülmüş ve denemede 7 farklı kalsiyum uygulaması (Kontrol, Taraklanma Dönemi 100 cc/da, Taraklanma Dönemi 200 cc/da, Taraklanma Dönemi 400 cc/da, Çiçeklenme Dönemi 100 cc/da, Çiçeklenme Dönemi 200 cc/da, Çiçeklenme Dönemi 400 cc/da) yer almıştır. Denemede materyal olarak MAY 455 pamuk çeşidi ile kalsiyum kaynağı olarak Kalsiyum Nitrat çözeltisi kullanılmıştır. Araştırmada kalsiyum uygulamalarının incelenen özelliklerden koza ağırlığı ve koza kütlü ağırlığı üzerine önemli etkisinin olduğu ve uygulamalar arasında önemli istatistikî farklılıkların bulunduğu belirlenmiştir. İncelenen diğer özelliklerden kütlü pamuk verimi, lif verimi, bitki boyu, odun dalı sayısı, meyve dalı sayısı, ilk meyve dalı boğum sayısı, boğum sayısı, koza sayısı, kozada tohum sayısı, çırcır randımanı, ilk el kütlü oranı, yaprakta klorofil içeriği (SPAD), normalize edilmiş vejetasyon farklılık indeksi (NDVI değeri), lif inceliği, lif uzunluğu, lif kopma dayanıklılığı, lif kopma uzaması, lif üniformite oranı, kısa lif oranı, lif sarılık değeri, lif parlaklık değeri ve iplik olabirlik indeksi değerlerinin kalsiyum uygulamalarından etkilenmediği belirlenmiştir. Araştırmada en yüksek koza ağırlığı ve kütlü koza ağırlığı değerleri çiçeklenme döneminde 400 cc/da dozunda uygulanan Ca ile elde edilmiştir. Pamukta çiçeklenme döneminde 400 cc/da dozunda Ca uygulaması ile koza ağırlığı ve koza kütlü ağırlığının artırılabilceği sonucuna varılmıştır.

Anahtar Kelimeler: Kalsiyum, Kalsiyum Nitrat, Lif Kalitesi, NDVI, Pamuk, Verim

**THE EFFECT OF DIFFERENT APPLICATIONS OF CALCIUM ON YIELD AND
FIBER QUALITY CHARACTERISTICS IN COTTON**

ABSTRACT

This research was carried out to determine the effects of different calcium (Ca) applications on yield, yield components and fiber quality characteristics in cotton. The research was conducted in 2021 according to the randomized complete blocks design with 4 replications. In the experiment 7 different calcium treatment (Control, Squaring Period 100 cc/da, Squaring Period 200 cc/da, Squaring Period 400 cc/da, Flowering Period 100 cc/da, Flowering Period 200 cc/da, Flowering Period 400 cc/da) were applied. In the experiment, MAY 455 cotton variety was used as plant material and Calcium Nitrate solution was used as calcium source. In the study, it was determined that calcium applications had a significant effect on the boll weight and seed cotton boll weight, and it was determined that there were significant statistical differences between the applications. Among the other characteristics examined it was determined that seed cotton yield, fiber yield, plant height, number of monopodial branches, number of sympodial branches, number of first fruiting branches, number of nodes, number of bolls, number of seeds per boll, ginning percentage, first picking percentage, chlorophyll content in leaves (SPAD), normalized difference vegetative index (NDVI value), fiber fineness, fiber length, fiber strength, fiber elongation, fiber uniformity, short fiber index, fiber yellowness value, fiber reflectance value and spinning consistency index (SCI) were not affected by calcium applications. In the study, the highest boll weight and seed cotton boll weight values were obtained with Ca applied at a dose of 400 cc/da during the flowering period. It has been concluded that the boll weight and seed cotton boll weight can be increased with the application of 400 cc/da Ca application during the flowering period in cotton.

Keywords: Calcium, Calcium Nitrate, Fiber Quality, NDVI, Cotton, Yield

Giriş

Pamuk, dünya genelinde yaklaşık 33.7 milyon hektar alanda tarımı yapılan ve bu alandan yaklaşık 26 milyon ton lif üretimi sağlanan (UPK, 2020), dünyanın en önemli endüstri bitkilerinden biridir. Lifi ile tekstil, çiğidi ile yağ sanayine hammadde olması, küspesi ile hayvancılığın gelişmesine katkıda bulunması gibi asıl ve yan ürünleri ile birçok farklı sanayi kollarına ham madde sağlamakta, bu nedenle hem ekonomik hem de sosyal açıdan birçok ülkenin kalkınmasında önemli rol oynamaktadır.

Pamuk, dünyada pamuk kuşağı (Cottonbelt) olarak isimlendirilen ve kuzey yarımkürede 45°, güney yarımkürede 32° enlemleri arasında kalan bölgede yetişmektedir. Ülkemizde ise pamuk; Ege, Çukurova ve Güneydoğu Anadolu Bölgelerinde yaygın şekilde üretilmektedir. Ülkemizde 2021 yılında 432.279 ha alanda pamuk ekimi yapılmış, bu alanlardan 2.250.000 ton kütlü pamuk, 832.500 ton lif pamuk üretimi gerçekleştirilmiştir. Güneydoğu Anadolu Bölgesinde ise, 2021 yılında 261.989,7 ha alanda pamuk ekimi yapılmış, 1.324.004 ton kütlü pamuk 489.880 ton lif pamuk üretimi gerçekleştirilmiştir (TÜİK, 2022).

Dünya pamuk üretiminin neredeyse tamamı (% 99,5) ülkemizin 7. sırada yer aldığı 10 büyük pamuk üreticisi ülke tarafından gerçekleştirilmektedir; bunlar Hindistan, Çin, ABD, Brezilya, Özbekistan, Pakistan, Türkiye, Avustralya, Meksika ve Yunanistan olarak sıralanmaktadır. Dünya pamuk kullanımının da yine, % 85 gibi önemli bir kısmı ülkemizin 5. sırada yer aldığı 8 büyük pamuk tüketicisi ülke tarafından gerçekleştirilmekte ve bu ülkeler Çin, Hindistan, Pakistan, Bangladeş, Türkiye, Vietnam, Brezilya ve ABD şeklinde sıralanmaktadır (UPK, 2022). Ulusal Pamuk Konseyi verilerine göre, 2021 yılında, yaklaşık değerlerle tekstil sanayi 1 milyon 617 bin ton lif pamuk tüketmiştir. Bu ihtiyacın yüzde 40 kadarı yerli pamuktan, yüzde 60'ı ithal pamuktan sağlanmıştır. Türkiye bu dönemde 1 milyon 170 bin ton pamuk ithal etmiştir (UPK, 2022). Artan talebi ve iç tüketimi karşılamanın ve lif ithalatını azaltmanın tek yolu, pamukta verimi ve lif kalitesini arttırmak, verim kaybına neden olan çevresel stres koşullarını önlemektir. Öte yandan, sahip olduğumuz agro-ekolojik potansiyel yurt içi pamuk talebinin miktar ve kalite olarak daha büyük oranlarda yerli üretimle karşılanmasına olanak sağlamaktadır.

Bitki büyümesi ve gelişimi için gerekli makro besin maddelerinden olan kalsiyum, bitki hücre duvarının tamamlayıcı bir parçası olduğu için hücre duvarı yapısını düzenleyen bitki besin elementi olarak bilinmektedir (Bolat ve Kara, 2017). Kalsiyum iyonları, granülasyonu artırarak toprak strüktürünü geliştirir. Strüktürü iyi olan topraklardan daha çok ürün sağlanır. Toprak pH'sını ayarlar. Kalsiyum bitki besin maddelerinin alınmasında; bitki ve toprakta bulunan toksik maddelerin çökmesinde rol oynar. Kalsiyum bitkilerde kök salgısı üzerinde

etkilidir. Bitki dokularını donma-çözünme stresine karşı korur (Güneş ve ark., 2000). Bitkilerde protein oluşumunda ve karbonhidratların taşınmasında önemli rol oynar (Bolat ve Kara, 2017). Sürgün ucu ve kök ucu gibi büyüme noktalarının gelişimi için son derece önemli olan kalsiyum, bitki besin elementlerinin alınımında oluşan metabolik süreçlerde görev alan, hücrelerdeki anyon-katyon dengesini sağlamada etkili bir besin elementidir (Tucker, 1999; Karaman ve ark., 2012). Bitkinin büyümesi ve gelişmesi için mutlak gerekli besin elementlerinden kalsiyumun eksikliğinde, büyüme yerleri çoğunlukla öldüğünden bitkilerde yeni sürgünler meydana gelememekte ve bitkinin kök sistemi de zarar görmektedir (Kacar, 1984).

Kalsiyum bakımından fakir olan topraklarda az ürün elde edilir ve üründeki protein oranı çok azalır. Kalsiyum hücre duvarlarının yapı taşı olduğundan, noksanlığı durumunda hücre duvarları zayıflar ve dokular zarar görür. Ksilemden daha çok, floemden beslenen bitki dokuları etkilenir. Kalsiyum bitkilerde immobil olduğu için noksanlık belirtileri ilk önce genç yapraklarda başlar. Genç yaprakların kenarlarında ve uçlarında sararmalar meydana gelir, yaprak kenarları kıvrılır, iç damarlarda klorozlar meydana gelir. Yaprak uç yanıklığı adı verilen yaprak uçlarının kahverengiye dönmesi kalsiyumun noksanlığında görülmektedir. Fazla dallanmış, kısa ve kahverengi kökler oluşur. Ayrıca kök ve sürgün uçları gelişiminde azalma görülür. Bitki gövdesi zayıflar, sürgün uçlarında bükülme ve kırılmalar, büyümede bodurlaşma, iç dokularda lekeler ve çürümeler meydana gelir. Anormal meyve ve tomurcuk oluşumu, çiçek ve tomurcuklarda dökülmeler görülür. Meyvelerde çatlamalar oluşur ve dolayısıyla meyve raf ömrü kısalmıştır (Karaman ve ark., 2012).

Pamukta kalsiyum noksanlığında büyüme ucu ölür, yan dallanmalar meydana gelir. Bu yan dalların yaprakları küçük ve kepe benzeri kıvrımlıdır. Genç yapraklarda nekrotik lekeler ortaya çıkar (Güneş ve ark., 2000). Son yıllarda yapılan çalışmalarda kalsiyumun bitki dokularını donma-çözünme stresine karşı koruduğu, yeterli kalsiyumun olması durumunda bitkilerin hastalıklara karşı daha dayanıklı olduğu, hücre duvarındaki kalsiyum pektatların bitkileri mantari ve bakteriyel enfeksiyonlara karşı korumada önemli olduğu bildirilmiştir (Güneş ve ark., 2000).

Stomaların açılma ve kapanmasında rol aldığı için kuraklık ve susuzluk etkisine karşı bitkileri koruduğu bildirilmektedir (Karaman ve ark., 2012). Kalsiyum, tuz stresinde bitki açısından olumlu etkiye sahip bir elementtir. Yapılan çalışmalarda yüksek dozda dışsal kalsiyum uygulamasının, hücre zarının Na⁺ iyonuna karşı geçirgenliğini azalttığı ve bu şekilde sodyumun pasif alınımıyla hücre içinde ve bitkide birikmesinin önlendiği bildirilmiştir (Hoffmann ve ark., 1989; Whittington ve Smith, 1992). Bu koşullar altında Ca²⁺ birçok fizyolojik ve hücresel olayı düzenleyerek stresten korunma sağladığı için önem kazanmaktadır

(Hirschi, 2004; Tang ve ark., 2006). Kalsiyumun Na⁺ alımını engellediği ve böylece tohumun çimlenmesi üzerindeki olumsuz etkisini azalttığı rapor edilmiştir (Zehra ve ark., 2012).

Yapılan bazı çalışmalar Ca eksikliğinin pamuk liflerinin uzamasını engellediği, pamuk liflerinin uzamasında kalsiyumun önemli rol oynadığını açığa çıkarmıştır (Guo ve ark., 2017). Bitkilerin çeşitli kısımlarında kalsiyum konsantrasyonu değişmektedir. Pamuk bitkisindeki kalsiyum konsantrasyonunun, olgun pamuk bitkilerinde 90 ile 160 kg ha⁻¹ arasında değiştiği, ancak tohum ve liflerde daha düşük olduğu belirtilmiştir (Ahmed ve ark., 2020).

Bu çalışma kalsiyumun farklı uygulamalarının pamukta verim, verim bileşenleri ve lif kalite özelliklerine etkisini belirlemek amacıyla yürütülmüştür.

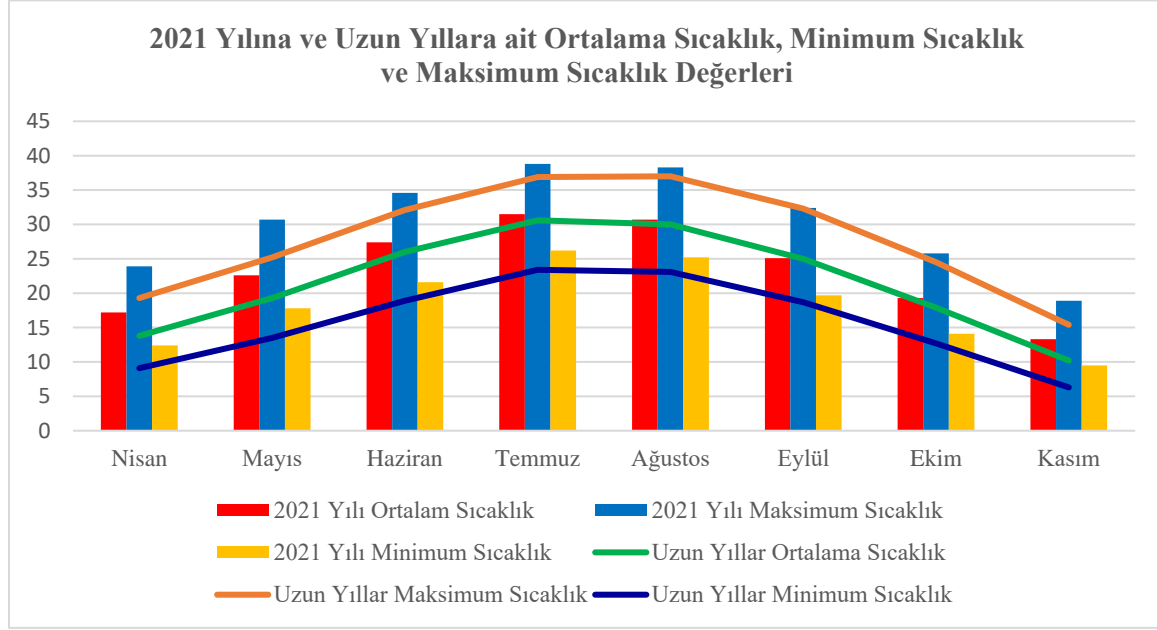
Materyal ve Metod

Siirt Üniversitesi Ziraat Fakültesi deneme alanında 2021 yılında tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak yürütülen bu çalışmada bitkisel materyal olarak özel sektörden temin edilen MAY 455 pamuk çeşidi ile kalsiyum kaynağı olarak sıvı formda Kalsiyum Nitrat Çözeltisi kullanılmıştır. Kalsiyum nitrat çözeltisi içeriğinde Suda Çözünür Kalsiyum Oksit (CaO) % 15, Toplam Azot (N) % 8, Nitrat Azotu (NO₃ - N) ise % 8' dir.

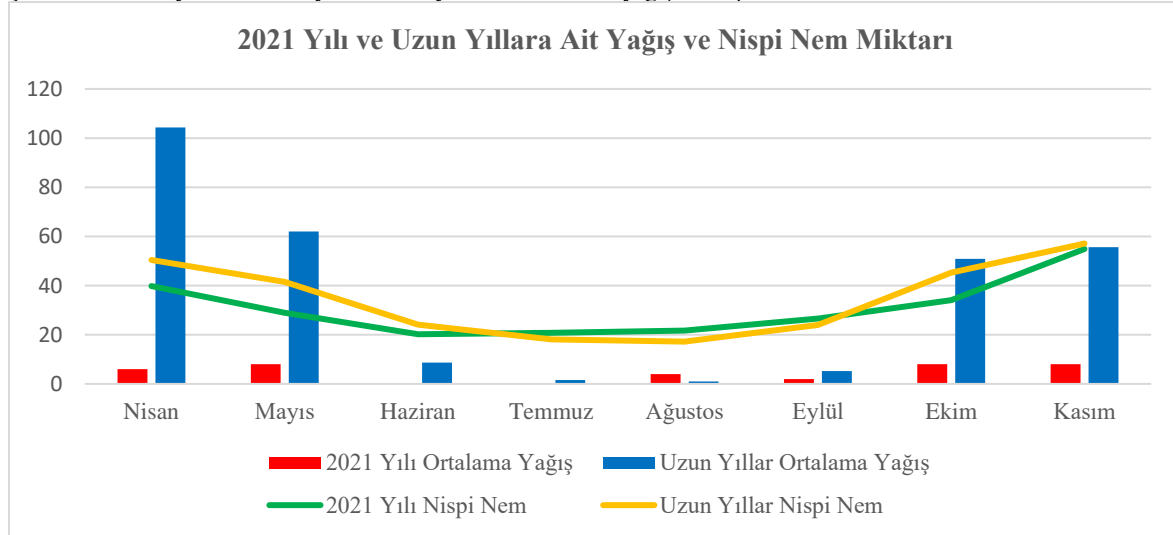
MAY 455 Pamuk Çeşidi

Erkenci bir çeşittir. Yaprakları az tüylüdür. Çepel oranı çok düşüktür. Konik bitki yapısına sahip olup kozalar ana gövdeye yakındır. 5 çenetli koza oranı % 60-70'tir. Adaptasyon kabiliyeti çok yüksektir. Çorak arazilerde çimlenme ve boylanma kabiliyeti oldukça iyidir. Yüksek verim kapasitesine sahiptir. Kuraklığa dayanımı yüksek, Verticillium wilt ve Fusarium wilt hastalıklarına karşı toleranslıdır. Güçlü bitki yapısı ile makineli hasada uygundur. Çırcır randımanı % 44- 46, lif inceliği 4,4 - 4,8 mic, lif uzunluğu 31-32 mm, lif mukavemeti 32-35 g/tex arasında değişmektedir (Anonim, 2014).

Şekil 1. Deneme yılı olan 2021 yılı ile uzun yıllara ait ortalama sıcaklık, minimum ve maksimum sıcaklık değerleri



Şekil 2. Deneme yılı olan 2021 yılı ile uzun yıllara ait ortalama yağış ve nispi nem miktarı



Kaynak: Siirt İli Meteoroloji Müdürlüğü, Siirt

Denemenin yürütüldüğü alan sonbaharda pullukla derin olarak sürülmüş, ilkbaharda ise kültivatörle yüzlek olarak işlenmiş, ekim öncesi 2 kez tapan çekilerek ekime hazır hale getirilmiştir. Ekim işlemleri 13 Nisan 2021 tarihinde mibzer ile yapılmıştır. Her parsel 6 m uzunluğunda 4 sıradan oluşturulmuştur. Sıra arası 70 cm sabit tutulmuş, sıra üzeri mesafe ise 15-20 cm olacak şekilde seyreltme yapılmıştır. Her bir parsel genişliği 2,8 m olup, bloklar arasında 2 m boşluk bırakılmıştır. Deneme alanının toprak analizleri yapılmış ve bitkinin ihtiyaç duyduğu gübre miktarı belirlenmiştir. Belirlenen toprak özellikleri Çizelge 1’de verilmiştir.

Çizelge 1. Deneme arazisinin toprak özellikleri

Analiz Adı	Birim	Analiz Sonucu	Değerlendirme
pH		7,90	Orta derecede alkali
EC	dS/m	0,37	Tuzsuz
Kireç	%	1,58	Kireçsiz
Bünye	%	59,4	Killi-Tımlı
Organik Madde	%	0,92	Çok az
Alınabilir Fosfor	kg/da	5,59	Az
Alınabilir Potasyum	kg/da	27,28	Orta

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Denemeye toplam 14 kg da⁻¹ saf N ile 8 kg da⁻¹ saf P₂O₅ verilmiş, ekim esnasında 8 kg⁻¹ da N ile 8 kg da⁻¹ P₂O₅ 20-20-0 kompoze gübre formunda banda, geriye kalan azot (6 kg da⁻¹ N) ise ilk sulama öncesinde üre formunda uygulanmıştır. Kalsiyum uygulamaları motorlu sırt pülverizatörü yardımı ile yaprağa püskürtme şeklinde uygulanmıştır. Kalsiyum uygulamaları, bitki gelişiminin taraklanma döneminde ve çiçeklenme döneminde olmak üzere 100 cc, 200 cc ve 400 cc dozlarında uygulanarak, kontrol ile kıyaslanmıştır. Denemede 7 farklı uygulama (Kontrol, Taraklanma Döneminde, 100 cc/da, Taraklanma Döneminde, 200 cc/da, Taraklanma Döneminde, 400 cc/da, Çiçeklenme Döneminde, 100 cc/da, Çiçeklenme Döneminde, 200 cc/da, Çiçeklenme Döneminde, 400 cc/da) yer almıştır.

Denemede tüm bakım işlemleri gerektiği dönemde yapılmıştır. Denemede 4 kez el, 3 kez makine çapası yapılmıştır. Deneme alanı karık usulü sulama yöntemine göre 8 kez sulanmıştır. Sulamalarda bitkinin su ihtiyacı göz önünde bulundurularak, sulama işlemi çiçeklenme öncesi dönemde başlamış ve % 10 koza açma döneminde son verilmiştir. Bitki gelişim dönemi boyunca zararlı kontrolü periyodik olarak yapılmış, taraklanma dönemi öncesi ve taraklanma döneminde thrips zararlısı görülmüştür. Thrips zararlısına karşı SP 20 (%20 Acetamiprid) suda çözünen toz insektisit yapraklara püskürtülerek uygulanmıştır. Hasat elle yapılarak iki defada tamamlanmıştır. Birinci el hasat 14 Eylül 2021 tarihinde, ikinci el hasat ise 2 Ekim 2021 tarihinde yapılmış, birinci ve ikinci elde toplanan ürünler ayrı ayrı tartılarak, toplam verime dönüştürülmüştür. Lif kalite analizleri GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi Laboratuvarında HVI aleti yardımı ile belirlenmiş, denemeden elde edilen tüm veriler, JUMP istatistik program yardımı ile analiz edilmiş ve gruplamalar LSD (0.05)' e göre yapılmıştır.

Bulgular ve Tartışma

Araştırmada incelenen tarımsal özelliklere ilişkin elde edilen ortalama değerler Çizelge 2 ve Çizelge 3'de, lif teknolojik özelliklere ilişkin ortalama değerler ise Çizelge 4'de verilmiştir.

Çizelge 2. İncelenen özelliklerden kütlü pamuk verimi, lif verimi, bitki boyu, odun dalı sayısı, meyve dalı sayısı, ilk meyve dalı boğum sayısı ve boğum sayısı bakımından elde edilen ortalama değerler

Uygulama	Kütlü Pamuk Verimi (kg /da)	Lif Verimi (kg /da)	Bitki Boyu (cm)	Odun Dalı Sayısı (ad/bitki)	Meyve Dalı Sayısı (ad/bitki)	İlk Meyve Dalı Boğ. Sayısı (ad/bitki)	Boğum Sayısı (ad/bitki)
1. Kontrol	369,14	170,67	66,55	2,30	11,35	6,35	17,70
2.Taraklanma Dönemi 100 cc/da	348,20	157,73	68,20	2,75	11,75	7,10	18,85
3.Taraklanma Dönemi 200 cc/da	360,24	162,65	69,35	2,45	12,10	7,15	19,25
4.Taraklanma Dönemi 400 cc/da	379,80	176,62	66,35	2,70	10,45	7,25	17,70
5.Çiçeklenme Dönemi 100 cc/da	340,27	157,76	66,35	2,40	11,45	7,50	18,95
6.Çiçeklenme Dönemi 200 cc/da	401,96	185,20	65,95	2,40	11,05	7,45	18,50
7.Çiçeklenme Dönemi 400 cc/da	403,07	183,84	67,80	2,15	11,05	7,35	18,40
Ortalama	371,80	170,64	67,22	2,45	11,31	7,16	18,47
CV (%)	10,38	9,99	7,18	27,10	8,35	9,58	4,46
LSD (0.05)	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D

**Aynı harfle gösterilen ortalamalar arasındaki farklar 0.05 düzeyinde önemli değildir.

Kütlü Pamuk Verimi: Kütlü pamuk verimi değerlerinin 340,27 ile 403,07 kg/da arasında değiştiği ve denemenin genel ortalamasının 371,80 kg/da olduğu Çizelge 2’de görülmektedir. En yüksek kütlü pamuk veriminin 7. uygulamadan (Çiçeklenme Dönemi 400 cc/da) elde edildiği (403,07 kg/da) ve bunu 6. uygulamanın (Çiçeklenme Dönemi 200 cc/da) takip ettiği (401,96 kg/da), en düşük kütlü pamuk veriminin ise 5. uygulama olan (Çiçeklenme Dönemi 100 cc/da) kalsiyum uygulamasından (340,27 kg/da) elde edildiği izlenebilmektedir. Kalsiyum uygulamalarının kütlü pamuk verimine önemli bir etkisinin olmadığı görülmektedir. Kalsiyum uygulamaları ile elde edilen en yüksek kütlü pamuk verimi ile kontrol kıyaslandığında 33,93 kg/da bir artışın görüldüğü, ancak bu farklılığın istatistiki olarak önemli olmadığı belirlenmiştir.

Zeng ve ark. (2022) kalsiyumun kütlü pamuk verimini % 9.3 ile 19.4 oranında arttırdığını, Tsialtas ve ark. (2016), yaprak Ca konsantrasyonunun, hem kütlü pamuk verimi hem de lif verimi ile güçlü korelasyon gösterdiğini belirtmişlerdir. Mısır pamuklarına yapraktan 60 ppm dozunda uygulanan Ca ile pamuk veriminin arttığı belirtilmiştir (Sawan ve ark., 2001; Sawan, 2014). Kalsiyumun kütlü pamuk verimini arttırdığını bildiren Sawan ve ark. (2001), Elms ve ark. (2001) ile topraklardaki kalsiyum içeriğinin kütlü pamuk verimini olumlu yönde etkilediği Aydın ve ark. (2012) tarafından bildirilmekte ve çalışmada elde edilen bulgular ile

paralellik göstermemektedir. Bu durum denemede kullanılan materyal, kullanılan pamuk çeşidi, uygulama zamanı ve yöntemleri ile iklim koşulları gibi farklılıklardan kaynaklanabilmektedir.

Lif Verimi: Lif verimi değerlerinin 157,73 ile 185,20 kg/da arasında değiştiği görülmektedir (Çizelge 2). En yüksek lif pamuk veriminin 185,20 kg/da ile 6. uygulamadan (Çiçeklenme Dönemi 200 cc/da) elde edildiği ve bunu 7. uygulamanın (Çiçeklenme Dönemi 400 cc/da) takip ettiği (183,84 kg/da), en düşük lif veriminin ise (157,73 kg/da) 2. uygulamadan (Taraklanma Dönemi 100 cc/da) elde edildiği izlenebilmektedir. Kalsiyum uygulamalarının lif pamuk verimi üzerine önemli bir etki yaratmadığı görülmüştür. Harris (2002) kalsiyum uygulaması ile lif veriminde önemli bir istatistiki farklılık belirlemediğini bildirmiş, elde edilen bulgular ile araştırma sonuçları paralellik göstermiştir. Heidari ve ark. (2022) Ca seviyesinin 1,5 g/L düzeyine kadar lif verimini arttırdığını, 3,0 g/L düzeyinde ise lif veriminin azaldığını bildirmişlerdir.

Bitki Boyu: Bitki boyuna ilişkin değerlerin, 65,95 ile 69,35 cm arasında değiştiği; denemenin genel ortalamasının 67,22 cm olduğu izlenmektedir. En yüksek bitki boyu değerinin 3. uygulama olan Taraklanma Döneminde 200 cc/da dozunda kalsiyum uygulamasından elde edildiği (69,35 cm), en düşük bitki boyu değerinin ise 6. uygulama olan Çiçeklenme Döneminde 200 cc/da kalsiyum uygulamasından elde edildiği (65,95 cm); uygulamalar arasındaki farklılıkların ise istatistiki olarak önemli olmadığı izlenebilmektedir. Kalsiyum uygulaması ile bitki boyu değerlerinde önemli bir farklılığın elde edilemediği belirlenmiştir. Heidari ve ark. (2022)'nin kalsiyumun bitki boyu üzerine önemli bir etkisinin olmadığını bildiren bulguları ile araştırma sonuçları paralellik göstermiştir. Rethwisch ve ark. (2007), DPL449BR pamuk çeşidinde kalsiyumun bitki boyu üzerine önemli etkisinin olduğunu bildirmişlerdir. Benzer bulgular Ahmad ve ark. (2003) ile Goud ve Kumar (2021) tarafından da bildirilmiştir.

Odun Dalı Sayısı: Çizelge 2'den odun dalı sayısı değerlerinin, 2,15 ile 2,75 adet/bitki arasında değiştiği ve denemenin genel ortalamasının 2,45 adet/bitki olduğu izlenebilmektedir. Aynı tablodan, en yüksek odun dalı sayısının 2. uygulama olan Taraklanma Döneminde 100 cc/da kalsiyum uygulamasından elde edildiği (2,75 adet/bitki), en düşük değer ise 7. uygulama olan Çiçeklenme Döneminde 400 cc/da kalsiyum uygulamasından elde edildiği (2,15 adet/bitki); ancak uygulamalar arasındaki farklılıkların istatistiki olarak önemli olmadığı izlenebilmektedir. Ahmad ve ark. (2003)'nin Ca uygulaması ile pamukta çimlenmeden 2 hafta sonra maksimum yan dal sayısına ulaşıldığını belirten bulguları ve Güneş ve ark. (2000)'nin pamukta kalsiyum noksanlığında yan dallanmaların meydana geldiğini belirten bulguları ile araştırma bulgularının farklılık gösterdiği görülmektedir.

Meyve Dalı Sayısı: Meyve dalı sayısı değerlerinin, 10,45 ile 12,10 adet/bitki arasında değiştiği ve denemenin genel ortalama değerinin 11,31 adet/bitki olduğu, ancak uygulamalar arasındaki farklılıkların önemli olmadığı görülmektedir. Meyve dalı sayısı bakımından taraklanma döneminde 400 cc/da dozunda uygulanan kalsiyum uygulamasından (4. uygulama) en düşük değer (10,45 adet/bitki) elde edildiği, en yüksek değer ise taraklanma döneminde 200 cc/da dozunda uygulanan kalsiyum uygulamasından (3. uygulama) elde edildiği (12,10 adet/bitki) izlenebilmektedir. Ananthkrishnan ve Backiyavathy (2020), kalsiyumu diğer besin elementleri ile karışım halinde uyguladıkları çalışmada en yüksek meyve dalı sayısını 12,9 adet/ bitki ile elde ettiklerini bildirmişlerdir.

İlk Meyve Dalı Boğum Sayısı: İlk meyve dalı boğum sayısı değerlerinin, 6,35 ile 7,50 adet/bitki arasında değiştiği; denemenin genel ortalamasının 7,16 adet/bitki olduğu izlenebilmektedir. İlk meyve dalı boğum sayısı bakımından en düşük değer (6,35 adet/bitki) kontrol uygulamasından (1. uygulama) elde edildiği, Çiçeklenme Döneminde 100 cc/da dozunda uygulanan kalsiyum uygulamasından (5. uygulama) ise en yüksek değer elde edildiği (7,50 adet/bitki); ancak uygulamalar arasındaki farklılıkların istatistiki olarak önemli olmadığı izlenebilmektedir. Rethwisch ve ark. (2007)'nin, kalsiyum içeren 7 farklı uygulama ile yürüttükleri çalışmada bu özellik bakımından önemli farklılıklar elde ettiklerini bildiren bulguları ile araştırma sonuçları farklılık göstermektedir. Bu durum çalışmadaki materyal ve yöntem farklılığından kaynaklanabilmektedir.

Boğum Sayısı: Boğum sayısı değerlerinin, 17,70 ile 19,25 adet/bitki arasında değiştiği ve denemenin genel ortalamasının 18,47 adet/bitki olduğu izlenebilmektedir. Boğum sayısı bakımından en düşük değer (17,70 adet/bitki) kontrol uygulaması (1. uygulama) ile Taraklanma Döneminde 400 cc/da dozunda uygulanan kalsiyum uygulamasından (4. uygulama) elde edildiği, Taraklanma Döneminde 200 cc/da dozunda uygulanan kalsiyum uygulamasından (3. uygulama) ise en yüksek değer elde edildiği (19,25 adet/bitki); fakat uygulamalar arasındaki farklılıkların istatistiki olarak önemli olmadığı görülmektedir. Boğum sayısı yönünden elde edilen bulgular Rethwisch ve ark. (2007)'nin bulguları ile farklılık göstermiştir.

Çizelge 3. İncelenen özelliklerden koza sayısı, kozada tohum sayısı, koza ağırlığı, koza kütlü ağırlığı, çırçır randımanı, ilk el kütlü oranı, SPAD değeri ve NDVI değeri bakımından elde edilen ortalama değerler ve oluşan gruplamalar

Uygulama	Koza Sayısı (ad/bitki)	Kozada Tohum Say (ad.)	Koza Ağırlığı (gr)	Koza Kütlü Ağırlığı (gr)	Çırçır Rand. (%)	İlk El Kütlü Oranı (%)	SPAD değeri (%)	NDVI Değeri
1. Kontrol	9,70	27,45	6,37 ab	4,92 abc	46,20	93,58	50,45	0,70
2.Taraklanma Dönemi 100 cc/da	9,70	26,38	5,87 c	4,50 c	45,30	92,24	52,35	0,73
3.Taraklanma Dönemi 200 cc/da	8,60	29,55	6,40 ab	4,77 bc	45,20	91,49	49,88	0,75
4.Taraklanma Dönemi 400 cc/da	9,45	27,65	6,62 ab	5,10 ab	46,50	93,62	49,53	0,73
5.Çiçeklenme Dönemi 100 cc/da	9,75	27,75	6,52 ab	5,02 ab	46,40	93,35	47,20	0,72
6.Çiçeklenme Dönemi 200 cc/da	8,75	28,45	6,35 b	4,92 abc	46,10	93,57	46,68	0,71
7.Çiçeklenme Dönemi 400 cc/da	8,85	30,08	6,82 a	5,25 a	45,60	92,25	49,13	0,73
Ortalama	9,25	28,19	6,42	4,92	45,90	92,87	49,31	0,72
CV (%)	14,46	6,13	4,92	5,81	1,67	2,31	6,61	4,73
LSD (0.05)	Ö.D	Ö.D	0,46*	0,42*	Ö.D	Ö.D	Ö.D	Ö.D

**Aynı harfle gösterilen ortalamalar arasındaki farklar 0.05 düzeyinde önemli değildir.

Koza Sayısı: Çizelge 3’den koza sayısı değerlerinin, 8,60 ile 9,75 adet/bitki arasında değiştiği görülmektedir. En önemli verim komponenti olarak bilinen koza sayısı bakımından en düşük değer (8,60 adet/bitki), Taraklanma Döneminde 200 cc/da dozunda uygulanan kalsiyum uygulamasından (3. uygulama) elde edildiği, Çiçeklenme Döneminde 100 cc/da dozunda uygulanan kalsiyum uygulamasından (5. uygulama) ise en yüksek değer (9,75 adet/bitki); ancak uygulamalar arasındaki farklılıkların istatistiki olarak önemli olmadığı izlenebilmektedir. Goud ve Kumar (2021), yapraktan uygulanan kalsiyumun verim ve verim parametrelerinde artışa yol açtığını bildirmişlerdir. Ananthakrishnan ve Backiyavathy (2020), farklı makro besin elementlerini karışım halinde bitkilere uyguladıkları çalışmada en yüksek koza sayısını kalsiyumun yer aldığı uygulamadan elde ettiklerini; Ahmad ve ark. (2003) en yüksek koza sayısı değerini kalsiyum uygulamasından 8 hafta sonra elde ettiklerini bildirmişlerdir.

Kozada Tohum Sayısı: Kozada tohum sayısı 26,38 ile 30,08 adet arasında değişmiştir. Taraklanma döneminde 100 cc/da kalsiyum uygulaması (2. uygulama) ile en düşük değer (26,38 adet) elde edildiği, çiçeklenme döneminde 400 cc/da kalsiyum uygulaması (7. uygulama) ile en yüksek değer (30,08 adet); ancak uygulamalar arasındaki farklılıkların istatistiki olarak önemli olmadığı izlenebilmektedir.

Koza Ağırlığı: Koza ağırlığı değerlerinin, 5,87 ile 6,82 gr arasında değiştiği; uygulamalar arasında % 5 önem düzeyinde istatistiki farklılıkların bulunduğu ve denemenin genel

ortalamasının 6,42 gr olduğu görülmektedir. Çiçeklenme Döneminde 400 cc/da dozunda kalsiyum uygulaması (7. uygulama) ile en yüksek değerin (6,82 gr) elde edildiği; Taraklanma Döneminde 100 cc/da kalsiyum uygulaması (2. uygulama) ile en düşük koza ağırlığı değerinin (5,87 gr) elde edildiği izlenebilmektedir. Çalışmada kalsiyum uygulamaları ile pamukta koza ağırlığının etkilendiği belirlenmiştir. Kalsiyum konsantrasyonlarının koza ağırlığının artmasında önemli rol oynadığını bildiren Sawan ve ark. (1997) ile araştırma bulguları benzerlik göstermektedir. Ananthakrishnan ve Backiyavathy (2020), koza ağırlığının kalsiyum uygulaması ile en yüksek düzeye ulaştığını bildirmişlerdir.

Koza Kütlü Ağırlığı: Koza kütlü ağırlığı değerlerinin, 4,50 ile 5,25 gr arasında değiştiği; uygulamalar arasında % 5 önem düzeyinde istatistiki farklılıkların bulunduğu ve denemenin genel ortalamasının 4,92 gr olduğu görülmektedir. Çiçeklenme Döneminde 400 cc/da kalsiyum uygulaması (7. uygulama) ile en yüksek değerin elde edildiği (5,25 gr); Taraklanma Döneminde 100 cc/da kalsiyum uygulaması (2. uygulama) ile en düşük değerin (4,50 gr) elde edildiği izlenebilmektedir. Çalışmada incelenen koza kütlü ağırlığı değerlerinin kalsiyum uygulamalarından önemli derecede etkilendiği görülmektedir.

Çırcır Randımanı: Çırcır randımanı değerlerinin, % 45,20 ile 46,50 arasında değiştiği ve denemenin genel ortalamasının % 45,90 olduğu görülmektedir. Taraklanma Döneminde 200 cc/da kalsiyum uygulaması ile (3. uygulama) çırcır randımanı bakımından en düşük değer (% 45,20) elde edilmiştir. Taraklanma Döneminde 400 cc/da kalsiyum uygulaması (4. Uygulama) ile en yüksek değerin elde edildiği (% 46,50); ancak uygulamalar arasındaki farklılıkların istatistiki olarak önemli olmadığı izlenebilmektedir.

İlk El Kütlü Oranı: İlk el kütlü oranı değerlerinin, % 91,49 ile 93,62 arasında değiştiği, denemenin genel ortalamasının % 92,87 olduğu görülmektedir. Taraklanma Döneminde 200 cc/da kalsiyum uygulaması (3. uygulama) ile en düşük ilk el kütlü oranı değerinin (%91,49) elde edildiği, Taraklanma döneminde 400 cc/da kalsiyum uygulaması ile (4. uygulama) en yüksek değerin elde edildiği (% 93,62); ancak uygulamalar arasındaki farklılıkların istatistiki olarak önemli olmadığı izlenebilmektedir. Kalsiyumun bitkide açan koza sayısını artırarak erkenciliği arttırdığını bildiren Sawan ve ark. (1997) ile farklı sonuçların elde edildiği görülmektedir.

Klorofil İçeriği (SPAD değeri): Yaprakta klorofil içeriğine ilişkin ortalama değerlerin, % 46,68 ile 52,35 arasında değiştiği ve denemenin genel ortalamasının % 49,31 olduğu belirlenmiştir. Çiçeklenme Döneminde 200 cc/da dozunda uygulanan kalsiyum uygulaması (6. uygulama) ile yaprakta klorofil içeriği bakımından en düşük değerin (% 46,68) elde edildiği, taraklanma döneminde 100 cc/da dozunda uygulanan kalsiyum uygulaması (2. uygulama) ile

en yüksek değerin (% 93,62) elde edildiği; ancak uygulamalar arasındaki farklılıkların istatistiksel olarak önemli olmadığı izlenebilmektedir.

Heidari ve ark. (2022), kalsiyum uygulaması ile pamukta klorofil içeriği değerinin arttığını, ancak bu farklılığın istatistiksel olarak önemli olmadığını belirtmişlerdir. Yao ve ark. (2022), kalsiyum uygulaması ile klorofil içeriğinin arttığını saptamışlardır. Rethwisch ve ark. (2007), pamukta kalsiyum içeren yedi yaprak gübresi uyguladıkları çalışmada kontrole kıyasla yaprak klorofil seviyesinin en az %7,4 oranında arttığını ve en yüksek klorofil içeriği değerinin (%21,3) artışla Kalsiyum Metalosate®'de kaydedildiğini bildirmişlerdir. Klorofil içeriği üzerine Ca'un önemli olduğu ve yüksek kalsiyumun (300 mg L^{-1}) yaprakta klorozu arttırdığı, bununla birlikte Mg alınımı için rekabete yol açtığı, Ca ve Mg arasında antagonistik bir etkileşimin olduğu bazı araştırmacılar tarafından bildirilmiştir (Ho ve ark., 1999; Paiva ve ark., 2008, Hao ve Papadopoulos, 2004).

Normalize Edilmiş Vegetasyon Farklılık İndeksi (NDVI değeri): Normalize edilmiş vegetasyon farklılık indeksi olan NDVI değerinin 0,70 ile 0,75 arasında değiştiği; denemenin genel ortalama değerinin ise 0,72 olduğu görülmektedir. NDVI değeri bakımından en yüksek değerin (0,75) ile taraklanma döneminde 200 cc/da kalsiyum uygulamasından (3. uygulama) elde edildiği belirlenirken, en düşük değerin (0,70) kontrol uygulamasından elde edildiği; ancak uygulamalar arasındaki farklılıkların istatistiksel olarak önemli olmadığı görülmektedir.

Çizelge 4. İncelenen lif kalite özelliklerine ilişkin ortalama değerler

Uygulama	Lif İncel. (mic)	Lif Uzun. (mm)	Lif Kopma Dayan. (g/tex)	Lif Kopma Uzaması (%)	Lif Ünlümler Oranı (%)	Kısa Lif Oranı (%)	Lif Sarılık Değeri (+b)	Lif Parlaklık Değeri (Rd)	İplik Olab. İndeksi (SCI)
1. Kontrol	4,95	29,09	35,38	5,53	84,38	7,28	8,98	76,38	150,50
2. Taraklanma Dönemi 100 cc/da	5,15	28,56	34,13	5,50	84,80	6,78	9,08	76,85	146,75
3. Taraklanma Dönemi 200 cc/da	4,99	28,37	35,28	5,58	83,60	7,23	9,40	77,35	146,00
4. Taraklanma Dönemi 400 cc/da	5,04	28,60	35,30	5,60	83,75	7,65	9,08	76,00	145,75
5. Çiçeklenme Dönemi 100 cc/da	5,18	29,10	34,15	5,80	82,73	8,08	8,90	77,68	138,00
6. Çiçeklenme Dönemi 200 cc/da	4,97	27,90	33,97	5,47	84,67	8,30	9,07	77,97	146,33
7. Çiçeklenme Dönemi 400 cc/da	5,00	28,98	35,43	5,73	84,63	7,38	8,93	77,75	152,25
Ortalama	5,04	28,66	34,80	5,60	84,08	7,53	9,06	77,14	146,51
CV (%)	5,06	2,79	5,20	3,69	1,28	13,36	3,58	2,04	7,09
LSD (0.05)	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D	Ö.D

** Aynı harfle gösterilen ortalamalar arasındaki farklar 0.05 düzeyinde önemli değildir.

Lif Teknolojik Özellikler: Lif kalite özelliklerinden lif inceliği, lif uzunluğu, lif kopma dayanıklılığı, lif kopma uzaması, lif üniformite oranı, kısa lif oranı, lif parlaklık değeri, lif sarılık değeri ve iplik olabilirlik indeksi bakımından kalsiyum uygulamaları arasında önemli bir istatistiksel farklılığın bulunmadığı Çizelge 4'den izlenmektedir. Kalsiyumun liflerde en düşük seviyede bulunan makro element olduğu, ancak lif gelişimi için önemli bir element olduğu, Ca eksikliğinin pamuk liflerinin uzamasını engellediği, pamuk liflerinin uzamasında kalsiyumun önemli rol oynadığı, ancak kalsiyumun yüksek dozlarının lif kopma uzamasını olumsuz yönde etkilediği, K ve Ca arasında lif kopma uzaması açısından bir bağlantının bulunduğu Guo ve ark., 2017 tarafından bildirilmiştir. Taliercio ve Haigler (2011), önceki araştırmalarda liflerin anthesis'ten yaklaşık 1 gün sonra Ca biriktirdiğini, bunda lif gelişiminde kalsiyumun önemli bir rol oynadığının göstergesi olduğunu, kalsiyum konsantrasyonunun azalması ile lif kopma uzamasının arttığını belirtmişlerdir.

Sonuç ve Öneriler

Çalışmada kalsiyum uygulamalarının koza ağırlığı ve koza kütlü ağırlığı üzerine önemli etkisinin olduğu ve uygulamalar arasında önemli istatistiksel farklılıkların bulunduğu, incelenen diğer özelliklerden kütlü pamuk verimi, lif verimi, bitki boyu, odun dalı sayısı, meyve dalı sayısı, ilk meyve dalı boğum sayısı, boğum sayısı, koza sayısı, çırçır randımanı, ilk el kütlü oranı, kozada tohum sayısı, yaprakta klorofil içeriği (SPAD değeri) ve NDVI değerinin (normalize edilmiş vejetasyon farklılık indeksi) kalsiyum uygulamalarından etkilenmediği saptanmıştır. Lif kalite kriterlerinin kalsiyum uygulamalarından etkilenmediği ve uygulamalar arasında önemli bir farklılığın bulunmadığı belirlenmiştir.

Araştırmada çiçeklenme döneminde 400 cc/da kalsiyum uygulaması ile en yüksek koza ağırlığı ile en yüksek koza kütlü ağırlığı değerleri elde edilmiştir. Çalışmada pamukta çiçeklenme döneminde 400 cc/da kalsiyum uygulaması ile en yüksek koza ağırlığı ve koza kütlü ağırlığı değerlerinin elde edilmesi bu uygulamanın önerilebileceğini göstermektedir.

Ancak çalışmada kalsiyumun verim üzerine istatistiksel anlamda bir etkisinin görülmemiş olması kalsiyumun etkisini belirlemek için daha fazla araştırmaya ihtiyaç duyulduğu anlaşılmaktadır. Yapılacak çalışmaların farklı çeşitler ile yürütülmesi, bitki gelişiminin farklı dönemlerinde ve dozlarda kalsiyumun uygulanması ve diğer besin elementleri ile interaksiyonlarında araştırılmasının uygun olacağı anlaşılmaktadır.

KAYNAKLAR

- Ahmad, Z., Yasin, M., Nadeem, S., Atta, B. M., 2003. Effect of Application of Calcium Carbide on Growth of Cotton Crop. *Asian Journal of Plant Sciences*, 2, 569-574.
- Ahmed, N., Ali, A. M., Danish, S., Chaudhry, U. K., Hussain, S., Hassan, W., Ahmad, F., Al, N., 2020. Role of Macronutrients in Cotton Production, Springer, Singapore. Chapter 6, 81-104.
- Ananthkrishnan, S. and Backiyavathy, M. R., 2020. Effect of macronutrient mixtures on growth and yield of cotton (var. CO 14). *Madras Agricultural Journal*, 107(june (4-6)), 1. doi:10.29321/MAJ.2020.000366
- Anonim, 2014. MAY Tohumculuk
<https://www.may.com.tr/urun/may455> [Ziyaret Tarihi: 21 Kasım 2021].
- Aydın, M., Albayrak, H., Kaptan, M. A., 2012. Aydın Merkez İlçesi Pamuk Üretiminde Toprak Organik Maddesi Ve Diğer Toprak Özelliklerinin Verim, Lif Ve Tohum Özellikleri Üzerine Etkisi. *Organomineral Gübre Çalıştayı Bildiriler*, (29 Eylül 2017), 109.
- Bolat, İ. ve Kara, Ö., 2017. Bitki besin elementleri: Kaynakları, işlevleri, eksik ve fazlalıkları. *Bartın Orman Fakültesi Dergisi*, 19 (1), 218-228.
- Elms, M. K., Green, C. J., Johnson, P. N., 2001. Variability of cotton yield and quality. *Communications in Soil Science and Plant Analysis*, 32(3&4), 351-368.
- Goud, E. L. and Kumar, P., 2021. Responses of Crops to Foliar Application of Calcium and Potassium. *Biological Forum An International Journal* 13(1): 54-60.
- Guo, K., Tu, L., He, Y., Deng, J., Wang, M., Huang, H., Li, Z., Zhang, X., 2017. Interaction between calcium and potassium modulates elongation rate in cotton fiber cells. *Journal of Experimental Botany*, 68 (18), 5161–5175.
- Güneş A., Alpaslan M., İnal A., 2000. Bitki Besleme ve Gübreleme. *Ankara Üniversitesi Ziraat Fakültesi Yayınları*, 1514, 338-346.
- Heidari, M., Moradi, M., Armin, M., Amerian, M. R., 2022. Effects of foliar application of salicylic acid and calcium chloride on yield, yield components and some physiological parameters in cotton. *Sustainability in Food and Agriculture (SFNA)*. 3(1), 28-32.
- Hao, X. and Papadopoulos, A. P., 2004. Effects of calcium and magnesium on plant growth, biomass partitioning and fruit yield of winter greenhouse tomato. *HortScience*, 39 (3), 512-515.
- Ho, L. C., Hand, D. C., Fussell, M., 1999. Improvement of tomato fruit quality by calcium nutrition. *Acta Horticulturae*. 481, 463-468.
- Harris, G., 2002. Effect of Foliar Calcium Applications on Cotton Lint Yields. Beltwide Cotton Conference University of Georgia, January 8-12, Atlanta, GA,
- Hirschi, K. D., 2004. The calcium conundrum. Both versatile nutrient and specific signal. *Plant Physiology*, 136(1), 2438-2442.
- Hoffmann, R., Tufariello, J., Bisson, M. A., 1989. Effect of divalent cations on Na⁺ permeability of *Chara corallina* and freshwater grown *Chara buckellii*. *Journal of Experimental Botany*, 40 (8): 875-881.
- Kacar, B., 1984. Bitki Besleme. Ankara Üniversitesi Ziraat Fakültesi Yayınları. 899: 250.
- Karaman, M. R, Adiloğlu, A., Brohi, R., Güneş, A., İnal, A., Kaplan, M., Katkat, V., Korkmaz, A., Okur, N., Ortaş, İ., Saltalı, K., Taban, S., Turan, M., Tüfenkçi, Ş., Eraslan, F., Zengin, M., 2012. Bitki Besleme. Gübretaş Rehber Kitaplar Dizisi No: 2, Dumat Ofset, Matbacılık San. Tic. Ltd. Şti. Ankara.
- Paiva, E. A., Sampaio, R. A., Martinez, H. E. P., 2008. Composition and quality of tomato fruit cultivated in nutrient solutions containing different calcium concentrations, *Journal of Plant Nutrition*. 21(18), 2653-2661.

- Rethwisch, M. D., Ramos, D. M., Luna, M., Wellman, J., 2007. Effects of Calcium Containing Foliar Fertilizers on DPL449BR Cotton in the Palo Verde Valley, 2005. College of Agriculture, University of Arizona (Tucson, AZ). <http://hdl.handle.net/10150/198217>
- Sawan, Z. M., Mahmoud, M. H., Momtaz, O. A., 1997. Effect of phosphorus fertilization and foliar application of chelated zinc and calcium on quantitative and qualitative properties of Egyptian cotton (*Gossypium barbadense* L. Var. Giza 75). *Journal of Agricultural and Food Chemistry*, 45(8), 3326-3330.
- Sawan, Z. M., Hafez, S. A., Basyony, A. E., 2001. Fosforlu gübreleme ve şelatlı çinko ve kalsiyumun yapraktan uygulanmasının pamuğun tohum, protein ve yağ verimleri ile yağ özelliklerine etkisi. *Tarım Bilimleri Dergisi*, 136 (2), 191-198.
- Sawan, Z. M., 2014. Cottonseed yield and its quality as affected by mineral fertilizers and plant growth retardants. *Agricultural Sciences* 5 (3), 1-24.
- Taliercio, E. and Haigler, C. H., 2011. The effect of calcium on early fiber elongation in cotton ovule culture. *The Journal of Cotton Science* 15, 154-161.
- Tang, D., Dean, W. L., Borchman, D., Paterson, C. A., 2006. The influence of embrane lipid structure on plasma membrane Ca^{2+} -ATPase activity. *Cell Calcium*, 39, 209-216
- Tsialtas, J. T., Shabala, S., Matsi, T., 2016. A prominent role for leaf calcium as a yield and quality determinant in upland cotton (*Gossypium hirsutum* L.) varieties grown under irrigated mediterranean conditions. *Journal of Agronomy and Crop Science*, 161-173.
- Tucker, M. R., 1999. Essential Plants Nutrients: Their presence in North Carolina soils and 42 role in plant nutrition. www.ncagr.gov/agronomi/pdf/essnutr.pdf
- TÜİK, 2022. Türkiye İstatistik Kurumu, Bitkisel Üretim İstatistikleri <https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr>
- UPK, 2020. Ulusal Pamuk Konseyi Pamuk Sektör Raporu 2020 http://www.upk.org.tr/User_Files/editor/file/2019%20Pamuk%20Raporu.pdf [Ziyaret Tarihi: 15 Haziran 2021].
- UPK, 2022. Ulusal Pamuk Konseyi Pamuk Sektör Raporu 2021 http://www.upk.org.tr/User_Files/pdf/ulusal-pamuk-konseyi--sektor-raporu-2021.pdf [Ziyaret Tarihi: 08 Nisan 2022].
- Whittington, J. and Smith, F. A., 1992. Calcium-salinity interactions affect ion transport in *Chara corallina*. *Plant, Cell and Environment*, 15(6), 727-733.ç
- Yao, P., Tun, Z. H., Fenge, Z., Hua, L. S., 2022. Effects of calcium on physiology and photosynthesis of *Paris polyphylla* Sm. under high temperature and strong light stress. *Pakistan Journal of Botany*, 54(3), 809-816.
- Zehra, A., Gul, B., Ansari, R., Khan, M. A., 2012. Role of calcium in alleviating effect of salinity on germination of phragmites karka seeds. *South African Journal of Botany*, 78, 122-128.
- Zeng, L., Sun, X., Zhou, W., Li, J., Guo, Y., Liu, X., Cui, D., 2022. Combined treatment of a pyroligneous solution and soluble calcium enhances cotton growth through improving soil quality in saline-alkali soils. *Journal of Soil Science and Plant Nutrition*, 22, 25-35.

**YEŞİL EKONOMİ BAKIŞ AÇISIYLA BİR DEĞERLENDİRME;
KAHRAMANMARAŞ MERKEZLİ DEPREMLER**

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ÖZET

Yeşil ekonomi, çevresel kaygılar ile sürdürülebilir kalkınmayı odağına alan, ekonomik büyüme ve kalkınmada doğanın korunmasının önemini vurgulayan iktisadi bir bakış açısıdır. Ekonomik faaliyetlerin olumsuz çevresel ve ekolojik etkilerini dikkate alan, 21.yüzyılda kalkınma anlayışına getirilmiş çevreci bir perspektif olarak ifade edilebilir. 6 Şubat 2023 tarihinde Kahramanmaraş'ın Pazarcık ilçesinde 7,7 şiddetindeki ve aynı tarihte Ekinözü ilçesinde 7,6 şiddetindeki depremler yaklaşık 350.000km²'lik alanda hasara yol açmıştır. Türkiye nüfusunun %16'sını oluşturan yaklaşık 14 milyon kişiyi doğrudan etkilenmiştir. Nisan 2023 itibariyle resmi verilere göre 50binden fazla kişi vefat etmiş, 107binden fazla kişi bu olay neticesinde yaralanmıştır. Depremi oluş biçimi ve yıkıcı etkisinin multidisipliner bakış açısı ile çok sayıda bilimsel araştırmayı gerekli kıldığı düşünülmektedir. Bu çalışmada amaç, yeşil ekonomi bakış açısıyla ilgili olayın ön değerlendirmesine ilişkin bir perspektif oluşturmaktır. Depremden doğrudan 11 il etkilenmiştir. Yaklaşık 387bin binadan 51bini yıkılmış veya acil yıkılacak olarak ilgili bakanlıkça tespit edilmiştir. 618bin kişi bölgeden tahliye uçuşları ile tahliye edilmiştir. Diğer ulaşım yolları da dikkate alındığında bölgeden yaklaşık 2milyon kişi geçici veya kalıcı olarak ayrılmıştır. Bölgede kalan kişilerin büyük kısmı geçici konaklama alanlarında (çadır ve konteynırlarda) konaklamaktadır. Bu geçici konaklama alanlarında ısınma şekli çoğunlukla kömür sobası olup bunun CO₂ salınımının hesaplanması için yakın gelecekte açıklanacak verilere ihtiyaç duyulmaktadır. 2021 GSYİH hesaplamalarından gelirler yöntemine göre bölge Türkiye'nin tarım, orman ve balıkçılık gelirine %15 oranında katkı sağlamaktadır. Bölgenin tarım ürünlerinin ihracattaki payı ise aynı yıl için yaklaşık 4,8milyar dolardır. Bölgede artan CO₂ salınımı, yıkılan ve yıkılacak binalardan doğaya karışan zararlı kimyasallar ve dolayısıyla bölgenin tarım alanlarının göreceği olası zarar dikkate alındığında, bölgenin yeşil ekonomi bakış açısıyla yaşadığı tehlikenin oldukça büyük olduğu düşünülmektedir. Bölgenin karşı karşıya olduğu durum yalnızca ulusal değil, aynı zamanda küreseldir. Olası risklerin bütüncül bakış açısıyla değerlendirilmesi, gerekli önlemlerin alınması gerektiği düşünülmektedir.

Anahtar Kelimeler: Kahramanmaraş, Deprem, Yeşil Ekonomi, Tarım

**AN ASSESSMENT FROM A GREEN ECONOMY PERSPECTIVE;
KAHRAMANMARAŞ-CENTERED EARTHQUAKES**

ABSTRACT

Green economy is an economic perspective that focuses on environmental concerns and sustainable development and emphasizes the importance of protecting nature in economic growth and development. It can be expressed as an environmentalist perspective brought to the understanding of development in the 21st century, taking into account the negative environmental and ecological impacts of economic activities. On February 6, 2023, a 7.7 magnitude earthquake in Pazarcık district of Kahramanmaraş and a 7.6 magnitude earthquake in Ekinözü district on the same date caused damage in an area of approximately 350,000 km². Approximately 14 million people, 16% of Turkey's population, were directly affected. According to official data as of April 2023, more than 50,000 people have died and more than 107,000 people have been injured as a result of this event. It is thought that the way the earthquake occurred and its devastating impact necessitates a multidisciplinary perspective and numerous scientific researches. The aim of this study is to create a perspective on the preliminary assessment of the event from a green economy perspective. 11 provinces were directly affected by the earthquake. Out of approximately 387,000 buildings, 51,000 have been identified by the relevant ministry as collapsed or in urgent need of demolition. 618 thousand people were evacuated from the region by evacuation flights. Considering other transportation routes, approximately 2 million people have left the region temporarily or permanently. Most of the people staying in the region are staying in temporary accommodation areas (tents and containers). Heating in these temporary accommodation areas is mostly coal stoves, for which CO₂ emissions need to be calculated based on data to be released in the near future. According to 2021 GDP calculations using the incomes method, the region contributes 15% to Turkey's agriculture, forestry and fisheries income. The share of the region's agricultural products in exports is approximately 4.8 billion dollars for the same year. Considering the increasing CO₂ emissions in the region, the harmful chemicals released into nature from the buildings that have been and will be demolished, and the potential damage to the region's agricultural lands, the danger that the region faces from a green economy perspective is considered to be quite great. The situation facing the region is not only national but also global. It is thought that possible risks should be evaluated from a holistic perspective and necessary measures should be taken.

Keywords: Kahramanmaraş, Earthquake, Green Economy, Agriculture

GİRİŞ

İktisadın bilim haline gelişinin temelini hazırlayan Adam Smith'in Ulusların Zenginliği eserinden bu zamana, sermaye daha çok kazanma, emek daha insani koşullarda çalışarak geçimlik ücretten daha fazlasını hak edebilme gayesini sürdürmüştür. Ancak iktisat yazınında sıkça vurgulanan, dört üretim faktöründen emek ve sermaye faktörleri bu derece öne çıkarken, doğal kaynak faktörünün göz ardı edilmiş olması yahut yeterince dikkate alınmamış olması günümüzde, gelecek yıllara ilişkin yoğun ekolojik kaygılara sahip olmamıza neden olmuştur.

Yeşil ekonomi kavramı bu noktada ortaya çıkmış olup ekonomilerin büyüme gayelerinin yanına, sürdürülebilir büyüme gayesini eklemiştir. Zira ekonomik zenginliklerden de doğal zenginliklerden de yararlanmak sadece bugünkü neslin değil aynı zamanda gelecek nesillerin de en doğal hakkı olacaktır.

Bu çalışmada, 6 Şubat 2023 tarihinde Türkiye'de yaşanan ve aynı anda oldukça büyük bir coğrafyayı etkileyerek tarihi bir doğal afete dönüşen Kahramanmaraş merkezli depremlerin, erken görünüm sonuçlarından yola çıkarak, bölgenin yeniden inşasında yeşil ekonomi perspektifine ilişkin bir bakış açısı sunulacaktır.

Bu amaçla öncelikle yeşil ekonomi kavramsal çerçevede incelenecek, ardından genel kabul görmüş yeşil ekonomi prensipleri ve endeksinden bahsedilecek, Kahramanmaraş merkezli depremlerin demografik, ekonomik ve ekolojik sonuçlarına yer verilerek bu sonuçların telafisi sürecinde yeşil ekonomi perspektifinden nasıl politikalar geliştirilebilir konusunda öneriler sıralanacaktır.

KAVRAMSAL ÇERÇEVE

Yeşil Ekonomi Kavramı ve Tarihi

Çalışmanın bu kısmında yeşil ekonomi kavramının ifade ettiği anlam ve kısa tarihçesi incelenecektir. Ekonomi kavramının anlamına ilişkin kullanılan en yaygın tanım olan “kıt kaynaklar ile sonsuz ihtiyaçların giderilmesi” ifadesi esasen özünde yeşil ekonomi kavramının manasını da barındırmaktadır. Yeşil ekonomi, kaynakların kıtlığının göz önüne alınarak sürdürülebilir kaynak kullanımını ile ekonomide kalkınmaya ulaşılmasını ifade etmektedir (Kuşat, 2013: 4897). Sürdürülebilirliği, bir başka ifade ile mevcut tüm kaynakların mümkün olduğunca korunarak geleceğe aktarılmasını ve bu aktarımda aynı zamanda kalkınmayı odağına alan yeşil ekonomi, sıklıkla ekolojik denge, üretimin pozitif dışsallığı, küresel dejenerasyon ve aşırı kaynak kullanımı ifadelerinden yararlanır. Ekonomik kalkınmayı doğa odaklı bir yaklaşım ile ele alan bu kavram için, sanayileşmeden bu yana yalnızca üretimi ve büyümeyi hedefleyen

görüşlerden ayrılarak, ekonomik kalkınmada ekolojik bir soluk ifadesini kullanmak yanlış olmayacaktır.

Yeşil düşünce, farklı bir ifade ile doğayı merkezine alan düşünce temeline dayanan yeşil ekonomi kavramının ortaya çıkışını hazırlayan olaylar dizisini kronolojik olarak; 1972 yılı Roma Kulübü “Büyümenin Sınırları” raporu, 1987 yılı World Commission on Environment and Development (Dünya Çevre ve Kalkınma Komisyonu) tarafından hazırlanan Brundtland Report (Ortak Geleceğimiz Raporu), 1992 yılı Rio Dünya Çevre ve Kalkınma Konferansı’nda katılımcı ülkelerce imzalanan “Gündem 21” isimli anlaşma, 2012 yılı Rio+20 Zirvesi “İstedığımız Gelecek” raporları olarak sıralamak mümkündür (Özçağ ve Hotunluoğlu, 2015: 307 ; Kuşat, 2013: 4899). Yeşil ekonomi kavramının evraksal kronolojik sıralamasının yanında, kavramın ortaya çıkışını hazırlayan olaylar dizisini ise, azalan doğal kaynaklar, nesli tükenen canlılar, kirlenen temiz su kaynakları, çoğalan doğal afetler, artan gelir dağılımı adaletsizliği, derinleşen bölgesel yoksulluk gibi negatif sosyo-ekonomik sonuçlar olarak ifade etmek mümkündür (Kılıç, 2012: 202). Kavram, salt bir söylem olmaktan öte durumdadır. Ülkelerin, “yenilenebilir enerji, düşük karbonlu ulaşım, enerji verimli binalar, gelişmiş atık yönetimi, iyileştirilmiş tatlı su temini, sürdürülebilir tarım, ormancılık ve balıkçılık” sektörlerine yoğunlaşmasını ve sermaye gelişimini bu sektörler üzerinden elde edilmesini vurgulamaktadır (Ağcakaya ve Kaya: 2022: 514).

Yeşil Ekonomi Prensipleri

Rio+20 zirvesi ile, daha önce kavramsallaştırılan ancak içerik tanımlaması daha yüzeysel kalan yeşil ekonomi kavramı, somut temellere oturtulmuştur. Bu prensipler 12 tane olup şu şekilde sıralanmaktadır;

Adil refah dağılımı,

Ekonomik eşitlik ve adalet,

Nesiller arası eşitlik,

İhtiyati (tedbir) yaklaşımı,

Gelişim hakkı,

Dışsallıkların içselleştirilmesi,

Uluslararası işbirliği,

Uluslararası sorumluluk,

Bilgi, katılım ve hesap verebilir sorumluluk,

Sürdürülebilir tüketim ve üretim,

Sürdürülebilir kalkınma, yeşil ekonomi ve yoksulluğun azaltılması için stratejik, koordineli ve entegre planlama,

Geçiş süreci (Stakeholder Forum, 2012).

Sıralanan prensipler, konunun uluslar üstü bağlamda, hem bugünü hem de geleceği dikkate alarak sosyo-ekonomik düzlemde ele alındığını göstermektedir. Elbette prensiplerin ilan edilmiş olması, tümünün eş zamanlı ve eksiksiz uygulandığı anlamını taşımaktan uzaktır. Bu noktada sorumluluğun politika yapıcılarda, uygulayıcılarda ve geleceğin arzın devamlılığında mı yoksa ekolojik sistemin devamlılığında mı mevcut olduğu ayrımını yapabilen bireylerde olduğu da açıktır.

LİTERATÜR ARAŞTIRMASI

Literatür araştırması önce yeşil ekonomi ardından Kahramanmaraş merkezli depremler olarak iki bölümde ele alınmıştır.

Yeşil Ekonomi Kavramı Literatür Araştırması

Yeşil ekonomi kavramını odağına alan çalışmaların her geçen yıl arttığı görülmektedir. Konu hakkında öne çıkan bazı çalışmalara, önce uluslararası ardından ulusal bazda, aşağıdaki tabloda yer vermeye çalışılmıştır.

Tablo 1. Yeşil Ekonomi Literatür Taraması

Yazar, Yıl	Araştırma Konusu
Tienhara, K. (2014).	Yeşil ekonomiye, yeşil kapitalizm rolü atfindan yola çıkarak, ekolojik modernleşmeyi irdelemektedir.
Teixeira, vd. (2015).	Amerika ve Çin ekonomilerini dikkate alarak “kişi başına düşen karbondioksit salınımı, içme suyuna erişim ve halk sağlığı, insani gelişmişlik endeksi ve yenilenebilir enerjinin toplam enerji tüketimindeki oranı” değişkenlerinden yeşil ekonomi endeksi oluşturmuşlardır.
Nahman, vd. (2016).	Yeşil ekonomi endeksi oluşturma gayesi ile 196 ülkeyi kapsayan bir araştırma hazırlamışlardır.
Vilasboas ve Teixeira (2017)	Brezilya'nın yeşil ekonomi endeksini oluşturma üzerine çalışmışlardır.
Schlör, vd. (2017).	Almanya için hazırlanan çalışmada su, enerji ve gıda sektörleri aracılığıyla yeşil endeks araştırması yapılmıştır.
Kararach, vd. (2018).	Afrika ülkelerini baz aldıkları çalışmada alt kategorili ve çok değişkenli bir yeşil büyüme endeksi oluşturmuşlardır.
M. Battaglia, E. Cerrini, N. Annesi, (2018)	“Yeşil ekonomi” ve “yeşil işler” arasındaki ilişkiye odaklanan çalışmada yeşil işler ve yeni yeşil iş modelleri ile endüstriyel dönüşüm arasındaki bağlantı araştırılmıştır.
D'Amato, D. ve Korhonen, J. (2021)	Sürdürülebilir kalkınmada yalnızca yeşil ekonomiyi değil, aynı zamanda döngüsel ekonomiyi ve biyo-ekonomiyi birbirine entegre ederek, kavramların içerik eksikliklerinin birbirilerini tamamlayacağı görüşünü öne sürmektedir.
Hao, X., vd. (2023)	Yeşil ekonomi kavramını güncel gelişmelerin gerisinde bırakmayarak, dijitalleşmenin kavrama etkilerine çalışmalarında yer vermişlerdir.
Kaypak, Ş. (2011).	Çalışmasında yeşil ekonomi kavramına giden yolda, sürdürülebilir bir çevre için çözüm arayışı gayesini vurgulamaktadır.
Kılıç, S., (2012).	Kalkınmanın sürdürülebilirliğinde ekolojik değişkenleri vurgulayan çalışması ile ulusal literatüre kavramsal anlamda önemli katkılar vermiştir.
Kuşat, N. (2013)	Yeşil ekonominin Türkiye için avantaj ve dezavantajları çalışmada değerlendirilmiştir.
Pekizoğlu, F. (2016).	Yeşil ekonominin tüm tabanlara yayılması için “yeşil pazarlama sistematığı, yeşil tüketici, yeşil üretim ve bu ikisini birbirine tanıttacak bir yeşil etiket” uygulamasının Türkiye’de ihtiyacını ortaya koymaktadır.
Demirtaş, I. (2017).	Çalışmada “yeşil ekonomi politikalarının durgunluk ve iklim değişikliği gibi çevresel ve ekonomik sorunları çözmedeki rolü” incelenmektedir.
Bilgili, M. Y. (2017).	Ekonominin yanında ekolojik ve sosyal boyutlarıyla sürdürülebilir kalkınmanın ifade ettiği anlamları incelemiştir.
Al, İ. (2019).	Türkiye için yeşil ekonomi endekslerini incelediği çalışmasında, “çevresel performansta son yıllarda olumlu gelişmeler olmakla birlikte, çevresel göstergelerin yeşil ekonomi performansına katkısı nispeten sınırlı” olduğu görüşünü vurgulamıştır.
Acci, Y. , Akarsu, G. & Cefri, R. (2023).	Yeşil büyüme ve ekonomik büyüme ilişkisini AB ülkelerini baz alarak ampirik bir analiz ile değerlendirmişlerdir.

Kahramanmaraş Merkezli Depremler Literatür Araştırması

Tablo 2’de ise Kahramanmaraş merkezli depremlerin çoğunlukla ekonomik etkilerine ve hatta tespiti daha hızlı olabilen finansal etkilerine odaklanan ulusal çalışmalara yer verilmiştir. Bu çalışma hazırlanırken, depremin üzerinden henüz yaklaşık iki buçuk ay geçmiş olmasına karşın, ulusal literatürde konu hakkındaki çalışmaların sayısında hızlı artış ivmesi dikkat çekicidir. Zira literatürde sadece ekonomi bakış açısıyla değil, başta mühendislik alt dallarından tıp bilimine, eğitimden sosyolojiye çok sayıda alanda konu hakkındaki çalışmaların hızla yayımlanışı

dikkate değerdir. Buna karşın henüz uluslararası yazında konu hakkında çalışmanın olmayışı da tespit edilmiştir.

Tablo 2. Kahramanmaraş Merkezli Depremler-Ekonomik Etkileri Literatür Taraması

Yazar, Yıl	Araştırma Konusu
Say, S. ve Doğan, M. (2023)	Depremin hisse senedi piyasasına etkisini inceledikleri ampirik çalışmalarında “analiz sonucunda olay günü [0] ve olay sonrası birinci [+1] ve ikinci [+2] gün ortalama anormal getiri elde edildiği” sonucuna ulaşmışlardır.
Gürsoy, S., vd. (2023)	Depremin finansal piyasalar üzerindeki etkilerinin incelendiği çalışmada “BIST Gıda, İçecek, BIST GMYO, BIST Madencilik, BIST Bankalar, BIST Aracı Kurumlar, BIST Enf. Teknoloji, BIST KOBİ Sanayi, BIST Tekstil, Deri” incelenmiş ve depremin sektör etkilerinin farklı oluşuna dikkat çekilmiştir.
Ozbilgin, M., vd. (2023)	Depremin sosyal etkilerini dikkate aldıkları çalışmada, “delil temelli, etik ve kapsayıcı afet yönetimine yönelik sosyal politikaların oluşumuna yardım edecek bir analiz” ortaya çıkardıklarını ifade etmişlerdir.
Kanat, E., & Tetik, N., (2023)	Borsa İstanbul’un deprem sürecinde kapanması ve ilgili dönemdeki işlem hacimlerini incelemişlerdir.
Tetik, N. ve Öner, A. (2023)	Depremin bölgedeki KOBİ’lere olası ekonomik ve finansal etkilerini incelemiş, covid döneminde alınan önlemleri baz alarak KOBİ’lerin devamlılığı için politika önerilerini sıralamışlardır.
Tetik, N. ve Akbulut, İ. İ. (2023)	İhracat üzerine deprem etkilerini araştırmış, ihracat yapan firmalara yönelik uygulanabilecek spesifik politika önerilerini vurgulamışlardır.
Koç, A. (2023)	Sosyo-ekonomik açıdan ele aldığı deprem olayının ardından kısa, orta ve uzun vadede alınacak kararlarına ilişkin önerilerini belirtmiştir.
Doker, A. C. ve Yiğit, A. G. (2023)	Sürdürülebilir kalkınma için deprem bölgesinin alt yapısından yeniden refahın inşasına çeşitli alt başlıklarda politika önerilerinde bulunmuşlardır.
Yiğit, M. (2023)	Davranışsal iktisat perspektifinden depremi değerlendirdiği çalışmasında, davranışsal iktisadın argümanlarını kullanarak politika önerilerini ortaya koymaktadır.
Gül, K. & Akyol, H. (2023).	Kırsal kalkınmaya depremin etkisini inceledikleri çalışmalarında afetlerin ulusal ve kırsal kalkınmadaki rolünün göz ardı edilmeyecek derecede önemli olduğunu vurgulamışlardır.
Özüdoğru Aydın, B., (2023)	Depremi geniş bir bakış açısıyla ele almış, ekonomi biliminin enflasyondan kamu maliyesine çok sayıda alt başlığını dikkate alarak konuya ilişkin değerlendirmelerini sunmuştur.
Şen, S. (2023)	Çalışmasında depremin ekonomiye etkisini makro göstergeler dahilinde değerlendirmiştir.

TÜRKİYE’NİN YEŞİL EKONOMİDE MEVCUT DURUMU

Yeşil ekonomi, salt ekonomik büyüme elde etmeyi değil aynı zamanda çevresel sürdürülebilirliği tahsis edebilme olgusunu ortaya çıkarmaktadır (Yıldız, 2021:2). Bunu tahsis ederken yeşil ekonomi ilkelerinin uygulanma düzeyleri global bazda ülkelere bir yeşil ekonomi karnesi sahibi olma imkanı sağlamaktadır. Dual Citizen isimli kurum tarafından oluşturulan “Global Green Economy Index (GGEI)” (küresel yeşil ekonomi endeksi) küresel ölçekte kabul görmüş bir yeşil ekonomi puanlaması sunmaktadır. “160 ülkenin yeşil ekonomi performansını 18 gösterge üzerinden” ölçen endeks ülkeleri hem 2005’ten günümüze ilerleme performansları hem de küresel anlamda sürdürülebilirlik hedefine ulaşmak için katetmeleri gereken yol ölçeğinde değerlendirmektedir (Dual Citizen, 2023a).

2022 yılında 2005-2020 yılları arasını kapsayacak sonuçlar yayınlanmış olup yayınlanan sonuçlara ilişkin özet Tablo 3’de yer almaktadır.

Tablo 3. Küresel Yeşil Ekonomi Endeks Sonuçları (2005-2020)

Ülke Bazlı İlerleme			Küresel Hedefe Mesafe			Toplam (Genel Değerlendirme Sonucu)		
Ülke	Puan	Sıralama	Ülke	Puan	Sıralama	Ülke	Puan	Sıralama
Ürdün	0,780	1	İsveç	0,888	1	İsveç	0,799	1
Uruguay	0,698	2	Norveç	0,863	2	İsviçre	0,781	2
İsrail	0,686	3	Danimarka	0,829	3	Norveç	0,747	3
Cibuti	0,684	4	İsviçre	0,825	4	Fransa	0,744	4
İrlanda	0,675	5	Fransa	0,792	5	Danimarka	0,742	5
Türkiye	0,426	130	Türkiye	0,391	136	Türkiye	0,399	140
Güney Afrika	0,345	157	Endonezya	0,291	157	Trinidad ve Tobago	0,334	157
Trinidad ve Tobago	0,310	158	Suudi Arabistan	0,271	158	Türkmenistan	0,318	158
Tacikistan	0,303	159	Türkmenistan	0,264	159	Suudi Arabistan	0,314	159
Mozambik	0,234	160	Umman	0,223	160	Umman	0,262	160

Kaynak: Dual Citizen, 2023b.

Puanlama (yüzdeler hesaplaması) 0 ile 1 arası olup ideal olan tüm ülkelerin 1 tam puana ulaşmasıdır. Tablo 3’te yer alan ilk kısım ülkelerin bir önceki dönemlere göre yeşil ekonomi prensipleri üzerinden ilerleme durumlarını ifade etmektedir. 160 ülke arasında mevcut durumundan daha iyi koşullara erişme bazında Ürdün birinci, Uruguay ikinci, İsrail ise üçüncü

sırada yer alırken Türkiye 130.sırada yer almaktadır. Bir başka ifade ile bir önceki rapor dönemi ile yayınlanan son rapor arasındaki süreçte Türkiye ilerleme bazında 0,426 puan almıştır.

Tablo 3'ün ikinci kısmında küresel hedefe ulaşma bazında bir sıralama yapılmış olup, global ölçekte ilk sırada İsveç, ardından Norveç ve Danimarka yer alarak küresel hedefe en yakın ülkeleri oluşturmuşlardır. Küresel hedefe uzaklıkta Türkiye 136.sırada yer alırken, küresel yeşil ekonomi hedefine en uzak ülkeler Arabistan, Türkmenistan ve Umman olarak görülmektedir.

Tablonun son kısmında ise hem ilerleme hem de küresel hedefe mesafe bazında yapılan değerlendirmelerin genel toplamını ifade eden bir sıralama verilmiş olup, İsveç, İsviçre ve Norveç dünyanın yeşil ekonomi puanı en yüksek ülkeleri olarak görülmektedir. Türkiye burada ise 140.sırada yer alırken liste sonunu 158.sırada Türkmenistan, 159.sırada Arabistan ve 160.sırada Umman oluşturmaktadır.

İlgili raporda burada tabloda yer verilen sıralamaların dışında Türkiye'nin OECD ülkeleri arasında 38. (son) sırasında yer aldığı, G20 ülkeleri arasında 15.sırada yer aldığı, 14 MENA ülkesi arasında ise 7.sırada olduğu görülmektedir (Dual Citizen, 2023b).

Bu rapor küresel bir prestijden çok daha öte, Türkiye'nin hem insani, hem ekolojik hem ekonomik olarak gelecek nesillerinin karşı karşıya kalacağı olası sorunların bir ön raporu olarak değerlendirilmelidir. Elde edilen rapor sonuçları, Türkiye'ye gelecek için bugünden alınması gereken ekolojik önlemlerin elzemliğini ifade eder niteliktedir.

KAHRAMANMARAŞ MERKEZLİ DEPREMLER VE ETKİLERİ

Tarih boyunca yer kabuğu çeşitli ölçeklerde depremler yaşamıştır. Yer kabuğu sarsıntısı olarak tanımlanan deprem, doğal afet statüsünde tanımlanan, büyüklük ve şiddetine göre yıkıcı etkiye sahip olabilen doğal bir olaydır (TDK, 2023).

Resmi verilere göre, 06.02.2023 tarihinde "Türkiye saati ile 04:17'de ve 13:24'te merkez üssü Kahramanmaraş'ın Pazarcık ve Elbistan ilçeleri olan Mw7.7 (odak derinlik=8,6km) ve Mw7.6 (odak derinlik=7km) büyüklüklerinde iki deprem meydana gelmiştir" (SBB, 2023).

Kahramanmaraş Merkezli Depremlerin Demografik Etki Alanı

Depremden etkilenen iller, resmi açıklamalara göre alfabetik olarak, Adana, Adıyaman, Diyarbakır, Elazığ, Gaziantep, Hatay, Malatya, Kahramanmaraş, Şanlıurfa, Kilis ve Osmaniye'dir. Esasen depremin etkisi ülke sınırlarını da aşmış, Türkiye'nin sınır komşusu Suriye'de de yıkıcı bir etki bırakmıştır.

Türkiye’de depremde etkilenen illerin toplam nüfusu, yaklaşık 14milyon olup bu sayı ülke nüfusunun %16,4’üne tekabül etmektedir. Eklemek gerekir ki bölgede buna ek olarak 1.7milyon “geçici koruma kapsamında ikamet eden göçmen” yaşamakta, bu Türkiye’de kayıtlı yabancıların %36,48’sine denk gelmekte olup toplamda yaklaşık 15.7milyon insan depremde doğrudan etkilenmiş durumdadır (Sağiroğlu, vd., 2023: 3).

Bu çalışma hazırlanırken bölgede deprem nedeniyle vefat edenlerin sayısının 50binden fazla olduğu, yaralananların sayısının ise 107bini geçtiği açıklanmıştır.

Bölgenin Türkiye geneli istihdam oranı içerisindeki payı %13,3 olup depremde önce ilgili illerde toplam 3.8milyon kişi kayıtlı istihdam nüfusu içerisinde yer almaktaydı (SBB, 2023).

Bölgede yaşam çoğunlukla çadır ve konteynır gibi geçici konaklama merkezlerinde sürmektedir. Yine bu çalışma hazırlanırken Nisan 2023 itibariyle açıklanan son bilgilere göre, “deprem bölgesinde 345 çadırkent ve 305 konteyner kent” kurulmuş olup “2.6 milyon kişinin çadır kentlerde, 79 bine yakın kişinin ise konteyner kentlerde yaşadığı” açıklanmıştır (OCHA, 2023).

Kahramanmaraş Merkezli Depremlerin Ekonomik Etki Alanı

Literatürde afetlerin ekonomik etkileri kısa, orta ve uzun olmak üzere üç grupta incelenmektedir. Kısa vadeli ekonomik etkiler, yaşanan can ve mal kayıpları ile, ilk aşamada yapılan sağlık, ulaşım, alt yapı ve iletişim harcamalarını, orta vadeli etkiler deprem bölgesindeki iş gücü ve kira gibi muhtelif gelir kayıplarını, uzun vadeli etkiler ise dış ticaret, enflasyon, kur gibi değişkenleri kapsamaktadır (Karancı, vd., 2011: 36 & Şahin ve Kılınç, 2016: 34).

Afetlerin ekonomik etkilerine ilişkin bir diğer sınıflandırma, birincil etki, ikincil etki ve üçüncü etki şeklindedir. Birincil etki depremin (afetin) hemen ardından “kamu malvarlığı, ürün stoğu, sermaye stoğu, alt yapı ve nüfus üzerindeki ekonomik etki” başta olmak üzere her türlü kamu hizmetinin olumsuz etkilenmesinin yanında sanayi sektöründe ilk etapta meydana gelen kayıplar ile konutlarda meydana gelen hasarları içermektedir (Altun, 2018: 11). İkincil etkiler, depremin üzerinden ortalama bir süre geçmesinin ardından makro ekonomik değişkenler üzerinde meydana gelen olumsuz etkiler ile sosyal ve psikolojik yıkıma uğrayanları içeren etki grubudur (Altun, 2018: 13).

Bu kısım ve devamında Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı (SBB) tarafından Mart 2023'te "SBB Deprem Sonrası Değerlendirme Raporu" ismiyle yayınlanan ve bu süreçteki en detaylı sayısal verileri içerdiği düşünülen rapordan yararlanılacaktır. Bölge ekonomisinin gidişatına yön verecek birincil etken, bir başka ifade ile kısa vadede ilk harcama yapılması gerekli alan konut sektörüdür. İlgili rapora göre;

"Bölgedeki toplam bina sayısı yaklaşık 2,6 milyondur. Söz konusu bina stokunun yaklaşık yüzde 90'ını mesken, yüzde 6'sını işyerleri ve yüzde 3'ünü kamu binaları oluşturmaktadır. Depremden etkilenen 11 ildeki konut sayısı 2022 yılı itibarıyla 5,6 milyon düzeyinde olup Türkiye genelindeki toplam konut stoku içindeki payı yüzde 14,05 düzeyindedir."

Türkiye Cumhuriyeti Çevre ve Şehircilik Bakanlığı'nın Mart 2023'te yaptığı açıklamaya göre, bahsi geçen 2.6milyon binadan 1.7milyonuna hasar tespit çalışması yapılmıştır. Bunlardan yaklaşık 860bin bina hasarsız raporu almıştır. Yine yaklaşık olarak 431bin bina az hasarlı, 40bin bina orta, 180bin bina ağır hasarlı, 35bin bina yıkık, 17bin bina acil yıkılacak olarak tespit edilmiştir (ÇŞİDB, 2023). İlgili bakanlığın orta hasarlı binaların da yıkılacağını açıklamasının ardından deprem bölgesinde kullanılamayacak durumda olan toplam bina sayısının yaklaşık 272bin olduğu görülmektedir. Aynı açıklamada 272bin binanın yaklaşık 818bin bağımsız bölüme (daireye/bireysel konuta) tekabül ettiği belirtilmektedir. Vurgulamak gerekir ki bu sayılar, ilgili tarihte henüz durum tespiti yapılamamış olan yaklaşık 900bin binayı (297bin bağımsız bölümü) içermemektedir.

İnşaat Mühendisleri Odası (İMO) ve ÇŞİDB ortak çalışmasıyla her yıl resmi gazetede yayımlanarak ilan edilen inşaatlarda minimum metrekare maliyeti tarifesine göre, 2023 yılında apartman tipi konutlarda (IV.Sınıf-A Grubu ve yapı yüksekliği 30,5m'den az) metrekare maliyeti 6.825TL olarak ilan edilmiştir (İMO, 2023). Yeniden inşası gerekli olan 818bin bağımsız bölümün her birinin ortalama 100metrekare yapılacağı varsayılırsa, toplam maliyetin yaklaşık 558.3milyar TL olacağı anlamını taşımaktadır. Bu tutar Türkiye'nin 2022 GSYİH'nın yaklaşık %3,72'sine eş değerdir. Yeniden vurgulamak gerekir ki bu maliyete az hasarlı binaların onarım maliyetleri ile henüz tespiti yapılamamış binaların olası yeniden inşa veya onarım maliyetleri dahil değildir. Bu nedenle, bölgenin yeniden inşası için ortaya çıkacak maliyetin 2022 GSYİH'sının %3,72'sinden daha fazla olacağı düşünülmektedir.

Bu hesaplamanın yanında SBB'nin deprem raporu dahilinde yaptığı maliyet çalışmasına da yer vermekte fayda olduğu düşünülmektedir. Tablo 4'te ilgili maliyet kalemleri yer almaktadır.

Tablo 4. Deprem Bina Hasar Maliyetleri

Hasar	Milyar TL	Milyar Dolar
Kullanılamaz Hale Gelen Konutları Yeniden İnşa Maliyeti	1.032	54,7
Kullanılamaz Hale Gelen Ahırları Yeniden İnşa Maliyeti1	3	0,2
Kullanılamaz Hale Gelen Ticarethaneleri Yeniden İnşa Maliyeti	39	2
Az Hasarlı Konutlar için Onarım Yardım	12,8	0,7
Kullanılamaz Hale Gelen Konutlardaki Eşya Maliyeti	58,5	3,1
Toplam Hasar	1.145,3	60,7
Enkaz Kaldırma ve Temizleme Maliyeti	29,8	1,6
Ağır Hasarlı, Acil Yıkılacak, Yıkık, Orta Hasarlı Konutlar için	6,5	0,3
Hane Halklarına Ödeme	25	1,3
Geçici Barınma	40,5	2,1
Konaklama ve İaşe	40,5	2,1
Genel Toplam	1.247,1	66

Kaynak: SBB, 2023.

Az hasarlı konutlar için tabloda yer alan maliyet hane başına verilen 10binTL'yi ifade etmekte olup enkaz kaldırma maliyeti ise yalnızca konut statüsündeki yapıların enkaz kaldırma maliyetlerini içermektedir. Tablodaki veriler dikkate alındığında 1.247,1 milyar TL'nin 2022 GSYİH'nın yaklaşık %8,3'üne tekabül etmektedir. 350bin kilometrekarelik bir alanın yeniden inşasının söz konusu olduğu bu doğal afet sonucunda, ekonomik kayıp da göz önüne alınırsa, ekolojik kaygılara düşmemek olanaksız görünmektedir.

Bölgede alt yapının aldığı zararlar sonucu oluşan tahmini maliyetler ise SBB'nin ilgili raporundan doğrudan alıntılanmış olup Tablo 5'te yer almaktadır.

Tablo 5. Bölgenin Tahmini Alt Yapı Onarım Maliyetleri

Alt Kalem	Birim	Miktar	Maliyet* (TL)	Veri Kaynağı
İçme Suyu İsale Hattı	km	169	1.595.000.000	DSİ
İçme Suyu Arıtma Tesisi	m ³ /gün	135.000	25.000.000	DSİ
Su Deposu	m ³	10.000	50.000.000	DSİ
İçme Suyu İshale Hattı	Km	185	2.118.000.000	DSİ
İçme Suyu Arıtma Tesisi	Adet	2	1.765.000.000	İlbank
Su Deposu	Adet	23	112.900.000	İlbank
İçme Suyu Şebekesi	Km	488	1.405.000.000	İlbank
Kanalizasyon Şebekesi	Km	1.842	6.262.000.000	İlbank
Atıksu Arıtma Tesisi	Adet	7	1.595.000.000	İlbank
Pompa İstasyonu	Adet	5	51.000.000	İlbank
İçme Suyu Şebekesi	Km	241	29.000.000	İl Özel İdaresi
Kaptaj Yapımı	Adet	5	800.000	İl Özel İdaresi
Su Deposu	Adet	22	71.000.000	İl Özel İdaresi
Toplam			15.080.700.000TL	

Kaynak: SBB, 2023.

Tablo 5, bölgenin içme suyu, atık su, kanalizasyon şebekesi gibi temel ve insani alt yapı hizmet ihtiyaçlarının aldığı zararı ortaya koymaktadır. “İçme suyu ve kanalizasyon altyapısını sağlayan tesisler çoğunlukla yerin altında gömülü olduğundan bu yapılarda hasar tespitinin yapılması oldukça zor” olup hasarlar yalnızca ilgili veri kaynağı kurum tarafından ihbar edilen durumların toplamını oluşturmakta ve 2022 ihale tutarları ile maliyetlendirilmiştir (SBB, 2023: 63). Bu hali ile alt yapının yeniden onarım maliyeti 15.1milyar TL olarak görülmektedir.

Bunlara ek olarak,

Şehir içi yol ve kaldırım niteliğindeki ulaşım altyapısının 1.188km’inde hasar olduğu ve yeniden yapım maliyetinin 3.350.628.582TL olduğu,

Belediye hizmet binaları ile araçlarının aldığı çeşitli hasar düzeyleri sonucu toplamda yaklaşık 75.335.000TL,

Belediye sosyal tesislerinin çeşitli hasar düzeylerine göre yeniden onarım maliyetlerinin yaklaşık 1.244.706.695TL,

Belediyelerin kent mobilyaları, istinat duvarları, köy yolu, bağlantı ve grup yolu hasar maliyetinin yaklaşık 179.319.070TL,

Belediye sınırlarındaki altyapı ve üretim tesislerinin onarım maliyetinin yaklaşık 303.919.024TL

Demiryollarında meydana gelen hasarların tahmini maliyetinin 17,4milyar TL, demiryolu araçlarında 19,6milyon TL, bölgede depremden önce inşası başlayan ancak depremle orta düzeyde hasar alan yüksek hızlı tren hattının ise 260milyonTL onarım maliyeti olduğu, böylece toplamda demiryolu hasarlarının yaklaşık 17.679.600.000TL,

Bölgede yer alan Kahramanmaraş, Adıyaman, Malatya ve Hatay havalimanlarında yaklaşık 3.300.000.000TL,

Denizyolu ulaşımına ilişkin tesislerde ise yaklaşık 38.000.000TL'lik hasar olduğu raporlanmıştır (SBB, 2023: 71-79).

Bu başlıkta sıralanan konut, alt yapı, ulaşım ve belediye sorumluluk alanlarındaki hasarların toplam maliyetinin; 1.288.352.208.371TL, bir başka ifade ile 1.29trilyon TL'dir. Bu genel toplam 2022 GSYİH'nin %8,59'üne tekabül etmektedir.

Bu çalışmanın kapsamı gereği yer verilemeyen ancak depremin ekonomik etki alanı içerisinde yer alan bölgedeki gıda ve sağlık hizmetleri ihtiyacı sonucu ortaya çıkan maliyetler hesaplamalara dahil edilmemiştir.

Kahramanmaraş Merkezli Depremlerin Ekolojik Etki Alanı

Bölgenin tarım, hayvancılık ve ormancılık sektöründeki son durumu bu başlık altında değerlendirilecektir. 2021 GSYİH hesaplamalarından gelirler yöntemine göre bölge Türkiye'nin tarım, orman ve balıkçılık gelirine yaklaşık %15,3 oranında katkı sağlamaktadır (TÜİK, 2022). Bölgenin tarım ürünlerinin ihracattaki payı ise aynı yıl için yaklaşık 4,8milyar dolardır (TİM, 2023).

Deprem bölgesi Türkiye'nin orman varlığının yaklaşık %11'ini, ağaç servetinin %6'sını ve ağaç büyüme oranı olan yıllık artımın %7'sine, ayrıca su ürünleri üretiminin yaklaşık %12'sine sahiptir (TOB, 2023).

Deprem nedeniyle bölgede;

8.241 büyükbaş, 64.260 küçükbaş, 42.000 baş kanatlı hayvanın öldüğü, 701.000 civcivin telef olduğu, 5.756 arı kovanının zarar gördüğü ve bunların toplam maliyetinin yaklaşık; 611.100.000TL,

Bölgedeki tahıl ürün depolarında meydana gelen zararların tahmini 81.600.000TL,

Tarım İşletmeleri Genel Müdürlüğü'ne bağlı tarım işletmelerinde ortalama 134.100.000TL hasar,

Bölgedeki özel sektör su ürünleri yetiştiriciliği işletmelerinde 101 ton balık ve 37.4 milyon yavru balığın öldüğü, bunların maliyetinin 63.200.000TL olduğu,

Gıda laboratuvar ve tesislerinde 51.300.000TL maliyetli hasar olduğu,

Orman Genel Müdürlüğü'ne bağlı alanlarda hasarların 3.000.000.000TL,

Devlet Su İşleri tesislerinde 19.500.000.000TL, baraj ve gölet havzalarındaki hasarın ise yaklaşık 2.700.000.000TL olduğu tespit olunmuştur (SBB, 2023: 100-123).

Tarım, hayvancılık, ormancılık ve balıkçılığın aldığı tahmini zararın şimdilik maliyeti 26.141.300.000TL olarak görülmektedir. Elbette buna, bölgeden zaruri göçler nedeniyle yapılamayacak tarım, hayvancılık, ormancılık ve balıkçılık maliyetlerini şuanda eklemek olası değildir. Ancak tutarı yakın gelecekte, muhtemelen artan gıda fiyatlarıyla ortaya çıkacak, bu maliyet kalemlerinin de göz önünde tutulması gereklidir.

Bölgede ekolojik sisteme katkıda bulunan çok sayıda alan mevcuttur. Bunlar “Nemrut Dağı Milli Parkı (Adıyaman), Gölbaşı Tabiat Parkı (Adıyaman), Kapıçam Tabiat Parkı (Kahramanmaraş), Beydağları Milli Parkı (Malatya), Belen Tabiat Parkı (Hatay) Yaban Hayvanı Üretme İstasyonu (Malatya), Kapıçam Keklik Üretme İstasyonu (Kahramanmaraş)” şeklinde sıralanabilir. Ancak bu alanlar için muhtelif hasarların olduğu bilinmekle birlikte henüz net bir hasar tespit ve maliyet çalışması yayınlanmamıştır.

Deprem bölgesinden 1 Mart 2023 tarihi itibarıyla 3.3milyon kişinin geçici veya kalıcı kararlar ayrıldığı, bu kişilerden 811bininin resmi tahliye yöntemleriyle bölgeyi terk ettiği görülmektedir (Sağiroğlu, vd., 2023: 2-6). Bu kişilerin başta Ankara, Antalya ve Mersin olmak üzere neredeyse Türkiye'deki bütün illere dağıldığı ancak dağılımın homojen olmadığı gözlemlenmektedir (Sağiroğlu, vd., 2023: 8). Bu göç hareketliliği esnasında kullanılan muhtelif ulaşım biçimlerinin atmosfere salınan gazlarda ne miktarda bir artışa neden olduğunun ilgili araştırmacılar tarafından araştırılması oldukça elzemdir.

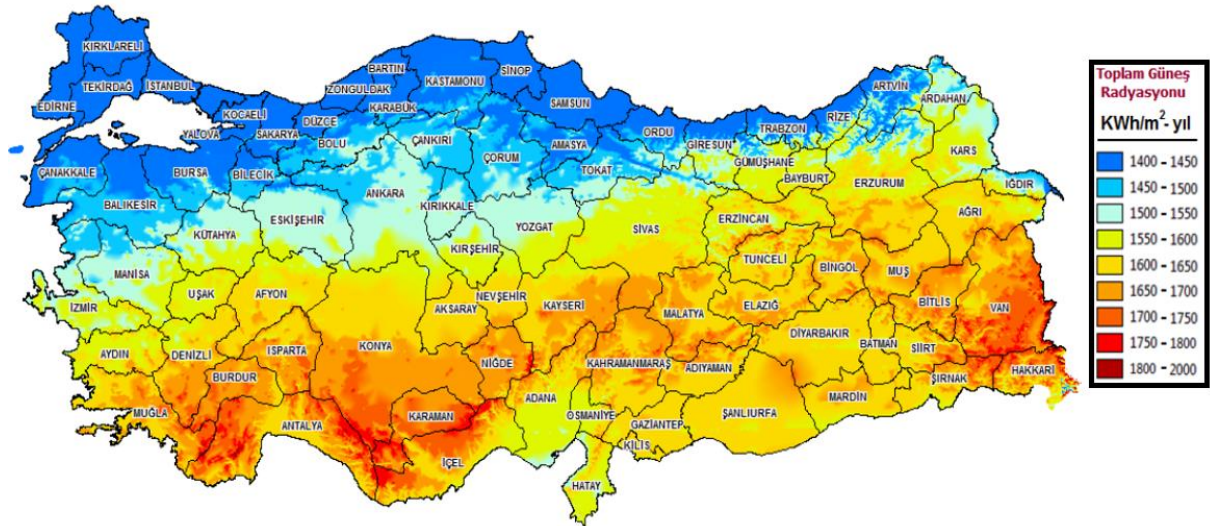
Buna ek olarak yukarıda bahsi geçen (orta hasarlı binalarla birlikte) 272bin binanın enkazından havaya karışan ve moloz dökülme alanlarından toprağa, su kaynaklarına ulaşan zehirli kimyasalların mutlak suretle kontrol altına alınması ve bu işlemlere ilişkin bilgilerin kamuoyuyla şeffaf biçimde paylaşılması gereklidir.

Deprem Etkilerine Yeşil Ekonomi Perspektifinde Politika Önerileri

Deprem yıkıcı etkisinin yalnızca insanların yaşam alanlarında değil, alt yapıdan ulaşıma, tarımdan balıkçılığa, su havzalarından kültürel yapılara çok sayıda alanda etkili olduğu, deprem sonrası erken görünüm raporları ile tespit edilmiştir.

Yeşil ekonomi özünde doğaya duyarlı olmayı öğütleyen felsefi bir yaklaşım barındırmaktadır (Ağcakaya ve Kaya, 2022: 514). Yaşanan olayın telafisi meşakkatli sonuçları ortadadır. Bu bir doğal afet krizi görünümündedir ve bu krizin mimarı ne yazık ki yeterli denetleme mekanizmasına tabi olmadan yapılaşmayı normalleştiren insanoğludur. Bu noktada, krizi bölge doğası için, bölge insanı için ve uzun vadede küresel anlamda insanlık için fırsata dönüştürmek de yine insanoğlunun elindedir. Krizin fırsata dönüşmesi, bir başka ifade ile depremin etkilerinin yeşil ekonomi perspektifinde politikalar ile çözümlenmesi olasıdır.

İlk olarak belirtmelidir ki, bölgenin iklim koşullarının hem güneş hem de rüzgar enerjisi ile enerji üretimine uygunluğu bilinmekte ancak bu alanlardan enerji elde ediminin oldukça sınırlı olduğu da görülmektedir. Şekil 1’de Türkiye Cumhuriyeti Enerji ve Tabii Kaynaklar Bakanlığı tarafından 2022 yılında hazırlanan “Türkiye Güneş Enerjisi Potansiyeli Atlası (GEPA)” yer almaktadır.



Şekil 1. Türkiye Güneş Enerjisi Potansiyeli Atlası-2022 (Kaynak: ETKB, 2023).

Harita, bölgenin yeniden inşa sürecinde güneşten enerji üretimine yönelik yapılacak yatırımların uygunluğunu ortaya koymaktadır. Eklemek gerekir ki, güneş enerjisi, enerji üretiminde zararlı atık oluşturmayan, yeşil ekonomi prensiplerini doğrudan taşıyan, kurulum ve kullanımı, görece olarak, diğer enerji üretim tesislerine göre daha kolay olan bir enerji üretim

türüdür. Bölgenin hali hazırda atık yönetiminde enkaz, asbest, pestisit gibi uzun vadeli zarar vericiler ile mücadele ettiği bir dönemde, güneş enerjisi üretiminin ve kullanımının uzun vadeli olarak yaygınlaşması, bir nebze olsa yaşanan ekolojik dejenerasyonu telafi edebilecek bir yöntem olabilir.

Ulaşım yollarının yeniden inşasında, karbon ayak izi daha düşük ulaştırma seçeneklerine öncelik verilmesi, buna yönelik imkanların artırılması ve bölge halkının konu hakkında teşvik edilmesi yerinde olacaktır. Bölgede hali hazırda yapıyı depremden önce başlayan yüksek hızlı tren hattı projesi mevcuttur. Bu proje Mersin-Adana-Gaziantep illerini kapsamaktadır (TCDD, 2023). Projenin bu aşamada yeniden değerlendirilmesi ve projede yer almayan Kahramanmaraş ilinin projeye eklenmesi, kısa vadede ise mevcut tren hattının lojistik sektöründe özendirilmesi yerinde olacaktır.

Yapılacak zemin etütleri neticesinde, bilhassa il ve ilçe merkezlerinde yer alan ve yeniden konut inşası olası olmayan alanların, bölge yapısına uygun olarak ağaçlandırılması gerek bu alanlara yeniden inşanın önlenmesi gerekse de yaşanan afet sonucunda bölgede artan zararlı gazların salınımının telafisinde etkili olabilecektir.

Yeniden inşa sürecinde çevreye duyarlı yapı malzemelerinin tercih edilmesi, bu tercihlerin devletçe desteklenmesi, yeniden yapılaşmada yeşil alanlara bilhassa önem verilmesi de oldukça elzemdir.

Bu çalışmada sıklıkla içeriğine yer verilen 142 sayfalık SBB Deprem Sonrası Değerlendirme Raporu'nda depremin ekolojik etkilerine ilişkin aşağıdaki üç madde, sürece ekolojik açıdan bakabilmek adına, oldukça önemlidir;

“Yıkılan ve yıkılması planlanan binalara ait inşaat ve yıkıntı atıklarındaki ilgili asbest, pestisitler vb. ile ilgili tehlikeli maddelere ilişkin önlemler alınmalıdır.

Atık yönetim sistemindeki tesis ya da toplama ve taşıma araçları ile ilgili aksaklıkların giderilerek işler hale getirilmesi sağlanmalıdır.

İnşaat ve yıkıntı atıklarından geri dönüştürülebilecek malzemelerle ilgili çalışmalar yapılmalıdır”(SBB, 2023: 72).

Bu gibi raporlar kamuoyu tarafından takip edilmekte, haber sitelerinde ve kanallarında veri olarak baz alınmakta ve farklı kesimlerden çok sayıda insana ulaşabilmektedir. Bu gibi raporlarda, bölgenin yeniden inşasında yeşil ekonomi perspektifinin vurgulanması, ekolojik dengeye verilen zarara ve bunları düzeltme yollarına dikkat çekilmesi yerinde olacaktır.

SONUÇ

Yeşil ekonomi, çevreye duyarlı bir büyüme modeli öngörmektedir. Sermayenin “acımasız” büyüme modellerinden uzaklaşması zor olsa da, krizi bir fırsata çevirme açısından, Kahramanmaraş merkezli depremlerin etki alanındaki illerde geleneksel ekonomik büyüme alışkanlarının kırılması, şehirlerinden yeniden inşasında topluma yeşil ekonomi bakış açısı kazandırılması olası olabilir. Elbette bu olasılığın artışı sağlayacak olan, etkin kalkınma politikalarından ileri gelecektir. Bu bağlamda çalışmada depremin demografik, ekonomik ve ekolojik etkilere, ulaşılabilen veriler ışığında, yer verilmiştir.

Doğal afetlerin ekonomik etkilerinin tasnif biçimleri göz önüne alındığında, yeşil ekonomi perspektifinde ekolojik dengede sürdürülebilirliği engelleyici etkilerin hem orta ve uzun vadede hem de ikincil etki grubunda yer alabileceği ifade edilebilir.

Alınacak politika önlemlerinin arzın devamlılığı veya güvenliği için mi yoksa doğanın sürdürülebilirliği ve güvenliği için mi alındığının ayırımına varılması oldukça önemlidir. Zira yaşanan depremler, bilhassa inşaat sektöründe, arz hızını arttırma, kar maksimizasyonunu sağlama güdüsü sonucu yaşanan bir felaketler dizisine dönüşmüş durumdayken, geleceği güvenle inşa etmenin fırsat maliyetinin dikkate değer olduğunu düşünmekteyiz.

Çalışmada depremin yıkıcı etkisinin sonuçlarını ortadan kaldırma sürecine yeşil ekonomi bağlamında bazı politika önerileri getirilmiştir. Bu öneriler, enerji, ulaşım, yeniden inşa, yeşil alanların korunması gibi temel başlıkları içermektedir. Ancak öneriler sınırlı sayıda rapor verisine dayanmaktadır. Gelecek aylarda açıklanacak yeni raporlar, bölgenin son durumunun değerlendirilmesinde ve bu alanlarda yeni çalışmalar yapılmasında önem arz edecektir.

Son olarak, yaşanan olaylar neticesinde, gelecek dönemlerde açıklanacak yeşil ekonomi endekslerinde Türkiye'nin sıralamasının negatif etkilenmesi olasıdır. Ne yazık ki Türkiye halihazırda çok da kabul edilebilir bir sırada yer alamamakta, ortalamada 160 ülke içerisinde 130 ile 140. sıralama arasında kendisine yer bulmaktadır. Öncelikle mevcut sıralamamamın korunması, ardından yaşanan sürecin ekolojik denge gözetilerek yönetilmesi halinde sıralamanın pozitif yönde artması konuyu gündemde tutacak akademik çalışmaların, politika yapımcıların, politika uygulayıcıların ve bu süreci doğrudan yaşayan bölge halkının elindedir.

KAYNAKÇA

- Acci, Y. , Akarsu, G. & Cafrı, R. (2023). Döngüsel Ekonomi ve Yeşil Büyüme Çerçevesinde Sürdürülebilir Kalkınma Göstergelerinin Ekonomik Büyüme Üzerine Etkisi: Seçilmiş AB Ülkelerinden Ampirik Kanıtlar. *Verimlilik Dergisi, Döngüsel Ekonomi Ve Sürdürülebilirlik*, 53-66 . DOI: 10.51551/verimlilik.1110535
- Ağcakaya, S. ve Kaya, I. (2022), Sürdürülebilir Kalkınma ve Yeşil Ekonomi Perspektifinden Yeşil Maliye Politikaları Uygulamaları, Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 31 (2), 514-527.
- Al, İ. (2019). Sürdürülebilir kalkınma ve yeşil ekonomi: Türkiye için bir endeks önerisi, Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 12(1), 112-124, doi: 10.17218/hititsosbil.473413.
- Altun, F. (2018). Afetlerin ekonomik ve sosyal etkileri: Türkiye örneği üzerinden bir değerlendirme. *Sosyal Çalışma Dergisi*, 2(1), 1-15.
- Battaglia, M., Cerrini, E., Annesi, N., (2018). Can environmental agreements represent an opportunity for green jobs? Evidence from two Italian experiences, *Journal of Cleaner Production*, Volume 175, Pages 257-266, ISSN 0959-6526, <https://doi.org/10.1016/j.jclepro.2017.12.086>.
- Bilgili, M. Y. (2017). “Ekonomik, Ekolojik ve Sosyal Boyutlarıyla Sürdürülebilir Kalkınma”, *The Journal of International Social Research*, Vol.10, No.49, April 2017, s.559 – 569.
- ÇŞİDB, (2023). <https://csb.gov.tr/> (Erişim: 24.04.2023).
- D'amato, D., & Korhonen, J. (2021). Integrating the green economy, circular economy and bioeconomy in a strategic sustainability framework. *Ecological Economics*, 188, 107143.
- Demirtaş, I. (2017). Ekolojik Ve Ekonomik Krizlere Alternatif Çözüm Olarak Yeşil Ekonomi Politikaları Alternatif Politika, Aralık 2017, İklim Değişikliği ve Enerji Özel Sayısı 107-132.
- Doker, A. C., & Yiğit, A. G., (2023). Deprem Sonrasında Sürdürülebilir Kalkınma Çerçevesinde Öneriler. *Kahramanmaraş Merkezli Depremler Sonrası İçin Akademik Öneriler* (pp.195-208), Gaziantep: ÖZGÜR.
- Dual Citizen, (2023a). <https://dualcitizeninc.com/about/> (Erişim: 23.04.2023).
- Dual Citizen, (2023b). <https://dualcitizeninc.com/global-green-economy-index/> (Erişim: 23.04.2023).
- ETKB, (2023). <https://enerji.gov.tr/eigm-yenilenebilir-enerji-kaynaklar-gunes#:~:text=Bakanl%C4%B1%C4%9F%C4%B1m%C4%B1zca%20haz%C4%B1rlanan%2C%20T%C3%BCrkiye%20G%C3%BCne%C5%9F%20Enerjisi,kWh%2Fm2%20olarak%20hesaplanm%C4%B1%C5%9Ft%C4%B1r>. (Erişim: 25.04.2023).
- Filiz Pezikoğlu, “Yeşil Ekonomi Göstergeleri ve Yeşil Etiketler”, Süleyman Demirel Üniversitesi Ziraat Fakültesi Tarım Ekonomisi Bölümü- XII. Ulusal Tarım Ekonomisi Kongresi, 25–27 Mayıs 2016, s.1393.

- Gürsoy, S. , Zeren, F. , Kevser, M. , Akyol, G. & Tunçel, M. B. (2023). The Impact of 2023 Turkey Earthquake on Istanbul Stock Market: Evidence from Fourier Volatility Spillover Test . Sosyal Bilimler Araştırma Dergisi , 12 (1) , 98-105 . Retrieved from <https://dergipark.org.tr/tr/pub/ssrj/issue/76085/1263888>
- Gül, K. & Akyol, H. (2023). Kahramanmaraş Depreminin Bölgenin Kırsal Kalkınmasına Etkisinin İncelenmesi. ISPEC 11th International Conference On Agriculture, Animal Sciences And Rural Development 03-05 March 2023- Mus / Türkiye
- Hao, X., vd.(2023). The role of digitalization on green economic growth: Does industrial structure optimization and green innovation matter?, Journal of Environmental Management, Volume 325, Part A, 116504, ISSN 0301-4797, <https://doi.org/10.1016/j.jenvman.2022.116>
- İMO, (2023). <https://www.imo.org.tr/Eklenti/8176,csb-2023-yili-yapi-yaklasik-birim-maliyetleripdf.pdf?0& tag1=A24B73EB8AF5A7646C9719F9F6881E67DAD10D07> (Erişim: 24.04.2023).
- Kanat, E., & Tetik, N., (2023). 6 Şubat 2023 Kahramanmaraş Merkezli Depremlerin Bist (Borsa İstanbul) Üzerindeki Etkileri. Kahramanmaraş Merkezli Depremler Sonrası İçin Akademik Öneriler (pp.113-122), Gaziantep: ÖZGÜR.
- Karancı, N. A., Kalaycıoğlu, S., Erkan, B. B., Özden, T. A., Çalışkan, İ., Özakşehir, G. (2011). Tabanlı-Van ve Edremit-Van Depremleri İnceleme Raporları. Ankara.
- Kararach, G., Nhamo, G., Mubila, M., Nhamo, S. Nhamechena, C. ve Babu, S. (2018). Reflections on the green growth index for developing countries: a focus of selected African countries, Development Policy Review. 36, 432-454.
- Kaypak, Ş. (2011). Küreselleşme Sürecinde Sürdürülebilir Bir Kalkınma İçin Sürdürülebilir Bir Çevre . Karamanoğlu Mehmetbey Üniversitesi Sosyal Ve Ekonomik Araştırmalar Dergisi , 2011 (1) , 19-33 . Retrieved from <https://dergipark.org.tr/tr/pub/kmusekad/issue/10216/125569>
- Kılıç, Selim: “Sürdürülebilir Kalkınma Anlayışının Ekonomik Boyutuna Ekolojik Bir Yaklaşım”, İ.Ü. Siyasal Bilgiler Fakültesi Dergisi, No.47, Ekim 2012, s.201 – 226.
- Koç, A., (2023). Kahramanmaraş'tan Türkiye'yi Sarsan Deprem Felaketinin Sosyal-Ekonomik Boyutu ve Çıkarmamız Gereken Dersler. Kahramanmaraş Merkezli Depremler Sonrası İçin Akademik Öneriler (pp.167-182), Gaziantep: ÖZGÜR.
- KUŞAT N (2013). Yeşil sürdürülebilirlik için yeşil ekonomi: Avantaj ve dezavantajları-Türkiye incelemesi. Journal of Yasar University, 8(29), 4896 - 4916.
- Nahman, A., Mahumani, B.K ve Lange W.J. (2016). Beyond GDP: towards a green economy index, Development Southern Africa. 33(2), 215-233.
- OCHA, (2023). <https://reliefweb.int/disaster/eq-2023-000015-tur> (Erişim: 24.04.2023).
- Ozbilgin, M. , Erbil, C. , Şimşek Demirbağ, K. , Demirbağ, O. & Tanriverdi, V. (2023). Afet Yönetiminde Sorumluluğun Yeniden İnşası: Deprem, Sosyal Dramalar, Sosyal Politikalar . Sosyal Mucit Academic Review , 4 (1) , 71-112 . DOI: 10.54733/smar.1253256

- Özçağ, Y. D. D. M. & Hotunluoğlu, Y. D. D. H. (2015). Kalkınma Anlayışında Yeni Bir Boyut: Yeşil Ekonomi . Manisa Celal Bayar Üniversitesi Sosyal Bilimler Dergisi , 13 (2) , 303-324 . DOI: 10.18026/cbusos.85473
- Özüdoğru Aydın, B., (2023). 2023 Yılında Gerçekleşen Kahramanmaraş Merkezli Depreminin Etkileri Ve Politika Önerileri. Türkiye Ekonomi Politikaları Araştırma Vakfı. https://www.tepav.org.tr/upload/files/1681620940-1.2023_YILINDA_GERCEKLESEN_KAHRAMANMARAS_MERKEZLI_DEPREMININ_ETKILERI_VE_POLITIKA_ONERILERI.pdf
- Sağiroğlu, A. Z., Ünsal, R., Özenci, F. (2023). Deprem Sonrası Göç ve İnsan Hareketlilikleri Durum Değerlendirme Raporu. AYBÜ-GPM Rapor Serisi-15. Ankara: Ankara Yıldırım Beyazıt Üniversitesi Göç Politikaları Uygulama ve Araştırma Merkezi (AYBÜ-GPM).
- Say, S. & Doğan, M. (2023). Depremlerin Hisse Senedi Getirileri Üzerindeki Etkisi: 2023 Yılı Kahramanmaraş Depremi Örneği . Sosyal Bilimler Araştırma Dergisi , 12 (1) , 90-97 . Retrieved from <https://dergipark.org.tr/pub/ssrj/issue/76085/1263621>
- SBB, (2023). Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı 2023 Kahramanmaraş ve Hatay Deprem Raporu, <https://www.sbb.gov.tr/2023-kahramanmaraş-ve-hatay-depremleri-raporu/> (Erişim: 19.04.2023).
- Schlor, H., Venghaus, S. ve Hake, J.F. (2017). Green economy innovation index (GEII)-a normative innovation approach for Germany & its FEW nexus, Energy Procedia. 142, 2310-2316.
- Stakeholder Forum, (2012). <https://stakeholderforum.org/wp-content/uploads/2020/06/Earth-Summit-2012-Principles-for-the-Green-Economy-1.pdf> (Erişim: 22.04.2023).
- Şahin, İ. & Kılınç, T. (2016). Türkiye’de 1980-2014 Yılları Arasında Görülen Depremlerin Ekonomik Etkileri . İktisadi Yenilik Dergisi , 4 (1) , 33-42 .
- Şen, S. "Kahramanmaraş Depremlerinin Ekonomiye Etkisi". Diplomasi ve Strateji Dergisi 4 (2023): 1-55.
- TCDD, (2023). <https://www.tcdd.gov.tr/projeler/mersin-adana-gaziantep-hizli-tren-projesi> (Erişim: 22.04.2023).
- Teixeira, J.R, Pinheiro, D.S. ve Vilasboas, A.E.S. (2015), Socioeconomic and environmental performance: a composite index & comparative application to the USA & China, Cadmus. 2(5), 146-164.
- Tetik, N., & Öner, A., (2023). 6 Şubat 2023 Kahramanmaraş Merkezli Depremin Bölgede Yer Alan Kobilere Üzerindeki Olası Ekonomik ve Finansal Etkileri. Kahramanmaraş Merkezli Depremler Sonrası İçin Akademik Öneriler (pp.83-92), Gaziantep: ÖZGÜR.
- Tienhara, Kyla (2014), “Varieties of Green Capitalism: Economy and Environment in the Wake of the Global Financial Crisis, Environmental Politics”, 23 (2):187-204.
- TDK, (2023). <https://sozluk.gov.tr/> (Erişim: 23.04.2023).
- TİM, (2023). <https://tim.org.tr/tr/ihracat-rakamlari> (Erişim: 11.04.2023).
- TOB, (2023). <https://www.tarimorman.gov.tr/> (Erişim: 15.04.2023).

- TÜİK, (2022). <https://data.tuik.gov.tr/Kategori/GetKategori?p=Ulusal-Hesaplar-113> (Erişim: 11.04.2023).
- Vilasboas, A.E. ve Teixeira, J.R. (2017). Green economy index: what really matters?, World Academy Art & Science, XIV International Colloquium 2017, Brazil.
- Yıldız F. (2021). Türkiye ve Yeşil Ekonomi: Mevcut Durum ve Öneriler, (Politika Notu: 2021/23). İstanbul: İLKE İlim Kültür Eğitim Vakfı. DOI:<http://dx.doi.org/10.26414/pn023>
- Yiğit, M., (2023). Davranışsal İktisat Penceresinden Deprem Öncesi ve Sonrası İçin Politika (Dürtme) Önerileri. Kahramanmaraş Merkezli Depremler Sonrası İçin Akademik Öneriler (pp.221-230), Gaziantep: ÖZGÜR.

**RETAIL CASH CONVERSION CYCLE AND PROFITABILITY NEW EVIDENCE
FROM A COINTEGRATION TEST WITH MULTIPLE STRUCTURAL BREAKS
FOR TURKISH RETAIL INDUSTRY**

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ABSTRACT

The cash conversion cycle (CCC) is a metric of time that it takes for a firm to convert its investments in current assets into cash flows generated from sales. It is a vital quantitative measure used to evaluate the efficiency and effectiveness of a firm's operations, and therefore management quality. Understanding cash conversion cycle and implementing a proper plan to shorten it is a must to increase financial performance and profitability, especially for specific industries such as retailing, trading, healthcare, software development, etc. that have tendency to have best working capital and cash conversion cycles. This study aims to analyze the relationship between cash conversion cycle and firm profitability on a sample consisting of quarterly data of Turkish retailing industry consisting of Borsa Istanbul (BIST) listed retailing firms covering 1997.q1-2022.q4. In the study, the stationarity of series is tested by unit root test of Carrioni-i-Silvestre et. al. (2009). Following, co-integration test of Maki (2012) is employed whether there exists a cointegration relationship among series or not. Finally, cointegration coefficients are estimated by the dynamic ordinary least squares (DOLS) method of Stock and Watson (1993). Estimated break dates refer to some turning points in Turkish retailing industry. The empirical findings indicate that there does not exist any significant relationship between cash conversion cycle and profitability, while there exists a statistically significant and a negative relationship between profitability and leverage.

Keywords: Cash conversion cycle, profitability, retailing industry, cointegration test with multiple structural breaks.

INTRODUCTION

According to a McKinsey&Company report by Dobbs et al. (2015), over the last couple of decades, the world is being transformed through the four global forces breaking all the trends. These forces can be summarized as (i) the shifting of the locus of economic activity and dynamism to emerging countries and to cities within those countries; (ii) the acceleration in the scope, scale, and economic impact of technology; (iii) graying of the world due to sharp decline in fertility rates in recent years and (iv) the degree to which the world is much more connected through trade and through movements in capital, people, and information. Nowadays, multiple health challenges such as pandemic influenzas like COVID-19, vaccine-preventable diseases like diphtheria, growing rates of obesity, and etc. may be referred as the fifth global force accelerating the transformation.

Besides, it is obvious that these forces also result in a highly intense and global, national and - even- local competition environment. In such an environment, firms struggle to provide sustainable profit by proper investment decisions to enhance an optimum capital structure that will maximize the firm value. As term *capital structure* generally refers to the mix of a firm's long-term capital as a combination of debt and equity; short-term investments in working capital are mostly ignored in optimal capital structure appraisals. However, working capital management (WCM) is closely related to entire asset composition and short-term liabilities of any firm and directly affects financial performance both in terms of profitability and firm value (Jose et al., 1996; Appuhami, 2008; Banos-Caballero et al., 2011; Habib and Mourad, 2022). Besides, the mediating role of profitability on the relationship between WCM and sustainable growth has been supported by several studies of Churchill and Mullins (2001), Amouzesh et al. (2011), and Mukherjee and Sen, (2018). On the contrary, inefficient working capital practices are regarded as significant reasons for many distressed and demised firms (Alshubiri, 2011; Habib and Kayani, 2022), and small and medium-sized enterprise (SME) failures (Cielen et al., 2004). Increasing awareness of the vitality of proper working capital investments has caused to draw greater attention to reconsideration of firms' short-term investments (Shin and Soenen, 1998; Ajilore and Falope, 2009). This attention has risen to prominence following the massive shocks created by the COVID-19 pandemic and these shocks have changed the ongoing stereotype attitude towards working capital practices (Gadelius and Larsson, 2019).

Ernst and Young's 2019 Working Capital Report shows that the 2,000 leading companies in the United States and Europe have failed to manage their working capital due to challenges caused

by the COVID-19 pandemic. Another report by PricewaterhouseCoopers indicates that due to social distancing to prevent the spread of COVID-19 pandemic, firms have faced serious problems related to access to cash and working capital. These cash related issues have also been confirmed by Barclays' report concluding that COVID-19 pandemic has intensely affected cash conversion cycle (CCC) in most industries¹. Besides, lockdowns and interruptions to economic activities due to COVID-19 pandemic have lowered the value of firms' assets (Almaghrabi, 2022; Hassan et al., 2022) and highly affected firms' working capital requirements.

However, from both macroeconomic and microeconomic perspectives, the recovery didn't last long. GDP in most developed countries returned to or exceeded pre-COVID-19 pandemic levels by April 2022. J.P. Morgan working capital index which peaked in 2020, sharply reserved and improved by 11.2 points in 2021. Average overall sales of S&P 1,500 companies increased by 20% in 2021 and this increase reduced days inventory outstanding and improved days sales outstanding figures. Besides, in 2021, the cash index improved by 6.0 points and companies began to deploy cash on capital expenditures, increased their payouts to shareholders as share buybacks and dividends, and M&A activities across the globe again gained popularity².

This study concentrates specifically on (Turkish) retail industry for a number of reasons. First of all, differing from other industries, retail industry must attribute more attention to working capital, as it connects manufacturers to end-customers (Shailaja, 2017). Therefore, effective management of working capital should be a priority for such firms to ensure customer satisfaction and long-term sustainability. Secondly, working capital requirement of any firm depends heavily on its operating cycle, i.e., the days required to receive inventory, sell it, and collect cash from the sale of the inventory. The retail firms with relatively long operating cycles should invest more in inventories for meeting customer demand on time and these inventory investments make them working capital intensive. Thirdly, throughout the growth of Turkey's economy, the Turkish retail industry has been one of the most appealing sectors for both investors and consumers. The value of Turkish retail industry reached at 1,751 billion Turkish liras in 2021 and is forecast to grow at a CAGR of 25.4% over the period of 2021-2026, reaching to 5,439 billion Turkish liras. Among the sub-sectors, food and grocery is the dominating one

¹ Reports of Ernst and Young (a and b), PricewaterhouseCoopers (c) and Barclays (d) are available at, respectively:

a) https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/transaction-advisory-services/transactionspdfs/ey-working-capital-report-2019.pdf

b) https://www.ey.com/en_us/strategy-transactions/improving-liquidity-and-working-capital

c) <https://www.pwc.com/us/en/library/covid-19/finance-liquidity.html>

d) <https://www.barclayscorporate.com/insights/trade/working-capital-post-covid/>

² Available at: <https://www.jpmmorgan.com/content/dam/jpm/treasury-services/documents/working-capital-report-2022.pdf>

with a value of 874 billion Turkish liras in 2021. Besides, the industry is dominated by mass-market players using hypermarkets, supermarkets and discounters as leading channels³. These figures point out the importance of retail industry in overall Turkish economy.

The aim of this study is to analyze the possible relationship between cash conversion cycle (CCC) and firm profitability on a sample consisting of quarterly data of Turkish retail industry consisting of Borsa Istanbul (BIST) listed retail firms covering 1997.q1-2022.q4. Besides, the study refers advanced econometric methodologies including Carrioni-i-Silvestre et al. (2009) unit root test; Maki (2012) cointegration test and the dynamic ordinary least squares method of Stock and Watson (1993).

The remainder of the study is as follows: After discussing the *Conceptual Framework*, a brief *Literature Review* is presented regarding previous studies concentrating mainly on the relationship between cash conversion cycle and profitability. Then, sample and data, variable selection, the research model specification and empirical findings are given in *Methodology*. Finally, the empirical findings and their implications are discussed in the *Conclusion*.

CONCEPTUAL FRAMEWORK

The roots of WCM theory may be dated back to the study of Sagan (1955), firstly emphasizing the importance of working capital management policies on financial health of companies. Following, the researches of Modigliani (1957) on inventory investments; Walker (1964) on risk-return trade-off of WCM; Chakraborty (1973) on the role of working capital as a fund covering all the operating expenses of a company on-going and Smith (1973) on the business failures arising from inefficient management of current assets and liabilities are among other pioneering studies.

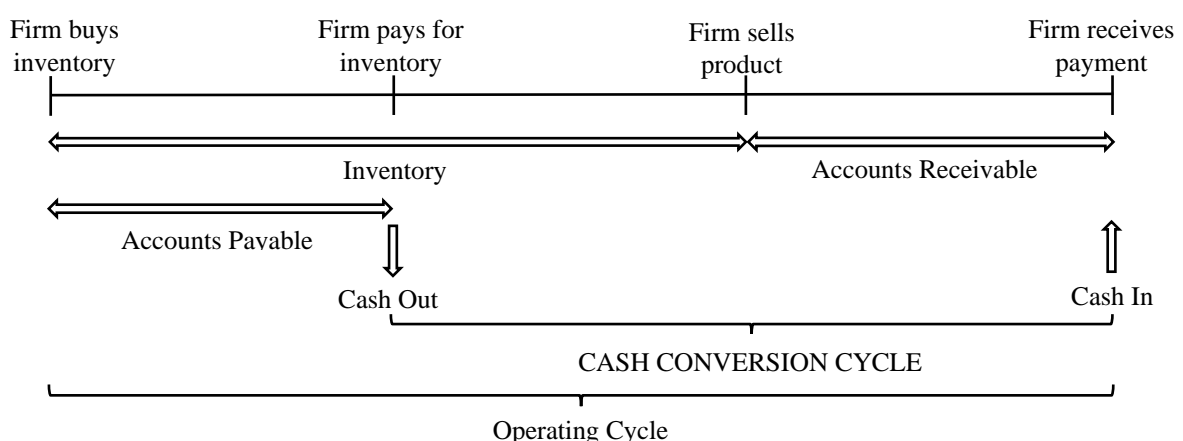
Efficiency and effectiveness of WCM practices are considered as strong predictors of profitability (Shin and Soenen, 1998; Deloof, 2003; Raheman and Nasr, 2007). The trade-off between the dual goals of WCM, that is liquidity and profitability, has been first highlighted by Smith (1980). He stated that profit maximization tendency is highly related to maintaining optimal liquidity; and focusing on only liquidity may tend to reduce potential profitability. However, how to measure liquidity arises as an empirical question. Though liquidity measures such as current, acid-test and cash ratios are the most common static measures of liquidity that focus on static balance sheet values; Shulman and Cox (1985), and Kamath (1989) question the

³ Available at: https://www.globaldata.com/store/report/turkey-retail-market-analysis/?view_report

validity of these measures depending that liquidity of an ongoing firm is more closely linked to the operating cash flow generated by its assets rather than the liquidation value of its assets. Therefore, evaluating efficiency and effectiveness of WCM practices requires an appropriate measure of liquidity that can provide dynamic insights.

Cash -conversion- cycle, initially introduced by Gitman (1974) and Hager (1976), and later operationalized by Richards and Laughlin (1980), is an extension of operating cycle. Operating cycle fails to consider liquidity requirements as affected by the time pattern of cash outflow requirements (Moss and Stine, 1993: 26). Cash conversion cycle (CCC) overcomes this failure by measuring liquidity with a time pattern (Wang, 2002; Afrifa and Padachi, 2016). CCC involves management of inventory, accounts receivable and accounts payable in optimal balance. This balance can be ensured by reducing accounts receivable period combined with lower inventory and extended supplier (trade) credit terms. A working capital policy based on relatively short CCC and low capital level mostly improves profitability, as such a policy reduces financing cost of operations (Ebben and Johnson, 2011).

As stated before, CCC is a derivation of operating cycle. Operating cycle is calculated by adding the average number of days necessary to purchase a product on credit and sell it (days inventory outstanding) to the average number of days required to collect sales (days sales outstanding). CCC takes the operating cycle analysis one step further by subtracting the length of the accounts payable period (days payable outstanding) from operating cycle. From this point of view, CCC is the actual time between cash outflows and cash inflows (Figure 1).



Source: Berk and DeMarzo, 2017: 951.

Figure 1: Cash Conversion Cycle

CCC and its three components, i.e., days inventory outstanding (DIO), days sales outstanding (DSO) and days payable outstanding (DPO) are calculated by using the following formulas:

$$CCC = [DIO + DSO] - DPO \quad (1)$$

where

$$DIO = \text{Inventory} / \text{Average Daily Cost of Goods Sold} \quad (2)$$

$$DSO = \text{Accounts Receivable} / \text{Average Daily Sales} \quad (3)$$

$$DPO = \text{Accounts Payable} / \text{Average Daily Cost of Goods Sold} \quad (4)$$

LITERATURE REVIEW

The earlier studies on cash -conversion- cycle are mostly established on models as extensions of operating cycle and/or theoretical frameworks to analyze working capital requirements. For instance; the theoretical framework developed by Gitman and Sachdeva (1982) was about the combination of value added and working capital. Investigating a possible relationship between CCC and firm size, Cheatham (1989) proposed a theoretical suggestion of shortening cash conversion cycle, while Cheatham et al. (1989) illustrated how the cash conversion cycle can be a value-driver for small firms. These theoretical suggestions were firstly tested by Ulrich and Reinhart (1991) for a sample of large and small firms, obtaining mixed empirical findings. Then, Moss and Stine (1993)'s research for a sample of building materials, hardware and garden to retail stores proved that firm size is a determinant of length of the CCC. Accordingly, cash conversion cycles of relatively large retail firms are found to be shorter and the length of the cash conversion cycle is inversely related to cash flows to the firm. Another earlier proposed model is the weighted cash conversion cycle of Gentry et al. (1990). This model calculates the weightings as the proportion of sales tied up to each component of the cash conversion cycle enabling better evaluation of firm's short-term financial performance.

Following these models, since especially the early 1990s, empirical studies on the effect working capital management practices on firm profitability have begun to draw greater attention. The main feature of these empirical studies is that they are concentrated on generally specific industries such as construction service, agriculture, mining, wholesale, oil and gas, transportation or manufacturing. Besides, a great majority of these studies is about US companies (Soenen, 1993; Jose et al., 1996; Shin and Soenen, 1998; Farris et al. 2005; Ebben and Johnson, 2011; Yazdanfar and Ohman, 2014); while several ones examine different European countries (Deloof, 2003; Lazaridis and Tryfonidis, 2006; Garcia-Teruel and Martinez-

Solano, 2007; Muscettola 2014; or emerging economies (Şamiloğlu and Demirgüneş, 2008; Ramachandran and Janakiraman, 2009; Coşkun and Kök, 2011; Sharma and Kumar, 2011; Tekin and Gör, 2022). Another feature is that while the early empirical studies on the subject refer to common static measures such as current ratio and acid-test ratio, etc. to evaluate firm's liquidity proficiency level; the contemporary ones suggest better liquidity measures such as cash conversion cycle, working capital requirement, the net trade cycle, the comprehensive liquidity index, and net liquid balance, tied up in firm's operations that include main components of net working capital cycle (Smith and Fletcher, 2009; Erasmus, 2010; Louw et al., 2016).

Focusing on US firms, studies of Soenen (1993), Jose et al. (1996), Shin and Soenen (1998), and Ebben and Johnson (2011) on various samples of US manufacturing firms over the periods 1974-1993, 1974-1993, 1975-1994 and 2002-2003, and respectively, conclude that working capital management policies shortening cash conversions cycles lead higher firm profitability due to tendency to minimize the cost of holding excess working capital. Deloof (2003)'s study on 1,009 Belgium firms throughout a wide range of sectors of the economy over the period of 1992-1996 claims that efficiency of working capital management practices affects both firm profitability and shareholder value. Empirical findings from the works of Lazaridis and Tryfonidis (2006) for 131 Athens Stock Exchange listed firms over the period of 2001-2004, Garcia-Teruel and Martinez-Solano (2007) for 8,872 Spanish SMEs over the period of 1996-2002 and Fernandez-Lopez et al. (2020) for 444 Spanish cheese-manufacturing firms over the period of 2010-2016 confirm Deloof (2003)'s findings.

Apart from findings on US and European firms, the empirical findings of Ramachandran and Janakiraman (2009) for India, Dong and Su (2010) for Vietnam, Mohamad and Saad (2010) for Malaysia, Nobanee et al. (2011) for Japan, Attari and Raza (2012) for Pakistan, Anser and Malik (2013) for Pakistan, Garanina and Petrova (2015) for Russia, Al-Mohareb (2019) for Jordan and Wang (2019) for both Japan and Taiwan, referring samples on different industries except retail also posit that there exists a significantly negative relationship between cash conversion cycle and profitability.

As stated before, one main feature of the related studies is that they are concentrated on a wide range of industries including construction service, agriculture, mining, wholesale, oil and gas, transportation and manufacturing, etc. From this point of view, it can be deduced that empirical studies on retail industry are comparatively rare and there is a research gap in this

field. Gosman and Kelly (2003), analyzing working capital management practices in US retail industry, focuses on inventory management and payment policies. In a similar study of Choudhary and Tripathi (2012) on a sample of three Indian retail firms, no evidence on the effect of inventory management on firm profitability is found. As seen, the existing studies on the relationship between working capital management practices and firm profitability in retail industry deals with the subject referring to static liquidity measures rather than a liquidity measure with a time pattern such as cash conversion cycle.

However, several studies of Lyrودي and Lazaridis (2000) on Athens Stock Exchange listed food firms; Gill et al. (2010) on US manufacturing firms, Sharma and Kumar (2011) and Abuzayed (2012) on non-financial firms in India and Jordan, respectively, point out a positive relationship between cash conversion cycle and working capital practices. These authors explain their findings indicating that firm profitability may be increased by keeping accounts receivable at an optimal level and relatively profitable firms may be less motivated to manage working capital efficiently. Moreover, while Panigrahi (2013) and Mathuva (2014) provide evidence for these claims by their studies on India and Kenya, respectively; Muscettola (2014) observes no significant relationship between cash conversion cycle and firm profitability.

It is obvious that previous empirical studies provide mixed and ambiguous findings concerning the form of the relationship between cash conversion cycle and firm profitability. These findings may be associated with sample selection procedures and the variables regarding cash conversion cycle included in research models.

METHODOLOGY

Sample and Data

This study analyzes the possible relationship between cash conversion cycle and firm profitability on a sample consisting of quarterly data of Turkish retail industry consisting of Borsa Istanbul (BIST) listed retail firms covering 1997.q1-2022.q4. The data is derived from the official website of Financial Information News Network (FINNET) by using Financial Analysis software.

Variable Selection

The dependent variable of the research model is firm profitability referred as return on assets (ROA), and is calculated as the book value of net profit (loss) after taxes divided by the book value of total assets.

The independent variable of interest is cash conversion cycle (CCC) and the formula to calculate it sums up the days inventory outstanding (DIO) and days sales outstanding (DSO) and then subtracts the days payable outstanding (DPO).

The control variable included in the research model is leverage (LEV) and is calculated by dividing the book value of total debt to the book value of total assets.

The Research Model Specification

The regression equations to test possible relationships between firm profitability and cash conversion cycle (Model 1), and between firm profitability and leverage (Model 2) are given in Equations 5-6:

$$ROA_t = \beta_0 + \beta_1 CCC_t + \varepsilon_t \quad (5)$$

$$ROA_t = \beta_0 + \beta_1 LEV_t + \varepsilon_t \quad (6)$$

Empirical Findings

This study tests relationship between ROA and CCC, and ROA and LEV using various methodologies including (i) multiple structural breaks unit root test of Carrioni-i-Silvestre et al. (2009), (ii) multiple structural breaks cointegration test of Maki (2012) and (iii) dynamic ordinary least squares (DOLS) method developed by Stock and Watson (1993).

The classical unit root tests may sometimes fail due to the effects of some events like economic and financial crises, wars, pandemics, etc. on the data, as such events may tend to cause structural breaks in the series. Therefore, it is recommended to employ multiple structural breaks unit root tests. Carrioni-i-Silvestre et al. (2009)'s unit root test as an extension of Kim and Perron (2009)'s work is one of these tests, allowing maximum up to five multiple breaks.

Totally five test statistics have been developed by Carrioni-i-Silvestre et al. (2009). Their first test statistics is based on the analyses of Elliot et al. (1996) and Perron and Rodriguez (2003) as given in Equation 7:

$$P_T^{GLS}(\lambda^0) = \{S(\bar{\alpha}, \lambda^0) - \bar{\alpha}S(1, \lambda^0)\} / s^2(\lambda^0) \quad (7)$$

where $s^2(\lambda^2)$ is an estimate of the spectral density at frequency zero of v_t .

Following Perron and Ng (1998), and Ng and Perron (2001), Carrioni-i-Silvestre et al. (2009) use an autoregressive estimate as defined in Equation 8:

$$s(\lambda^0)^2 = s_{ek}^2 / (1 - \sum_{j=1}^k \hat{b}_j)^2 \quad (8)$$

where $s_{ek}^2 = (T - k)^{-1} \sum_{t=k+1}^T \hat{e}_{t,k}^2$ and $\{\hat{b}_j, \hat{e}_{t,k}\}$ are obtained from the ordinary least squares (OLS) regression in Equation 9:

$$\Delta \tilde{y}_t = b_0 \tilde{y}_{t-1} + \sum_{j=1}^k b_j \Delta \tilde{y}_{t-j} + e_{t,k} \quad (9)$$

with $\tilde{y}_t = y_t - \hat{\Psi}' z_t(\lambda^0)$ where $\hat{\Psi}$ minimizes the objective function.

The order of autoregression k is selected using the modified information criteria suggested by Ng and Perron (2001) with the modification proposed by Perron and Qu (2007).

Carrioni-i-Silvestre et al. (2009)'s three M -class of test statistics that allow for multiple structural breaks are defined by Equations 10-12:

$$MZ_{\alpha}^{GLS}(\lambda^0) = (T^{-1} - s(\lambda^0)^2)(2T^{-2} \sum_{t=1}^T \tilde{y}_{t-1}^2)^{-1} \quad (10)$$

$$MSB^{GLS}(\lambda^0) = (s(\lambda^0)^{-2} T^{-2} \sum_{t=1}^T \tilde{y}_{t-1}^2)^{\frac{1}{2}} \quad (11)$$

$$MZ_t^{GLS}(\lambda^0) = (T^{-1} \tilde{y}_T^2 - s(\lambda^0)^2) \left(4s(\lambda^0)^2 T^{-2} \sum_{t=1}^T \tilde{y}_{t-1}^2 \right)^{-\frac{1}{2}} \quad (12)$$

with $\tilde{y}_t = y_t - \hat{\Psi}' z_t(\lambda^0)$, where $\hat{\Psi}$ minimizes the objective function.

The fifth test statistics of Carrioni-i-Silvestre et al. (2009) is a modified feasible point optimal test defined by Equation 13:

$$MP_T^{GLS}(\lambda^0) = \frac{[c^{-2} T^{-2} \sum_{t=1}^T \tilde{y}_{t-1}^2 + (1-c) T^{-1} \tilde{y}_T^2]}{s(\lambda^0)^2} \quad (13)$$

Carrioni-i-Silvestre et al. (2009) obtains asymptotic critical values by using the bootstrap. The null hypothesis of a unit root is rejected in case of calculated test statistics being smaller than critical values referring that series is stationary under the presence of structural break. Results of unit root test of Carrioni-i-Silvestre et al. (2009) are presented in Table 1.

Table 1: Results of Unit Root Test of Carrion-i-Silvestre et al. (2009)

Variable	Critical Values					Break Dates
	P_T^{GLS}	MZ_{α}^{GLS}	MSB^{GLS}	MZ_t^{GLS}	MP_T^{GLS}	
<i>ROA</i>	11.126 (8.869)	-28.815 (-46.219)	0.111 (0.103)	-3.998 (-4.786)	14.529 (8.869)	1997.q4; 1998.q3; 2001.q4 2019.q4; 2022.q1
<i>CCC</i>	18.726 (9.250)	-28.419 (-47.749)	0.148 (0.101)	-2.998 (-4.877)	18.739 (9.250)	1999.q4; 2000.q3; 2009.q1 2016.q4; 2019.q3
<i>LEV</i>	14.011 (9.169)	-31.859 (-46.490)	0.117 (0.103)	-3.983 (-4.806)	10.129 (9.169)	1999.q2; 2001.q4; 2012.q3 2017.q1; 2019.q4
ΔROA	3.489** (5.543)	-37.895** (-17.325)	0.128** (0.168)	-4.259** (-2.896)	2.890** (5.543)	
ΔCCC	2.894** (5.543)	-34.789** (-17.325)	0.145** (0.168)	-4.425** (-2.896)	1.978** (5.543)	
ΔLEV	3.825** (5.543)	-37.152** (-17.325)	0.109** (0.168)	-3.042** (-2.896)	3.358** (5.543)	

Note: Critical values obtained by using the bootstrap at significance level of 5% are given in parenthesis. ** and Δ denote stationarity at significance level of 5%, and the first difference, respectively.

The null hypotheses of a unit root test is accepted as calculated test statistics at level are bigger than critical values. Therefore, test results indicate that series are stationary at their first differences and integrated of order one, $I(1)$. Structural break dates estimated by the unit root test of Carrion-i-Silvestre et al. (2009) point out dramatic turning points for not only Turkish retail industry, but also the entire Turkish economy.

Gregory and Hansen (1996) criticize cointegration tests of Zivot and Andrews (1992), and Westerlund and Edgerton (2007) which allow only one structural break. They recommend processing multiple (that is, at least more than one) structural breaks in cointegration tests, as structural breaks may cause spurious unit root behavior in the cointegrating relationship. Tests developed by Carrion-i-Silvestre and Sanso (2006) and Hatemi-J (2008) allow two structural breaks. However, Maki (2012) proposes a test that performs better, when the cointegration relationship has more than three (maximum up to five) structural breaks. Therefore, this study employs Maki (2012) cointegration test.

Maki (2012) identifies the long-run relationships between series with four different regression models in as given in Equation 14-17.

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \beta' x_t + \mu_t \quad (14)$$

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \beta' x_t + \sum_{i=1}^k \beta_i x_t D_{i,t} + \mu_t \quad (15)$$

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \gamma t + \beta' x_t + \sum_{i=1}^k \beta_i x_t D_{i,t} + \mu_t \quad (16)$$

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \gamma t + \sum_{i=1}^k \gamma_i t D_{i,t} + \beta_i x_t + \sum_{i=1}^k \beta_i x_t D_{i,t} + u_t \quad (17)$$

where $t = 1, 2, \dots, T$. y_t and $x_t = (x_{1t} \dots x_{mt})'$ denote observable I(1) variables, and u_t is the equilibrium error. y_t is a scalar and $x_t = (x_{1t}, \dots, x_{mt})'$ is an $(m \times 1)$ vector. It is assumed that an $(n \times 1)$ vector z_t is generated by $z_t = (y_t, x_t) = z_{t-1} + \varepsilon_t$, where ε_t are independent identically distributed with mean zero, definite variance-covariance matrix Σ , and $E|\varepsilon_t|^s < \infty$ for some $s > 4$. $\mu, \mu_i, \gamma, \gamma_i, \beta' = (\beta_{i1}, \dots, \beta_{im})$ are true parameters. $D_{i,t}$ takes a value of 1 if $t > T_{Bi}$ ($i = 1, \dots, k$) and of 0 otherwise, where k is the maximum number of breaks and T_{Bi} denotes the time period of the break.

The first model with level shifts and without trend in which there is a break in the constant term, and the second regime-shifts model without trend in which there are breaks in both constant term and slope are formulated in Equations (14) and (15), respectively. The third model (Equation 16) is the second model with a trend. The fourth model is the comprehensive one with breaks in constant term, slope and trend (Equation 17).

The approximation of asymptotic critical values of the tests for the maximum number of breaks (from 1 to 5) are calculated by Monte Carlo simulations as given in Maki (2012). The null hypothesis of non-existence of cointegration between series is rejected in case of calculated test statistics being smaller than these critical values. In the study, null hypothesis is accepted for the first model, while it is rejected for the second one. This indicates the existence of a cointegration relationship between firm profitability and leverage (Table 2).

Calculated test statistics being smaller than critical values point out that alternative hypothesis of existence of cointegration between the series under multiple structural breaks is accepted. Maki (2012) test results show that the series are cointegrated in the long-run. This study estimates long-run parameters by the dynamic ordinary least squares (DOLS) method developed by Stock and Watson (1993). Break dates obtained from cointegration test are also included in the model.

The DOLS estimator is obtained from the Equation 18:

$$y_t = \alpha_0 + \alpha_1 t + \alpha_2 x_t + \sum_{i=-q}^q \delta_i \Delta x_{t-i} + \varepsilon_t \quad (18)$$

where q and ε_t represent optimum leads and lags, and error term, respectively.

Table 2: Results of Maki (2012) Cointegration Tests

	Models	Test Statistics	Critical Values			Break Dates	Existence of Cointegration	
			1%	5%	10%			
<i>ROA</i> → <i>CCC</i>	Null hypothesis is accepted	Model 0	-4.122	-5.959	-5.426	-5.131	1997.q1; 1998.q4; 2001.q4 2009.q2; 2018.q1	-
		Model 1	-5.312	-6.193	-5.699	-5.449	1999.q4; 2000.q2; 2008.q3 2012.q4; 2017.q1	-
		Model 2	-5.998	-6.915	-6.357	-6.057	2000.q4; 2002.q3; 2010.q4 2017.q1; 2022.q1	-
		Model 3	-6.421	-8.004	-7.414	-7.110	1998.q4; 2000.q2; 2012.q3 2018.q4; 2021.q4	-
<i>ROA</i> → <i>LEV</i>	Null hypothesis is rejected	Model 0	-4.879	-5.959	-5.426	-5.131	1998.q4; 2000.q4; 2009.q4 2012.q1; 2020.q2	-
		Model 1	-5.712**	-6.195	-5.699	-5.449	2000.q4; 2004.q2; 2009.q4 2012.q1; 2020.q2	+
		Model 2	-4.879	-6.915	-6.357	-6.057	1999.q1; 2002.q4; 2018.q4 2020.q1; 2022.q2	-
		Model 3	-6.759	-8.004	-7.414	-7.110	1999.q4; 2003.q3; 2008.q1 2017.q3; 2022.q2	-

Note: Critical values are obtained from Maki (2012). ** denotes significance level of 5%.

The long-run parameters estimated by DOLS method indicate that leverage has statistically negative effect on firm profitability. The other independent variable, cash conversion cycle has no significant effect on firm profitability.

Table 3: DOLS Estimation Results (Model 2)

Variables	Coefficients	t-statistics	Prob.
<i>LEV</i>	-0.003***	-1.812	0.081
D1	-0.052	-0.708	0.512
D2	0.140	2.288	0.018
D3	0.017	0.224	0.811
D4	-0.175	-2.912	0.005
D5	0.079	0.063	0.209
C	0.144	2.589	0.011

R^2 : 0.59; *D-W* test statistics: 1.51

Note: *** denotes significance level of 10%.

CONCLUSION

The aim of this study is to test the relationship between cash conversion cycle and firm profitability in Turkish retail industry. Through this aim, multiple structural breaks unit root test of Carrioni-i-Silvestre et al. (2009), multiple structural breaks cointegration test of Maki (2012) and dynamic ordinary least squares (DOLS) method developed by Stock and Watson (1993) are employed on a sample consisting of quarterly data of Turkish retailing industry consisting of Borsa Istanbul (BIST) listed retailing firms covering 1997.q1-2022.q4.

Unit root test results indicate that series are stationary at their first differences and the structural break dates estimated point out dramatic events for not only Turkish retail industry, but also the

entire Turkish economy. On 17 August 1999, a moment magnitude 7.6 earthquake struck the Marmara, causing high casualties and significant material damage on property. Following this earthquake, on 12 November 1999 another one occurred in Düzce with a moment magnitude of 7.2, again causing high damage and casualties. Then, on 19 February 2001 a crisis in the form of a virtual raid on foreign currencies emerged. After a recovery period following 2001 crises, Turkish economy faced with 2008 Financial Crisis. This crisis is considered by many economists as the worst financial crisis since the Great Depression. On 15 July 2016, a coup d'état was attempted against state institutions, including the government. This attempt failed after forces loyal to the state defeated the coup plotters. Beginning from 2018, Turkish currency and debt crisis is an ongoing financial and economic crisis in Turkey. The main characteristics of this crisis is the value decrease in the Turkish Lira high inflation, rising borrowing costs, and correspondingly rising loan defaults. These earthquakes and crises cause severe effects on retail industry and entire Turkish economy.

This study tests cointegration relationship and coefficients between firm profitability, cash conversion cycle and leverage by employing cointegration test of Maki (2012) and Stock and Watson (1993)'s dynamic ordinary least squares method, respectively. The results of Maki (2012) test indicate a cointegration relationship between firm profitability and leverage. The long-run parameters estimated by dynamic ordinary least squares method show that the only statistically significant relationship is between firm profitability and leverage. Accordingly, leverage has negative effect on profitability indicating that firm profitability decreases due to increase in leverage. The relationship between firm profitability and cash conversion cycle is not statistically significant. This finding is similar to Muscettola (2014).

References

- Abuzayed, B. 2012. Working capital management and firms' performance in emerging markets: the case of Jordan. *International Journal of Managerial Finance*, 8(2): 155-179.
- Afrifa, G.A., Padachi, K. 2016. Working capital level influence on SME profitability. *Journal of Small Business and Enterprise Development*, 23(1): 44-63.
- Ajilore, T. O., Falope, I. O. 2009. Working capital management and corporate profitability: evidence from panel data analysis of selected quoted companies in Nigeria. *Research Journal of Business Management*, 3(3): 73-84.
- Almaghrabi, K. S. 2022. COVID-19 and the cost of bond debt: the role of corporate diversification. *Finance Research Letters*, 46(B): 102454.
- Al-Mohareb, M., 2019. Cash conversion cycle and profitability evidence from Jordan. *Asian Journal of Finance and Accounting*, 11(2): 81-95.
- Alshubiri, F. (2011). The effect of working capital practices on risk management: evidence from Jordan. *Global Journal of Business Research*, 5(1): 39-54.
- Amouzesh N., Moeinfar, Z., Mousavi, Z. 2011. Sustainable growth rate and firm performance: evidence from Iran stock exchange. *International Journal of Business and Social Science* 2(23): 249-255.
- Anser, R., Malik, Q. A. 2013. Cash conversion cycle and firms' profitability - a study of listed manufacturing companies of Pakistan. *IOSR Journal of Business and Management*, 8(2): 83-87.
- Appuhami, R. 2008. The impact of firms' capital expenditure on working capital management: an empirical study across industries in Thailand. *International Management Review*, 4(1): 11-24.
- Attari, M. A., Raza, K. 2012. The optimal relationship of cash conversion cycle with firm size and profitability. *International Journal of Academic Research in Business and Social Sciences*, 2(4), 189-203.
- Banos-Caballero, S., Garcia-Teruel, P., Martinez-Solano, P. 2011. How does working capital management affect the profitability of Spanish SMEs. *Small Business Economics*, 39(2): 517-529.
- Berk, J., DeMarzo, P. 2017. *Corporate Finance*, 4th Edition, Pearson Education Limited, England.
- Carrioni-i-Silvestre, J. L., Kim, D., Perron, P. 2009. GLS-based unit root tests with multiple structural breaks under both the null and the alternative hypothesis. *Econometric Theory*, 25(6): 1754-1792.
- Carrioni-i-Silvestre, J. L., Sanso, A. 2006. Testing the null of cointegration with structural breaks. *Oxford Bulletin of Economics and Statistics*, 68(5): 623-646.
- Chakraborty, S. K. 1973. Use of operating cycle concept for better management of working capital. *The Economic and Political Weekly*, 8(34): 69-76.
- Cheatham, C. 1989. Economizing on cash investment in current assets. *Managerial Finance*, 15(6): 20-25.
- Cheatham, L., Dunn, P., Cheatham, C. 1989. Working capital financing and cash flow in the small business. *Journal of Business and Entrepreneurship*, 1(2): 1-12.
- Choudhary, H., Tripathi, G. 2012. An analysis of the inventory turnover and its impact on financial performance in Indian organized retail industry. *Journal of Services Research*, 12(1): 43-64.
- Churchill N., Mullins, J. 2001. How fast can your company afford to grow?. *Harvard Business Review*, 79(5): 135-143.
- Cielen, A., Peeters, L., Vanhoof, K. 2004. Bankruptcy prediction using a data envelopment analysis. *European Journal of Operational Research*, 154(2), 526-532.

- Coşkun, E. and Kök, D. (2011). Effect of working capital policies on profitability: a dynamic panel analysis. *Ege Academic Review*, 11(Special Issue): 75-85.
- Deloof, M. 2003. Does working capital management affect profitability of Belgian firms?. *Journal of Business Finance and Accounting*, 30(3-4): 573-588.
- Dobbs, R., Manyika, J., Woetzel, J. 2015. The four global forces breaking all the trends. *No Ordinary Disruption: The Four Global Forces Breaking All The Trends*, McKinsey Global Institute.
- Dong, H. P., Su, J. T. 2010. The relationship between working capital management and profitability: a Vietnam case. *International Research Journal of Finance and Economics*, 49(1): 59-67.
- Ebben, J., Johnson, A. 2011. Cash conversion cycle management in small firms: relationships with liquidity. *Journal of Small Business and Entrepreneurship*, 24(3): 381-396.
- Elliot, G., Rothenberg, T. J., Stock, J. H. 1996. Efficient tests for an autoregressive time series with a unit root. *Econometrica*, 64(4): 813-836.
- Erasmus, P. D. 2010. The relationship between working capital management and profitability for South African listed industrial firms. *The Business Review*, 15(1): 2-10.
- Farris II, M. T., Hutchison, P. D., Hasty, R.W. 2005. Using cash-to-cash to benchmark service industry performance. *Journal of Applied Business Research*, 21(2): 113-123.
- Fernandez-Lopez, S., Rodeiro-Pazos, D., Rey-Ares, L. 2020. Effects of working capital management on firms' profitability: evidence from cheese-producing companies. *Agribusiness*, 36(4), 770-791.
- Gadelius, A., Larsson, E. 2019. The impact of the global financial crisis on working capital management in Swedish listed firms. Available online: <https://www.semanticscholar.org/paper/The-impact-of-the-global-financial-crisis-on-in-Nilsson/7a882b480b1b2c969b62d188502b8b55b53cae7f> (accessed on 3 May 2023).
- Garanina, T. A., Petrova, O. 2015. Relationship between liquidity, cash conversion cycle and returns of Russian companies. *Journal of Corporate Finance Research*, 9(1): 33-40.
- Garcia-Teruel, J., Martinez-Solano, P. 2007. Effects of working capital management on SME profitability. *International Journal of Managerial Finance*, 3(2): 164-177.
- Gentry, J., Vaidyanathan, R., Lee, H. 1990. A weighted cash conversion cycle. *Financial Management*, 19(1): 90-99.
- Gill, A., Biger, N., Mathur, N. 2010. The relationship between working capital management and profitability: evidence from the United States. *Business and Economics Journal*, 10(1): 1-9.
- Gitman, L. J., Sachdeva, K. S. 1982. A framework for estimating and analyzing the required working capital investment. *Review of Business and Economic Research*, 17(3): 35-44.
- Gosman, M., Kelly, T. (2003). Working-capital efficiencies resulting from large retailers' power. *Commercial Lending Review*, 18(2): 25-31.
- Gregory, A.W., Hansen, B. E. 1996. Tests for cointegration in models with regime and trend shifts. *Oxford Bulletin of Economics and Statistics*, 58(3): 555-560.
- Habib, A. M., Kayani, U. N. 2022. Does the efficiency of working capital management affect a firm's financial distress? Evidence from UAE. *Corporate Governance*, 22(7): 1567-1586.
- Habib, A. M., Mourad, N. 2022. Analyzing the efficiency of working capital management: a new approach based on DEA-Malmquist technology. *Operations Research Forum*, 3(3): 31-51.
- Hager, H. C. 1976. Cash management and cash cycle. *Management Accounting*, 57(9): 19-21.

- Hassan, T. A., Hollander, S., Van Lent, L., Schwedeler, M., Tahoun, A. 2022. Firm-level exposure to epidemic diseases: covid-19, sars, and h1n1. NBER Working Paper 26971, New York.
- Hatemi-J, A. 2008. Tests for cointegration with two unknown regime shifts with an application to financial market integration. *Empirical Economics*, 35: 497-505.
- Jose, M., Lancaster, C., Stevens, J. L. 1996. Corporate returns and cash conversion cycles. *Journal of Economics and Finance*, 20(1): 33-46.
- Kamath, R. 1989. How useful are common liquidity measures?. *Journal of Cash Management*, 9(1): 24-28.
- Kim, D., Perron, p. 2009. Unit root tests allowing for a break in the trend function at an unknown time under both the null and alternative hypothesis. *Journal of Econometrics*, 148(1): 1-13.
- Lazaridis, I., Tryfonidis, D. 2006. Relationship between working capital management and profitability of listed companies in the Athens stock exchange. *Journal of Financial Management and Analysis*, 19(1): 26-35.
- Louw, E., Hall, J., Brümmer, L. 2016. Working Capital Management of South African Retail Firms. *Journal of Economic and Financial Services*, 9(2): 545-560.
- Lyrودي, K., Lazaridis, Y. 2000. The cash conversion cycle and liquidity analysis of the food industry in Greece. Available at SSRN: <http://dx.doi.org/10.2139/ssrn.236175>
- Maki, D. 2012. Tests for cointegration allowing for an unknown number of breaks. *Economic Modelling*, 29(5): 2011-2015.
- Mathuva, D. M. 2014. An empirical analysis of the determinants of the cash conversion cycle in Kenyan listed non-financial firms. *Journal of Accounting in Emerging Economies*, 4(2): 175-196.
- Modigliani, F. 1957. Business reasons for holding inventories and their macro-economic implications. In *Problems of Capital Formation: Concepts, Measurement, and Controlling Factors*. Conference on Research in Income and Wealth, NBER: 495-511.
- Mohamad, N. E. A. B., Saad, N. B. M. 2010. Working capital management: The effect of market valuation and profitability in Malaysia. *International Journal of Business and Management*, 5(11): 140-147.
- Moss, J. D., Stine, B. 1989. Liquidity characteristics of small and large manufacturing firms. *Managerial Finance*, 15(6): 14-19.
- Moss, J. D., Stine, B. 1993. Cash conversion cycle and firm size: a study of retail firms. *Managerial Finance*, 19(8): 25-34.
- Mukherjee T., Sen, S. S. (2018) Sustainable growth: a study on some selected banks in India. *International Journal of Money, Banking and Finance*, 6(1): 52-59.
- Muscettola, M. 2014. Cash conversion cycle and firm's profitability: an empirical analysis on a sample of 4,226 manufacturing SMEs of Italy. *International Journal of Business and Management*, 9(5): 25-35.
- Ng, S., Perron, P. 2001. Lag length selection and the construction of unit root tests with good size and power. *Econometrica*, 69(6): 1519-1554.
- Nobanee, H., Abdullatif, M., Al-Hajjar, M., 2011. Cash conversion cycle and firm's performance of Japanese firms. *Asian Review of Accounting*. 19(2): 147-156.
- Panigrahi, C. M. A. 2013. Cash conversion cycle and firms' profitability - a study of cement manufacturing companies of India. *International Journal of Current Research*, 5(6): 1484-1488.
- Perron, P., Ng, S. 1998. An autoregressive spectral density estimator at frequency zero for nonstationarity tests. *Econometric Theory*, 14(5): 560-603.

- Perron, P., Qu, Z. 2007. A simple modification to improve the finite sample properties of Ng and Perron's unit root tests. *Economics Letters*, 94(1): 12-19.
- Perron, P., Rodriguez, G. 2003. GLS detrending efficient unit root tests and structural change. *Journal of Econometrics*, 115(1): 1-27.
- Raheman, A., Nasr, M. 2007. Working capital management and profitability - case of Pakistani firms. *International Review of Business Research Papers*, 3(1): 279-300.
- Ramachandran, A., Janakiraman, M. 2009. The relationship between working capital management efficiency and EBIT. *Managing Global Transitions: International Research Journal*, 7(1): 61-74.
- Sagan, J. 1955. Towards a theory of working capital management. *The Journal of Finance*, 10(2): 121-129.
- Şamiloğlu, F., Demirgüneş, K. 2008. The effect of working capital management on firm profitability: evidence from Turkey. *The International Journal of Applied Economics and Finance*, 2(1): 44-50.
- Shailaja, S. M. 2017. Inventory and capital-intensive businesses and cash flow management in small industries - an overview. *Journal of Emerging Technologies and Innovative Research*, 4(8): 451-458.
- Sharma, A. K., Kumar, S. 2011. Effect of working capital management on firm profitability: empirical evidence from India. *Global Business Review*, 12(1): 159-173.
- Shin, H. H., Soenen, L. 1998. Efficiency of working capital management and corporate profitability. *Financial Practice and Education*, 8(2), 39-45.
- Shulman, J. M., Cox, R. A. K. 1985. An integrative approach to working capital management. *Journal of Cash Management*, 5(6): 64-67.
- Smith, K. V. 1973. State of the art of working capital management. *Financial Management*, 2(3): 50-55.
- Smith, K. V. 1980. Profitability versus liquidity tradeoffs in working capital management. readings on the management of working capital. West Publishing Company, New York.
- Smith, M. B., Fletcher, L. 2009. Factors influencing working capital management in South Africa. *Journal of the Southern African Institute for Management Scientists*, 18(3): 15-24.
- Soenen, L. A. 1993. Cash conversion cycle and corporate profitability. *Journal of Cash Management*, 13(4), 53-53.
- Stock, J. H., Watson, M. W. 1993. A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica*, 61(4): 783-820.
- Tekin, B., Gör, Y. 2022. Cash conversion cycle and its relationship with profitability as a cash management tool in companies: an application on companies trading in Borsa Istanbul. *Theoretical and Applied Economics*, 29(3): 113-130.
- Ulrich, T. A., Reinhart, W. J. 1991. Differences in cash conversion cycles between large and small firms. *Journal of Small Business Finance*, 1(1): 95-96.
- Walker, E. W. 1964. Towards a theory of working capital. *Engineering Economist*, 9: 21-35.
- Wang, B. 2019. The cash conversion cycle spread. *Journal of Financial Economics*, 133(2): 472-497.
- Wang, Y.-J. 2002. Liquidity management, operating performance, and corporate value: evidence from Japan and Taiwan. *Journal of Multinational Financial Management*, 12(2): 159-169.

- Westerlund, J., Edgerton, D. L. 2007. A panel bootstrap cointegration tests. *Economics Letters*, 97(3): 185-190.
- Yazdanfar, D., Ohman, P. 2014. The impact of cash conversion cycle on firm profitability: an empirical study based on Swedish data. *International Journal of Managerial Finance*, 10(4): 442-452.
- Zivot, E., Andrews, D. W. K. 1992. Further evidence on the Great Crash, the Oil Price Shock, and the unit-root hypothesis. *Journal of Business and Economic Studies*, 10(3): 251-270.

**THE EFFECT OF THE FERMENTATION PROCESS ON GARLIC (*Allium sativum*)
COMPOSITION AND THE USE OF RAW AND FERMENTED GARLIC IN
POULTRY NUTRITION**

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ABSTRACT

Garlic (*Allium sativum*) is a food that mainly contains organosulfur compounds such as alliin, allicin, S-allyl cysteine, diallyl sulfide, diallyl disulfide and diallyl trisulfide. Garlic contains antibacterial, antioxidant, antifungal, anti-atherosclerotic, hypoglycemic, and antitumoral properties due to these bioactive components, which play significant roles in cellular metabolism. Despite these positive benefits, its characteristic smell and aroma greatly limit its consumption as a raw form. It is known that the substance causing the smell originates from the allicin, which is released as a result of the degradation of the raw garlic heads and the decomposition of alliin by the alliinase enzyme. Various methods are used to prevent this reaction. Special fermentation devices without using any additives have been developed for the fermentation of raw garlic heads. In this fermentation the color of raw garlic turns black as a result of the non-enzymatic Maillard reaction. The obtained product is called as black garlic due to its color. There are differences in physical and chemical properties between raw and black garlic due to fermentation processes. Since the alliinase enzyme becomes inactive during fermentation, the smell of raw garlic can be eliminated by converting alliin into S-allyl cysteine rather than the odor-causing allicin. S-allyl cysteine produced during fermentation has strong antioxidant properties. Many studies have reported that black garlic contains higher levels of phenolic compounds, methionine and arginine than raw garlic. Although the consumption of raw garlic above a certain level causes a toxic effect, the black garlic consumption is more reliable. There were many studies investigating the effects of the use of different forms of garlic in diets on performance, egg and meat quality, oxidative stress and cholesterol content in poultry. However, there are limited number of studies on the use of black garlic. In this review, the chemical and physical properties of raw and black garlic and the studies about the usage of these different forms of garlic in poultry nutrition were summarized.

Keywords: Poultry nutrition, black garlic, raw garlic, bioactive compounds, fermentation

INTRODUCTION

The ban on the use of antibiotics at sub-therapeutic levels to promote growth in animal nutrition due to bacterial resistance and residues in products has increased interest in phytobiotics as an alternative natural additive (Diaz-Sanchez et al., 2015). Phytobiotics include a wide range of herbs, spices, and botanical products such as medicinal and aromatic plants and their extracts (Mohammadi-Gheisar and Kim, 2018). They show antioxidant, antibacterial, antiviral, antifungal, and anti-inflammatory properties due to their bioactive components (Bagno et al., 2018). One of the important phytobiotics is the garlic (*Allium sativum*). Garlic is a member of the Alliaceae family (Najman et al., 2021) and the genus *Allium* (Stavělíková, 2008). Garlic, one of the oldest known plants, has great importance in production in Turkey. According to Turkish Statistical Institute (TUIK) data, 47.487 tons of fresh (green) and 140.464 tons of dry garlic were produced in 2022 (TUIK, 2023).

Garlic can be consumed fresh and raw as well as in different forms such as dried, powdered, pureed, juice, and essential oil (Evren et al., 2006). It has important activities due to having organosulfur compounds, saponins, and phenolic substances (Shang et al., 2019). When the integrity of the garlic heads is disrupted through crushing, shredding or cutting, the odorless alliin is converted to allicin by the action of the enzyme alinase (Kovarovič et al., 2019). Allicin gives garlic a characteristic odor and aroma (Borlinghaus et al., 2021). This limits the raw consumption of garlic (Zhang et al., 2016; Daliri et al., 2019; Qiu et al., 2020). Various methods are used to prevent this situation. One of them is the fermentation of garlic (Daliri et al., 2019; Qiu et al., 2020). Black garlic is obtained after the fermentation process carried out at a certain temperature, and humidity at an appropriate time (Kimura et al., 2017; Zhang et al., 2016). The appearance of raw garlic and black garlic is given in Figure 1 (Afzaal et al., 2021). In this review, the composition of raw and black garlic, the effect of the fermentation process on garlic composition, and studies in poultry are summarized.



Figure 1. The appearance of raw garlic (a) and black garlic (b) (Afzaal et al., 2021)

Effect of Fermentation Process on Garlic Composition (Black Garlic)

Garlic, one of the oldest known medicinal aromatic plants, has antioxidant (Santhosha et al., 2013; Jang et al., 2018), antibacterial (Srinivasan et al., 2004), anti-inflammatory (Çiçek, 2022), anticancer (Srinivasan et al., 2004; Santhosha et al., 2013), hypocholesterolemic (Yeh and Liu, 2001), hypolipidemic (Zeng et al., 2013), hepatoprotective (Santhosha et al., 2013) and cardioprotective properties (Çiçek, 2022) due to having various bioactive components (Santhosha et al., 2013). The main organosulfur compounds found in *Allium* species are given in Figure 2 (Poojary et al., 2017).

Black garlic is produced by keeping garlic heads under high temperatures (60-90°C) with controlled humidity (80-90%) for a certain period of time (Kimura et al., 2017). High temperature causes the loss of alliinase enzyme activity (Ríos-Ríos et al., 2016). In this case, alliin is converted to S-allyl cysteine instead of allicin which causes odor (Karakaya et al., 2020). S-allyl cysteine is known to be a powerful antioxidant (Geddo et al., 2023). Therefore, black garlic has higher antioxidant activity than raw garlic (Akan, 2014; Afzaal et al., 2021). Color changes in garlic according to the fermentation time are given in Figure 3 (Choi et al., 2014). Total phenolic substances, flavonoid content and antioxidant activity of raw and black garlic for the extracts of ethanol and water were given in Table 1 (Atun et al., 2021). Differences in the total phenolic substances and flavonoid levels were observed between raw and black garlic. The antioxidant activity of black garlic extract was higher than that of the raw form (Atun et al., 2021).

Tahir et al. (2022) showed that moisture of garlic was reduced whereas the contents of crude protein, crude fiber, crude ash and soluble carbohydrates were increased after fermentation of different varieties (*desi* and *farmi*) of garlic in Pakistan.

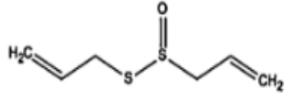
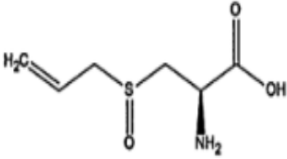
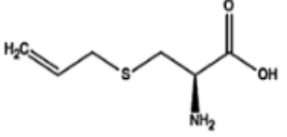
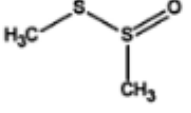
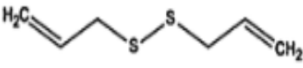
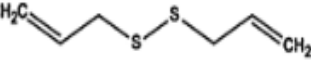
Allicin	Alliin	S-Allyl cysteine
		
S-Methylthiomethanesulfinate	Di-allyl disulphide	Di-allyl tri-sulphide
		

Figure 2. Some organosulfur compounds found in garlic (Poojary et al., 2017)

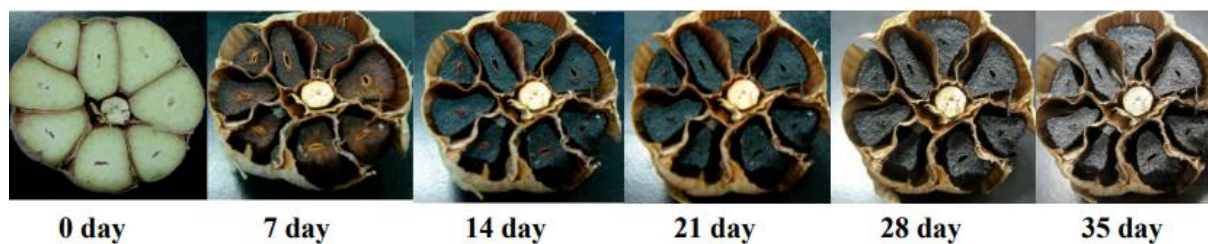


Figure 3. Color changes according to fermentation time (Choi et al., 2014)

Table 1. Total phenolic substances, flavonoid content and antioxidant activity of raw and black garlic (Atun et al., 2021)

Extract	Total phenolic substances (mg gallic acid/g)	Flavonoid (mg rutin/g)	Antioxidant activity (IC ₅₀ , µg/ml)
Raw garlic			
Ethanol	71.54	2.32	938.90
Water	165.16	ND	913.08
Black garlic			
Ethanol	306.09	9.25	38.61
Water	296.32	ND	220.71

ND: not detected

Studies on the Use of Raw Garlic in Poultry Nutrition

There are many studies investigating the usage of raw garlic in poultry nutrition. Some of these are summarized in Table 2.

Table 2. Some studies of raw garlic in poultry nutrition

Garlic form	Garlic dose	References
Laying hen		
Garlic paste	%0, 2, 4, 6, 8 10	Chowdhury et al. (2002)
Powder	0, 5, 10 g/kg	Yalçın et al. (2006)
Powder	%0, 2, 6, 8	Khan et al. (2008)
Powder	%0, 0.5, 1, 2	Canogullari et al. (2009)
Garlic juice	0, 3.75, 7.5, 15 ml	Mahmoud et al. (2010)
Aged garlic extract	%0, 0.5, 1, 2	Hossain et al. (2015)
Extract	% 0, 0.0032	Damaziak et al. (2017)
Powder	%0, 0.5, 1, 2	Kolawole and Folake (2019)
Powder	%0, 0.25, 0.5, 1	Mousa et al. (2019)
Powder	%0, 0.5, 1	Omer et al. (2019)
Garlic paste	%0, 1	Omri et al. (2019)
Broiler		
Garlic meal	%0, 0.125, 0.25, 0.5, 1, 2	Adibmoradi et al. (2006)
Powder	0, 500, 5000 mg/kg	Onibi et al. (2009)
Powder	%0, 0.5, 1, 3	Raeesi et al. (2010)
Powder	0, 1 g/kg	Mansoub (2011)
Powder	0, 2, 4 g/kg	Toghyani et al. (2011)
Aqueous extract	0, 50 ml/l water	Oleforuh-Okoleh et al. (2015)
Powder	%0, 1	Karangiya et al. (2016)
Powder	%0, 0.25, 0.50, 0.75	Khaidem et al. (2019)
Powder	%0, 1, 3, 5	Mulugeta et al. (2019)
Garlic paste	%0, 0.25, 0.50	Sangilimadan et al. (2019)
Extract	0, 1 ml/l	Sözcü (2019)
Nanoencapsule (oil)	0, 100, 200 mg/kg	Amiri et al. (2021)
Powder	0, 0.5 g/kg	Elbaz et al. (2021)
Powder	%0, 3	Tanti et al. (2022a)
Quail		
Powder	%0, 5, 10 g/kg	Yalçın et al. (2007)
Powder	%0, 0.5, 1, 2, 4	Güçlü et al. (2010)
Powder	%0, 2, 4	Ismael and Ameen (2022)
Powder	%0, 1, 2, 4	Canogullari et al. (2010)
Garlic meal	%0, 1, 2, 3	Nurhayati et al. (2023)
Powder	%0, 0.5, 1, 1.5, 2	Saghi and Zarghi (2022)
Powder	%0, 4	Sobhani et al. (2023)

Garlic usage in the diets of laying hens in different doses has increased egg production (Canogullari et al., 2009) and egg weight (Yalçın et al., 2006). In contrast to these studies, there are studies showing that garlic in different forms and doses in laying hen diets had no significant effect on body weight gain (Chowdhury et al., 2002; Yalçın et al., 2006; Mousa et al., 2019), egg weight (Chowdhury et al., 2002; Khan et al., 2008), egg mass (Chowdhury et al., 2002; Khan et al., 2008; Omri et al., 2019), egg production (Yalçın et al., 2006; Hossain et al., 2015), feed intake (Chowdhury et al., 2002; Yalçın et al., 2006; Khan et al., 2008; Canogullari et al.,

2009; Hossain et al., 2015) and feed conversion ratio (Chowdhury et al., 2002; Yalçın et al., 2006; Khan et al., 2008; Canogullari et al., 2009; Kolawole and Folake, 2019; Omri et al., 2019). It has been indicated that garlic had no significant effect on shape index (Yalçın et al., 2006), yolk index (Yalçın et al., 2006; Kolawole and Folake, 2019), yolk weight (Canogullari et al., 2009; Kolawole and Folake, 2019) albumen index (Yalçın et al., 2006), Haugh unit (Yalçın et al., 2006), shell thickness (Omri et al., 2019) and breaking strength (Yalçın et al., 2006). In contrast to these studies, Omri et al. (2019) determined that garlic increased albumen and yolk weight; while Hossain et al. (2015) observed that garlic increased yolk height and shell thickness. In some studies the levels of egg cholesterol (Yalçın et al., 2006; Kolawole and Folake, 2019; Omri et al., 2019) and serum cholesterol (Yalçın et al., 2006; Hossain et al., 2015; Omri et al., 2019), triglyceride (Yalçın et al., 2006) and LDL (Canogullari et al., 2009) were decreased by dietary garlic supplementation. Hossain et al. (2015) found that aged garlic extract increased the serum lymphocyte and IgG values and decreased the number of *Escherichia coli* in excreta of laying hens. Mousa et al. (2019) reported that garlic supplementation decreased the total aerobic bacteria in the cecum, but did not significantly affect duodenum and jejunum morphology (villus height, crypt depth, villus width) and internal organ (liver, heart, spleen, gizzard) weights.

Different levels and forms of garlic in broiler diets had no significant effect on body weight (Khaidem et al., 2019), body weight gain (Onibi et al., 2009; Khaidem et al., 2019), feed intake (Onibi et al., 2009; Toghyani et al., 2011; Khaidem et al., 2019), feed efficiency (Onibi et al., 2009; Toghyani et al., 2011; Khaidem et al., 2019), and weights of gizzard, liver, heart, thigh, breast, abdominal fat (Onibi et al., 2009). Garlic supplementation improved meat shelf life by reducing MDA level (Onibi et al., 2009).

Garlic supplementation decreased serum LDL (Toghyani et al., 2011; Elbaz et al., 2021), triglyceride (Elbaz et al., 2021), and cholesterol (Elbaz et al., 2021), and increased HDL (Toghyani et al., 2011; Elbaz et al., 2021), hemoglobin (Toghyani et al., 2011) and hematocrit (Toghyani et al., 2011) levels in blood in broilers. In the study of Sangilimadan et al. (2019), dietary garlic improved body weight and feed efficiency but did not affect carcass characteristics in broilers. *Lactobacillus* counts were increased and *E. coli* and total coliform counts were decreased in the ileum with the usage of garlic in broilers (Elbaz et al., 2021).

In a study conducted on quails (Yalçın et al., 2007), garlic did not affect live weight, egg production, feed intake, feed efficiency, and egg quality characteristics (albumen index, yolk

index, Haugh unit) but increased egg weight. Yalçın et al. (2007) also determined that garlic significantly decreased serum cholesterol levels. In the study of Sobhani et al. (2023), garlic decreased the *E. coli* level and increased the number of *Lactobacillus* in the intestine of male quails. Sobhani et al. (2023) also stated that garlic improved some sperm parameters (viability, acrosome integrity, sperm production).

Studies on the Use of Black Garlic in Poultry Nutrition

According to the literature review, it is seen that there are a limited number of studies investigating the possibilities of using black garlic, which is obtained by fermentation, in poultry nutrition. Some of these studies are summarized in Table 3.

Table 3. Some studies on black garlic in poultry nutrition

Garlic form	Garlic dose	References
Broiler		
Powder	%0, 3	Tanti et al. (2022a)
Powder	%0, 1, 2, 3	Tanti et al. (2022b)
Powder	%0, 3	Tanti et al. (2023)
Powder	%0, 3	Zulfikar et al. (2022)
Quail		
Garlic meal	%0, 1, 2, 3	Nurhayati et al. (2023)

Nurhayati et al. (2023) added different levels (0, 1, 2, 3%) of raw and black garlic to quail diets and observed no significant effect on egg weight, egg mass, feed efficiency, serum total cholesterol, LDL, and HDL levels. Egg production, feed intake, and meat protein percentages were increased and the percentage of meat fat decreased with black garlic supplementation in the diet of quails. Nurhayati et al. (2023) concluded that black garlic can be used instead of raw garlic to improve performance in quails.

Zulfikar et al. (2022) reported that black garlic at 3% level in the diet affected feed intake and abdominal fat weight, but did not affect carcass percentages in broilers. In a study conducted by Tanti et al. (2023), 3% black garlic powder had no significant effect on final body weight, body weight gain, feed intake, feed efficiency, and intestinal length in broilers. Tanti et al. (2023) also stated that black garlic increased the width and height of intestinal villi.

CONCLUSION

Various additives are used to increase the quantity and quality of animal products and to protect animal health. Since some of these additives are controversial and limited in use due to their

properties. Garlic contains organosulfur compounds and phenolic substances. However, its characteristic odor and aroma limit its consumption as raw. When raw garlic is fermented, its odor and aroma disappear and the antioxidant content increases due to the release of S-allyl cysteine in significant amounts. There are many studies on the use of raw garlic in poultry nutrition. However, studies about the usage of black garlic in poultry feeding are very limited. Therefore, there is a need for a comprehensive investigation of the use of black garlic as a feed additive in poultry.

REFERENCES

- Adibmoradi, M., Navidshad, B., Seifdavati, J. & Royan, M. (2006). Effect of dietary garlic meal on histological structure of small intestine in broiler chickens. *The Journal of Poultry Science*, 43(4), 378-383.
- Afzaal, M., Saeed, F., Rasheed, R., Hussain, M., Aamir, M., Hussain, S. & Anjum, F.M. (2021). Nutritional, biological, and therapeutic properties of black garlic: a critical review. *International Journal of Food Properties*, 24(1), 1387-1402.
- Akan, S. (2014). Siyah sarımsak. *Gıda*, 39(6).
- Amiri, N., Afsharmanesh, M., Salarmoini, M., Meimandipour, A., Hosseini, S.A. & Ebrahimnejad, H. (2021). Nanoencapsulation (*in vitro* and *in vivo*) as an efficient technology to boost the potential of garlic essential oil as alternatives for antibiotics in broiler nutrition. *Animal*, 15(1), 100022.
- Atun, S., Aznam, N., Arianingrum, R., Senam, Devi, Y. & Melasari, R. (2021). Characterization and biological activity test of garlic and its fermentation as antioxidant, analgesic, and anticancer. *Advances in Social Science, Education and Humanities Research*, 528, 159-165.
- Bagno, O.A., Prokhorov, O.N., Shevchenko, S.A., Shevchenko, A.I. & Dyadichkina, T.V. (2018). Use of phytobiotics in farm animal feeding (review). *Agricultural Biology*, 53(4), 687-697.
- Borlinghaus, J., Foerster, J., Kappler, U., Antelmann, H., Noll, U., Gruhlke, M.C. & Slusarenko, A.J. (2021). Allicin, the odor of freshly crushed garlic: A review of recent progress in understanding allicin's effects on cells. *Molecules*, 26(6), 1505.
- Canogullari, S., Karaman, M., Erdogan, Z., Baylan, M., Kucukgul, A., Duzguner, V. & Ozugur, A.K. (2009). Effect of garlic powder on egg yolk and serum cholesterol and performance of laying hens. *Bulletin of the Veterinary Institute in Pulawy*, 53(3), 515-519.
- Canogullari, S., Baylan, M., Erdogan, Z., Duzguner, V. & Kucukgul, A. (2010). The effects of dietary garlic powder on performance, egg yolk and serum cholesterol concentrations in laying quails. *Czech Journal of Animal Science*, 55(7), 286-293.
- Choi, I.S., Cha, H.S. & Lee, Y.S. (2014). Physicochemical and antioxidant properties of black garlic. *Molecules*, 19(10), 16811-16823.
- Chowdhury, S.R., Chowdhury, S.D. & Smith, T.K. (2002). Effects of dietary garlic on cholesterol metabolism in laying hens. *Poultry Science*, 81(12), 1856-1862.
- Çiçek, İ.S. 2022. Siyah sarımsağın kardiyovasküler hastalıklar üzerine etkisi. *Fenerbahçe Üniversitesi Sağlık Bilimleri Dergisi*, 2(1), 299-311.
- Daliri, E.B.M., Kim, S.H., Park, B.J., Kim, H.S., Kim, J.M., Kim, H.S. & Oh, D.H. (2019). Effects of different processing methods on the antioxidant and immune stimulating abilities of garlic. *Food Science & Nutrition*, 7(4), 1222-1229.
- Damaziak, K., Riedel, J., Gozdowski, D., Niemiec, J., Siennicka, A. & Róg, D. (2017). Productive performance and egg quality of laying hens fed diets supplemented with garlic and onion extracts. *Journal of Applied Poultry Research*, 26(3), 337-349.
- Diaz-Sanchez, S., D'Souza, D., Biswas, D. & Hanning, I. (2015). Botanical alternatives to antibiotics for use in organic poultry production. *Poultry Science*, 94(6), 1419-1430.
- Elbaz, A.M., Ibrahim, N.S., Shehata, A.M., Mohamed, N.G. & Abdel-Moneim, A.M.E. (2021). Impact of multi-strain probiotic, citric acid, garlic powder or their combinations on performance, ileal histomorphometry, microbial enumeration and humoral immunity of broiler chickens. *Tropical Animal Health and Production*, 53, 1-10.
- Evren, M., Apan, M. & Albayram, C. (2006). Sarımsağın antimikrobiyal özellikleri. *Türkiye 9. Gıda Kongresi. Bolu, Turkey: Gıda Teknolojisi Derneği Yayın No: 33.*

- Geddo, F., Querio, G., Asteggiano, A., Antoniotti, S., Porcu, A., Occhipinti, A., Medana, C. & Gallo, M.P. (2023). Improving endothelial health with food-derived H₂S donors: an in vitro study with S-allyl cysteine and with a black-garlic extract enriched in sulfur-containing compounds. *Food & Function*, DOI: 10.1039/d3fo00412k.
- Güçlü, B.K., Eren, M., Uyanık, F. & Kara, K. (2010). Japon bildirem (*Coturnix coturnix Japonica*) yemlerine ilave edilen sarımsak tozunun performans, yumurta kalitesi, bazı biyokimyasal parametreler ve yumurta sarısı kolesterolüne etkisi. *Erciyes Üniversitesi Veteriner Fakültesi Dergisi*, 7(2), 89-97.
- Hossain, M.M., Begum, M. & Kim, I.H. (2015). Effect of *Leuconostoc mesenteroides* KCCM35046 fermented aged garlic extract on egg production, egg quality, odour gas emissions, targeted *E. coli* colony, haematological characteristics and fatty acids composition of egg yolk in laying hens. *Journal of Applied Animal Research*, 44(1), 458-465.
- Ismael, L.A. & Ameen, E.M. (2022). Reproductive, biochemical, and hormonal traits of local quail in response to dietary supplementation of dried garlic powder. *Iraqi Journal of Agricultural Sciences*, 53(2), 278-287.
- Jang, H.J., Lee, H.J., Yoon, D.K., Ji, D.S., Kim, J.H. & Lee, C.H. (2018). Antioxidant and antimicrobial activities of fresh garlic and aged garlic by-products extracted with different solvents. *Food Science and Biotechnology*, 27, 219-225.
- Karakaya, H., Öztürk, F. & Yılmaztekin, M. (2020). Taze ve olgunlaştırılmış Taşköprü sarımsağından (*Allium sativum* L.) farklı çözücüler kullanılarak elde edilen ekstraktların antimikrobiyal aktivitelerinin karşılaştırılması. *Gümüşhane Üniversitesi Fen Bilimleri Dergisi*, 10(3), 762-770.
- Karangiya, V.K., Savsani, H.H., Patil, S.S., Garg, D.D., Murthy, K.S., Ribadiya, N.K. & Vekariya, S.J. (2016). Effect of dietary supplementation of garlic, ginger and their combination on feed intake, growth performance and economics in commercial broilers. *Veterinary World*, 9(3), 245.
- Khaidem, A., Zuyie, R., Haque, N. & Vidyarthi, V.K. (2019). Effect of garlic supplementation on performance, carcass traits and blood profile of broiler chicken. *International Journal of Bio-resource and Stress Management*, 10(3), 292-297.
- Khan, S.H., Hasan, S., Sardar, R. & Anjum, M.A. (2008). Effects of dietary garlic powder on cholesterol concentration in Native Desi laying hens. *American Journal of Food Technology*, 3(3), 207-213.
- Kimura, S., Tung, Y.C., Pan, M.H., Su, N.W., Lai, Y.J. & Cheng, K.C. (2017). Black garlic: A critical review of its production, bioactivity, and application. *Journal of Food and Drug Analysis*, 25(1), 62-70.
- Kolawole, F.S.O. & Folake, A.O. (2019). Egg traits and productive performance of Isa-Brown laying hens fed garlic supplemented diets. *Asian Journal of Applied Sciences*, 7(4).
- Kovarovič, J., Bystricka, J., Vollmannová, A., Tóth, T. & Brindza, J. (2019). Biologically valuable substances in garlic (*Allium sativum* L.)—A review. *Journal of Central European Agriculture*, 20(1), 292-304.
- Mahmoud, K.Z., Gharaibeh, S.M., Zakaria, H.A. & Qatramiz, A.M. (2010). Garlic (*Allium sativum*) supplementation: Influence on egg production, quality, and yolk cholesterol level in layer hens. *Asian-Australasian Journal of Animal Sciences*, 23(11), 1503-1509.
- Mansoub, N.H. (2011). Comparative effects of using garlic as probiotic on performance and serum composition of broiler chickens. *Annals of Biological Research*, 2(3), 486-490.
- Mohammadi Gheisar, M. & Kim, I.H. (2018). Phytobiotics in poultry and swine nutrition—a review. *Italian Journal of Animal Science*, 17(1), 92-99.

- Mousa, B.H., Awad, A.M., Alhamdani, H.A.A., Nafea, H.H. & Alhamdani, A.A. (2019). Inclusion of Garlic (*Allium sativum*.) and Turmeric (*Curcuma longa* L.) powder to laying hens' diets on egg quality traits, bacterial population and intestinal histomorphology. *Annals of Tropical Medicine and Public Health*, 22, 231-240.
- Mulugeta, M., Worku, Z., Seid, A. & Debela, L. (2019). Effect of garlic powder (*Allium sativum*) on performance of broiler chicken. *Livestock Research for Rural Development*, 31.
- Najman, K., Sadowska, A. & Hallmann, E. (2021). Evaluation of bioactive and physicochemical properties of white and black garlic (*Allium sativum* L.) from conventional and organic cultivation. *Applied Sciences*, 11(2), 874.
- Nurhayati, N., Berliana, B., Nelwida, N., Muthalib, R.A. & Alwi, Y. (2023). Effect of using black garlic instead of fresh garlic in the ration on the performances and blood cholesterol properties of quail. *Jurnal Agripet*, 23(1), 91-97.
- Oleforuh-Okoleh, V.U., Ndofor-Foleng, H.M., Olorunleke, S.O. & Uguru, J.O. (2015). Evaluation of growth performance, haematological and serum biochemical response of broiler chickens to aqueous extract of ginger and garlic. *Journal of Agricultural Science*, 7(4), 167.
- Omer, H.A., Ahmed, S.M., Abdel-Magid, S.S., El-Mallah, G.M., Bakr, A.A. & Abdel Fattah, M.M. (2019). Nutritional impact of inclusion of garlic (*Allium sativum*) and/or onion (*Allium cepa* L.) powder in laying hens' diets on their performance, egg quality, and some blood constituents. *Bulletin of the National Research Centre*, 43, 1-9.
- Omri, B., Larbi Manel, B., Jihed, Z., Durazzo, A., Lucarini, M., Romano, R., Santini, A. & Abdouli, H. (2019). Effect of a combination of fenugreek seeds, linseeds, garlic and copper sulfate on laying hens performances, egg physical and chemical qualities. *Foods*, 8(8), 311.
- Onibi, G.E., Adebisi, O.E., Fajemisin, A.N. & Adetunji, A.V. (2009). Response of broiler chickens in terms of performance and meat quality to garlic (*Allium sativum*) supplementation. *African Journal of Agricultural Research*, 4(5), 511-517.
- Poojary, M.M., Putnik, P., Kovačević, D.B., Barba, F.J., Lorenzo, J.M., Dias, D.A. & Shpigelman, A. (2017). Stability and extraction of bioactive sulfur compounds from *Allium* genus processed by traditional and innovative technologies. *Journal of Food Composition and Analysis*, 61, 28-39.
- Qiu, Z., Zheng, Z., Zhang, B., Sun-Waterhouse, D. & Qiao, X. (2020). Formation, nutritional value, and enhancement of characteristic components in black garlic: A review for maximizing the goodness to humans. *Comprehensive Reviews in Food Science and Food Safety*, 19(2), 801-834.
- Raeesi, M., Hoseini-Aliabad, S.A., Roofchae, A., Shahneh, A.Z. & Pirali, S. (2010). Effect of periodically use of garlic (*Allium sativum*) powder on performance and carcass characteristics in broiler chickens. *International Journal of Animal and Veterinary Sciences*, 4(8), 683-689.
- Ríos-Ríos, K.L., Gaytán-Martínez, M., Mercado-Silva, E., Rivera-Pastrana, D.M., Moreno-Mayorga, S. & Vázquez-Barrios, M.E. (2016). Effect of convective drying pretreatment on the physicochemical properties of black garlic. In VIII International Postharvest Symposium: Enhancing Supply Chain and Consumer Benefits-Ethical and Technological Issues, 1194, 845-852.
- Saghi, R. & Zarghi, H. (2022). The effect of different levels of garlic powder on performance, carcass efficiency and serum metabolites of Japanese quail. *Animal Sciences Journal*, 34(133), 31-44.

- Sangilimadan, K., Richard Churchil, R., Premavalli, K. & Omprakash, A. (2019). Effect of garlic (*Allium sativum*) on production performances and carcass traits of Nandanam Broiler-2. *International Journal of Current Microbiology and Applied Sciences*, 8(4), 2531-2538.
- Santhosha, S.G., Jamuna, P. & Prabhavathi, S.N. (2013). Bioactive components of garlic and their physiological role in health maintenance: A review. *Food Bioscience*, 3, 59-74.
- Shang, A., Cao, S.Y., Xu, X.Y., Gan, R.Y., Tang, G.Y., Corke, H., Mavumengwana, V. & Li, H.B. (2019). Bioactive compounds and biological functions of garlic (*Allium sativum* L.). *Foods*, 8(7), 246.
- Sobhani, K., Vaziry, A., Farzinpour, A. & Meraati, Z. (2023). Effect of garlic (*Allium Sativum*) powder-supplemented diet on productive performance, immune response, intestinal microbial flora, liver histopathology, and some blood and sperm parameters in male Japanese quail. *Veterinary Research & Biological Products*, 36(1), 2-12.
- Sözcü, A. (2019). Etlik piliçlerde içme suyuna sarımsak (*Allium sativum* L.) ekstraktı ilavesinin büyüme performansı, serum biyokimyasal ve immünolojik parametreler üzerine etkisi. *Bursa Uludağ Üniversitesi Ziraat Fakültesi Dergisi*, 33(2), 307-319.
- Srinivasan, K., Sambaiyah, K. & Chandrasekhara, N. (2004). Spices as beneficial hypolipidemic food adjuncts: a review. *Food Reviews International*, 20(2), 187-220.
- Stavělíková, H. (2008). Morphological characteristics of garlic (*Allium sativum* L.) genetic resources collection–Information. *Europe*, 123(116.220), 114-040.
- Tahir, Z., Saeed, F., Nosheen, F., Ahmed, A. & Anjum, F.M. (2022). Comparative study of nutritional properties and antioxidant activity of raw and fermented (black) garlic. *International Journal of Food Properties*, 25 (1), 116-127.
- Tanti, A., Retnani, Y. & Soesanto, I.R.H. (2022a). Effect of supplementation garlic (*Allium sativum*) by various processing on performances of broiler. In *IOP Conference Series: Earth and Environmental Science*, 1020, 012015.
- Tanti, A., Nurhayati, N., Berliana, B. & Nelwida, N. (2022b). Effect of black garlic and curcuma addition on carcass and abdominal fat of broilers. *Jurnal Ilmu Nutrisi dan Teknologi Pakan*, 20(3), 130-134.
- Tanti, A., Retnani, Y. & Soesanto, I.R.H. (2023). Effect dietary garlic processed on performance and intestinal of broilers. *Jurnal Ilmu Nutrisi dan Teknologi Pakan (Nutrition and Feed Technology Journal)*, 21(1), 63-68.
- Toghyani, M., Toghyani, M., Gheisari, A., Ghalamkari, G. & Eghbalsaied, S. (2011). Evaluation of cinnamon and garlic as antibiotic growth promoter substitutions on performance, immune responses, serum biochemical and haematological parameters in broiler chicks. *Livestock Science*, 138(1-3), 167-173.
- TUIK (2023). Turkish Statistical Institute. Plant Production Statistics. Website: (Acessed, 02 May 2023) <https://www.tuik.gov.tr>
- Yalçın, S., Onbaşlar, E.E., Reisli, Z. & Yalçın, S. (2006). Effect of garlic powder on the performance, egg traits and blood parameters of laying hens. *Journal of the Science of Food and Agriculture*, 86(9), 1336-1339.
- Yalçın, S., Onbaşlar, I., Sehu, A. & Yalçın, S. (2007). The effects of dietary garlic powder on the performance, egg traits and blood serum cholesterol of laying quails. *Asian-Australasian Journal of Animal Sciences*, 20(6), 944-947.
- Yeh, Y.Y. & Liu, L. (2001). Cholesterol-lowering effect of garlic extracts and organosulfur compounds: human and animal studies. *The Journal of Nutrition*, 131(3), 989-993.

- Zeng, T., Zhang, C.L., Zhao, X.L. & Xie, K.Q. (2013). The roles of garlic on the lipid parameters: a systematic review of the literature. *Critical Reviews in Food Science and Nutrition*, 53(3), 215-230.
- Zhang, X., Li, N., Lu, X., Liu, P. & Qiao, X. (2016). Effects of temperature on the quality of black garlic. *Journal of the Science of Food and Agriculture*, 96(7), 2366-2372.
- Zulfikar, M.I., Berliana, B., Nelwida, N. & Nurhayati, N. (2022). Pengaruh penggunaan tepung kunyit dalam ransum yang mengandung bawang hitam (black garlic) terhadap bobot karkas dan lemak abdomen broiler. *Jurnal Ilmiah Ilmu-Ilmu Peternakan*, 25(1), 21-33.

TÜRKİYE'DE TIBBİ Ve AROMATİK BİTKİLERİN DIŞ TİCARETİNİN GELİŞİMİ

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ÖZET

Türkiye'nin bulunduğu coğrafi konum birçok bitkinin kültüre alınmasına, birçok bitkinin de doğal olarak yetişmesine imkan tanımaktadır. Bu özellik, tıbbi ve aromatik bitkilerin ülke ekonomisinde önemli bir yer almasına neden olmuştur. Sağlıklı yaşam düşüncesi ve ilaçların muhtemel yan etkileri tıbbi ve aromatik bitkilere olan küresel talebi artırmasına rağmen, küresel iklim değişikliği, doğal afetler ve tıbbi ve aromatik bitkilerin doğadan bilinçsizce toplanması, bu ürünlerin sürdürülebilirliğini tehdit etmektedir. Bu çalışmada son 15 yıllık verilerin ışığında dünya ve Türkiye'de tıbbi ve aromatik bitkilerin dış ticaretindeki gelişmeler incelenmiştir. Veriler Uluslararası Ticaret Merkezi ve Birleşmiş Milletler Gıda ve Tarım Örgütü internet sitelerinden derlenmiştir. Sonuçlar Türkiye'nin tıbbi aromatik bitkiler konusunda net ithalatçı bir ülke olduğunu, ihracatın ithalatı karşılama oranının her geçen gün arttığını, 2021 yılına gelindiğinde ihracatın ithalatı karşılama oranının %83 olduğunu göstermiştir. Dünyada tıbbi ve aromatik bitkilerin dış ticaret hacmi 2007 yılında yaklaşık 108 milyar \$ iken, 2021 yılında 236 milyar \$'ı geçmiştir. Türkiye dünya pazarından %0.60'lık bir pay almaktadır. Bu oran Türkiye'nin sahip olduğu potansiyelden çok uzaktır. En önemli ihracatçı ülkeler Fransa, Almanya, ABD, Çin ve Singapur olurken, ithalatta da Çin, ABD ve Almanya başı çekmektedir. Yetiştiriciliği yapılan ürünlerde çeşit ıslahı çalışmalarının hızlandırılması verimlilik ve kaliteli tohumluk temini açısından önemli görülmektedir. Ayrıca doğal olarak yetişen bitkilerin sürekliliğinin sağlanması açısından toplayıcıların eğitimi en önemli konularından biridir.

Anahtar Kelimeler: İthalat, ihracat, sağlıklı yaşam, endemik bitki, Tarım Ekonomisi

**DEVELOPMENT OF FOREIGN TRADE IN MEDICINAL AND AROMATIC
PLANTS IN TÜRKİYE**

ABSTRACT

The geographical location of Türkiye allows for the cultivation of many plants and the natural growth of many others. This feature has led to the country's economy's significant presence of medicinal and aromatic plants. Despite the global demand for medicinal and aromatic plants increasing due to the desire for a healthy lifestyle and the potential side effects of drugs, global climate change, natural disasters, and the unconscious collection of medicinal and aromatic plants from nature threaten the sustainability of these products. This study examined developments in the international trade of medicinal and aromatic plants in Türkiye and the world in light of data from the last 15 years. Data were compiled from the websites of the International Trade Centre and the Food and Agriculture Organization of the United Nations. The results showed that Türkiye is a net importer of medicinal and aromatic plants. The ratio of exports to imports increased yearly, reaching 83% in 2021. While the foreign trade volume of medicinal and aromatic plants in the world was approximately \$108 billion in 2007, it exceeded \$236 billion in 2021. Türkiye has a share of 0.60% of the world market, which is far from the country's potential. France, Germany, the USA, China, and Singapore are the major countries in world trade. The acceleration of variety breeding studies in cultivated crops is considered important in terms of productivity and quality of seed supply. In addition, the training of collectors is one of the most important issues in terms of ensuring the continuity of naturally growing plants.

Keywords: Import, export, healthy living, endemic plants, Agricultural Economics

Giriş

Yapılan bir çalışmada dünya üzerinde 422.000 bitki türünün olduğu ve bunların 52.885'inin tıbbi ve aromatik bitkilerden oluştuğu bildirilmiştir (Schippmann vd., 2002). Türkiye, zengin bitki çeşitliliği ile birçok tıbbi ve aromatik bitkiyi kendi coğrafyasında barındırmaktadır (Temel vd., 2018). Tıbbi ve aromatik bitkiler, insanlık tarihi boyunca tedavi amacıyla kullanılmıştır. Bu bitkilerin tüketiminin dejeneratif hastalıklarla ilgili riskleri azaltma potansiyellerinin, sahip oldukları antioksidan özellik gösteren biyoaktif bileşikler, özellikle fenolik maddelerle ilgili olduğu son yıllarda yapılan çalışmalarla ortaya koyulmuştur (Karadağ, 2019). Tıbbi bitkilerin kullanımı sadece geleneksel tıpla sınırlı olmayıp gıda ve ilaç endüstrilerini de kapsamaktadır. Ancak, kontrolsüz bir şekilde yapılan toplama ve aşırı faydalanmalar sonucunda tıbbi bitki türlerinin önemli bir bölümünün geleceği tehlike altına girmiştir (Güneri vd., 2023).

Tıbbi ve aromatik bitkiler besin değeri bakımından oldukça zengindir. Örneğin, dut (*Morus alba* L.), fenolik asitler, flavonoidler, flavonoller, antosiyaninler, makro besinler, vitaminler, mineraller ve uçucu aromatik bileşikler dahil olmak üzere bol miktarda fitokimyasal içeren ve mükemmel farmakolojik yeteneklerini gösteren bir bitkidir (Chen vd., 2021). *Satureja hortensis*, gıda ve ilaç endüstrilerinde özel uygulamaları olan iyi bilinen bir tıbbi, aromatik ve baharat bitkisidir. Yüksek besin değerlerine ek olarak, yaygın olarak kullanılan ikincil metabolitler içerir (Mohtashami vd., 2021). Zencefil (*Zingiber Officinale*), baharat ve tıbbi bileşen olarak çok popüler olan rizomlu bir bitkidir. Zencefilin antiartritik, antitrombotik ve anti-inflamatuar etkiye sahip olduğu tespit edilmiştir (Therkleson, 2013). Ayrıca, tıbbi ve aromatik bitkilerden elde edilen uçucu yağlar, gıda endüstrisi için sentetik katkı maddelerine alternatif olarak kullanılan uçucu bileşiklerin karışımlarıdır. En hayati eser elementlerden biri olan selenyum, insan beslenmesinde önemli bir role sahiptir ve faydalı eser elementleri elde etmek için baharatlar, otlar ve şifalı bitkiler tüketilmelidir (Ozkutlu vd., 2011). Tıbbi ve aromatik bitkiler önemli besin değerine sahiptir ve faydalı eser elementlerin, vitaminlerin ve minerallerin kaynağı olarak kullanılabilir.

Tıbbi ve aromatik bitkilerin ticareti birçok ülkede önemli bir ekonomik faaliyettir. Örneğin, Güney Afrika'da tıbbi ve aromatik bitki ticareti ülke ekonomisinde önemli yer kaplamaktadır. Malavi'de bitki tüccarları hane gelirlerinin %50'sinden fazlasını tıbbi bitki satışından elde etmektedir. Fas'ta tıbbi bitkilerin ihracatından elde edilen yıllık gelir 2015 yılında 55,9 milyon dolardır (Andel vd., 2012). Ayrıca bu bitkilerin kullanımı aynı zamanda kırsal topluluklar için önemli bir gelir kaynağıdır (Bhat vd., 2013). Tıbbi bitkilerin küresel ticareti, aşırı sömürüye yol açabilen ve önemli tıbbi bitki türlerinin hayatta kalmasını tehdit edebilen, doğadan kapsamlı bir

şekilde toplanmasına bağlıdır (Kuniyal vd., 2005). Tıbbi ve aromatik bitkilerin ticareti, önemli tıbbi bitki türlerinin hayatta kalmasını sağlamak için sürdürülebilir yönetim gerektiren önemli bir ekonomik faaliyettir. Tıbbi ve aromatik bitkiler ve ürünlerine yönelik artan talep, bu bitkilerin kültüre alınmasını teşvik etmiştir (Zeng vd., 2013). Tıbbi ve aromatik bitkilerin kültüre alınmasının, yabancı popülasyonlar üzerindeki baskının azaltılmasına ve sürdürülebilir bir bitki materyali tedarikinin sağlanmasına yardımcı olacaktır. Sonuç olarak, tıbbi ve aromatik bitkiler yüzyıllardır tedavi edici özelliklerinden ve gıda kaynağı olmalarından dolayı kullanılan ve günümüzde çeşitli endüstrilerde hala geçerli olan önemli kaynaklardır. Ancak, bunların korunması ve sürdürülebilir yönetimi, hayatta kalmaları ve sürekli kullanımlarını sağlamak için çok önemlidir.

Materyal ve Metot

Çalışmada materyal olarak ikincil veriler kullanılmıştır. Veriler Uluslararası Ticaret Merkezi (ITC-Trade Map) ve Birleşmiş Milletler Gıda ve Tarım Örgütü (FAO) internet sitelerinden elde edilmiştir. Elde edilen verilerle basit indeksler hesaplanmış, artış ve azalışlar yorumlanmıştır.

Araştırma Bulguları ve Tartışma

Tıbbi ve aromatik bitkiler doğadan toplama ve yetiştiriciliği yapılarak üretilmektedir. Yetiştiriciliği yapılan tıbbi ve aromatik bitkilerin üretim alan ve miktarlarına ait toplu olarak istatistikleri veren bir kaynağın bulunmaması, bu bitkilerin ayrı ayrı istatistiklerine ulaşmayı zorunlu kılmaktadır. Ancak tıbbi ve aromatik bitkiler grubunda çok sayıda bitkinin bulunması, bu bitkilerin tamamının ayrı ayrı değerlendirilmesini imkansız hale getirmektedir. Bu nedenle üretim miktar ve alanına ait toplu bir istatistik verilememiş, seçilen bazı ürünlere ait istatistikler verilmiştir (Çizelge 1). Türkiye dünya haşhaş tohumu üretiminin %88,87'sini, çay üretiminin %5,14'ünü karşılamaktadır. 2007 yılından bu yana dünya haşhaş tohumu üretim alanı yaklaşık %62 azalmışken, Türkiye'de %70 artmış ve dünya haşhaş tohumu üretim alanının %97'si Türkiye'de yer almıştır. Son yıllarda tıbbi ve aromatik bitkilere olan talebin artması bu ürünlerin doğadan toplanmasının yanında yetiştiriciliğini de teşvik etmiştir.

Çizelge 1. Türkiye’de ve dünyada üretimi yapılan bazı tıbbi ve aromatik bitkilere ait istatistikler

Bitki	Türkiye						Dünya						Dünya Üretimdeki Payı (%)
	Alan (1.000 ha)			Üretim (1.000 ton)			Alan (1.000 ha)			Üretim (1.000 ton)			
	2007	2021	Değişim	2007	2021	Değişim	2007	2021	Değişim	2007	2021	Değişim	
Çay	76,58	82,25	7,40	1.145,32	1.450,00	26,60	2.882,01	5.245,32	82,00	16.600,83	28.191,56	69,82	5,14
Kuru Biber	6,85	6,67	-2,57	16,57	15,82	-4,55	1.690,85	1.619,92	-4,19	2.966,20	4.839,31	63,15	0,33
Baharatlar	32,32	49,40	52,86	81,72	289,88	254,72	940,53	1.408,95	49,80	1.820,61	3.152,94	73,18	9,19
Anason, Rezene, Kişniş, Karaçörek Otu	12,29	69,91	468,78	8,01	332,31	4.050,76	861,65	2.300,30	166,97	698,63	2.698,10	286,20	12,32
Haşhaş Tohumu	24,59	41,89	70,39	8,98	21,04	134,24	113,43	43,16	-61,95	67,45	23,67	-64,91	88,87

Kaynak: FAO, 2023.

Dış ticaret verilerinin değerlendirilmesinde International Trade Centre (ITC) sınıflaması dikkate alınarak değerlendirme yapılmıştır. ITC sınıflamasında tıbbi ve aromatik bitkiler üç ana gruba ayrılmıştır. Bunlar;

- 1- Kahve, çay, mate ve baharatlar
- 2- Sakız, reçine ve diğer bitkisel özler ve ekstraktlar
- 3- Uçucu yağlar ve resinoidler’dir.

İhracat

Kahve, çay, mate ve baharat grubuna ait ihracat değerleri Çizelge 2’de verilmiştir. Bu grupta en fazla ihracat yapan ülke %10,66’lık payıyla Brezilya’dır. Brezilya’yı %7,07’lik payla Çin, %6,87’lik payıyla Hindistan takip etmektedir. İlk on ülkenin bu gruptaki ihracat payı %58,26’dır. Türkiye’nin kahve, çay, mate ve baharat grubundaki ihracat payı %0,46’dır. 2021 yılında 2007 yılına göre ihracat değerini oransal ve mutlak olarak en fazla artıran ülke İsviçre olmuştur. Çin de bu gruptaki payını en fazla artıran ülkelerin başında gelmektedir. Son 15 yılda dünya genelindeki yaklaşık %121’lik artışın yarısından daha fazlası (%58,49) ilk on ülkedeki ihracat artışından kaynaklanmıştır. Türkiye 155 farklı ülkeye ihracat yapmakla birlikte, ihracatının %45,28’ini ABD, Almanya, İngiltere, Çin ve Suriye’ye yapmaktadır. Türkiye’nin bu gruptaki ihracat materyali çoğunlukla zencefil, safran, zerdeçal, nane, defne yaprağı, köri ve diğer baharatlardır.

Çizelge 2. Dünya kahve, çay, mate ve baharatların ihracat değerleri (1.000 \$)

Ülkeler	2007	2014	2021	Pay (%)	Değişim (%)
Brezilya	3.601.970	6.534.531	6.309.144	10,66	75,16
Çin	1.088.875	2.452.618	4.189.096	7,07	284,72
Hindistan	1.386.684	2.770.950	4.066.066	6,87	193,22
Viet Nam	2.350.472	4.869.769	3.718.534	6,28	58,20
Almanya	1.812.963	3.125.847	3.646.749	6,16	101,15
İsviçre	486.158	2.249.191	3.645.502	6,16	649,86
Kolombiya	1.740.212	2.526.471	3.205.854	5,41	84,22
İtalya	873.679	1.585.955	2.177.294	3,68	149,21
Sri Lanka	1.144.033	1.851.488	1.828.339	3,09	59,82
Endonezya	1.036.918	1.835.143	1.711.852	2,89	65,09
İlk 10 Ülke	15.521.964	29.801.963	34.498.430	58,26	122,26
Türkiye	94.671	205.283	271.378	0,46	186,65
Diğer Ülkeler	11.152.959	19.637.792	24.441.465	41,28	119,15
Dünya	26.769.594	49.645.038	59.211.273	100,00	121,19

Kaynak: ITC-TRADE MAP, 2023.

Sakız, reçine ve diğer bitkisel özler ve ekstraktlar grubunda ihracat lideri ülke Çin'dir (Çizelge 3). Çin'i Hindistan, Fransa, İspanya ve ABD takip etmektedir. Bu grupta ilk on ülkenin ihracattaki payı %74,03'tür. Son 15 yılda Türkiye ihracatını yedi kata yakın artırsa da bu grupta ihracattan aldığı pay düşük seviyelerde kalmıştır (%0,40). Tıbbi ve aromatik bitkilerin bu grubunda son 15 yılda dünya genelinde ihracat değerinde yaklaşık %127'lik bir artış olmuştur. Bu artışın %36,58'lik kısmı Çin'deki artıştan kaynaklanmaktadır. İspanya, Hindistan ve Fransa ihracatını en fazla artıran ülkeler arasındadır. Türkiye sakız, reçine ve diğer bitkisel özler ve ekstraktlar grubunda 36,85 milyon dolarlık ihracatının yaklaşık %69'unu Almanya (%28,33), Çin (%22,83), Güney Kore (%9,08), Malezya (%4,52) ve Meksika'ya (%4,33) yapmıştır.

Çizelge 3. Dünya sakız, reçine ve diğer bitkisel özler ve ekstraktlar ihracat değerleri (1.000 \$)

Ülkeler	2007	2014	2021	Pay (%)	Değişim (%)
Çin	206.344	1.305.974	2.113.751	22,69	924,38
Hindistan	387.807	2.305.278	867.029	9,31	123,57
Fransa	440.280	569.386	771.478	8,28	75,22
İspanya	226.830	351.706	720.493	7,73	217,64
ABD	400.570	605.390	634.679	6,81	58,44
Almanya	480.214	674.110	582.748	6,25	21,35
İtalya	169.575	267.329	502.088	5,39	196,09
Danimarka	256.802	283.371	301.784	3,24	17,52
Filipinler	70.653	215.033	209.470	2,25	196,48
Endonezya	64.467	90.602	193.927	2,08	200,82
İlk 10 Ülke	2.703.542	6.668.179	6.897.447	74,03	155,13
Türkiye	5.454	9.783	36.850	0,40	575,65
Diğer Ülkeler	1.393.987	1.978.612	2.383.355	25,58	70,97
Dünya	4.102.983	8.656.574	9.317.652	100,00	127,09

Kaynak: ITC-TRADE MAP, 2023.

Dünya uçucu yağlar ve resinoidler ihracat değerleri Çizelge 4'te sunulmuştur. Çizelge 4 incelendiğinde Fransa'nın yaklaşık 22 milyar dolarlık ihracat değeriyle bu alanda lider ülke olduğu, Fransa'yı ABD, Almanya, Singapur ve İrlanda'nın takip ettiği görülebilir. İhracatta ilk on ülke bu gruptaki ihracat değerinin %61,55'ini oluşturmaktadır. Güney Kore, Singapur ve Fransa son 15 yılda ihracatını değer bazında en fazla artıran ülkeler olmuştur. Bu süre zarfında Türkiye uçucu yağlar ve resinoidler grubunda ihracat değerini yaklaşık üç kat artırmıştır. Türkiye bu grupta en fazla ihracatı Irak (%10,47), ABD (%8,51), İran (%5,32), Hollanda (%4,92), Birleşik Arap Emirlikleri (%4,56) ve Rusya Federasyonu'na (%4,36) yapmıştır.

Çizelge 4. Dünya uçucu yağlar ve resinoidler ihracat değerleri (1.000 \$)

Ülkeler	2007	2014	2021	Pay (%)	Değişim (%)
Fransa	14.559.240	17.457.217	22.024.479	13,15	51,27
ABD	7.613.509	11.551.622	13.578.568	8,11	78,35
Almanya	8.481.286	11.119.241	12.007.800	7,17	41,58
Singapur	2.025.685	4.570.753	10.393.092	6,20	413,07
İrlanda	7.172.363	9.136.018	9.816.619	5,86	36,87
Güney Kore	341.103	1.920.013	9.051.165	5,40	2.553,50
Japonya	1.113.227	1.706.606	7.648.009	4,57	587,01
İtalya	3.303.952	4.619.725	6.306.998	3,76	90,89
Çin	1.792.679	4.187.334	6.290.145	3,75	250,88
İngiltere	5.531.470	6.389.094	5.996.682	3,58	8,41
İlk 10 Ülke	51.934.514	72.657.623	103.113.557	61,55	98,55
Türkiye	361.008	870.720	1.111.812	0,66	207,97
Diğer Ülkeler	24.801.016	43.250.026	63.292.091	37,78	155,20
Dünya	77.096.538	116.778.369	167.517.460	100,00	117,28

Kaynak: ITC-TRADE MAP, 2023.

İthalat

Çizelge 5 kahve, çay, mate ve baharat grubuna ait ithalat değerlerini vermektedir. ABD, Almanya ve Fransa en fazla ithalat yapan ve son 15 yılda ithalatını en fazla artıran ülkelerdir. Bu süreçte oransal olarak ithalatını en fazla artıran ülke ise Çin'dir. Bu grupta ithalatın yarıdan fazlası ilk on ülke tarafından gerçekleştirilmektedir. Türkiye'nin bu gruptaki ithalat değeri ihracat değerinden daha fazladır. Türkiye 2021 yılında yaklaşık 374 milyon dolarlık ithalat yapmıştır. Türkiye ithalatının %63,91'ini Brezilya (%39,28), Sri Lanka (%7,83), Hindistan (%6,62), Hollanda (%5,69) ve Suriye'den (%4,49) yapmıştır. Brezilya'dan kahve, Sri Lanka'dan ise çay ithal etmektedir.

Çizelge 5. Dünya kahve, çay, mate ve baharatların ithalat değerleri (1.000 \$)

Ülkeler	2007	2014	2021	Pay (%)	Değişim (%)
ABD	4.620.504	7.881.468	9.431.815	16,36	104,13
Almanya	3.189.540	4.895.512	5.184.796	8,99	62,56
Fransa	1.388.286	3.114.020	3.719.288	6,45	167,91
İtalya	1.217.390	1.903.703	1.974.892	3,42	62,22
Hollanda	813.501	1.663.248	1.943.536	3,37	138,91
Kanada	913.910	1.650.787	1.881.841	3,26	105,91
Japonya	1.472.596	1.995.248	1.838.586	3,19	24,85
Çin	77.372	342.297	1.680.810	2,91	2.072,38
Belçika	756.723	1.299.957	1.651.860	2,86	118,29
İngiltere	1.000.969	1.563.102	1.647.867	2,86	64,63
İlk 10 Ülke	15.450.791	26.309.342	30.955.291	53,68	100,35
Türkiye	68.036	187.841	373.912	0,65	449,58
Diğer Ülkeler	11.096.197	21.052.450	26.337.508	45,67	137,36
Dünya	26.615.024	47.549.633	57.666.711	100,00	116,67

Kaynak: ITC-TRADE MAP, 2023.

Sakız, reçine ve diğer bitkisel özler ve ekstraktlar grubunda en fazla ithalat yapan ülkeler ABD, Almanya, Çin, Fransa ve Japonya'dır (Çizelge 3). Son 15 yılda bu grupta dünya ithalatı %115,12 artmıştır. Bu artışın %59,53'lük kısmı ilk on ülkenin ithalat artışından kaynaklanmıştır. Türkiye bu süreçte ithalatını 3,6 kat artırmıştır. Türkiye 2021 yılında 78,1 milyon dolarlık ithalat yapmış, bu ithalatın %62,22'si Almanya, Fransa, Çin, Hindistan ve İspanya'dan yapılmıştır.

Çizelge 6. Dünya sakız, reçine ve diğer bitkisel özler ve ekstraktlar ithalat değerleri (1.000 \$)

Ülkeler	2007	2014	2021	Pay (%)	Değişim (%)
ABD	710.450	2.302.560	1.840.866	20,28	159,11
Almanya	403.353	597.950	738.376	8,13	83,06
Çin	89.919	234.637	467.294	5,15	419,68
Fransa	254.006	365.899	439.139	4,84	72,89
Japonya	287.553	357.966	325.091	3,58	13,05
Güney Kore	102.150	166.332	321.069	3,54	214,31
İtalya	160.114	229.003	287.600	3,17	79,62
İspanya	117.598	195.286	285.297	3,14	142,60
Hindistan	66.205	186.856	277.637	3,06	319,36
İngiltere	168.335	232.126	269.632	2,97	60,18
İlk 10 Ülke	2.359.683	4.868.615	5.252.001	57,85	122,57
Türkiye	21.470	43.905	78.105	0,86	263,79
Diğer Ülkeler	1.839.387	2.947.167	3.748.975	41,29	103,82
Dünya	4.220.540	7.859.687	9.079.081	100,00	115,12

Kaynak: ITC-TRADE MAP, 2023.

Dünya uçucu yağlar ve resinoidler ithalat değerleri Çizelge 7'de sunulmuştur. Çin son 15 yıllık süreçte bu grupta ithalatını 29,8 kat artırarak 2021 yılında en fazla ithalat yapan ülke konumuna

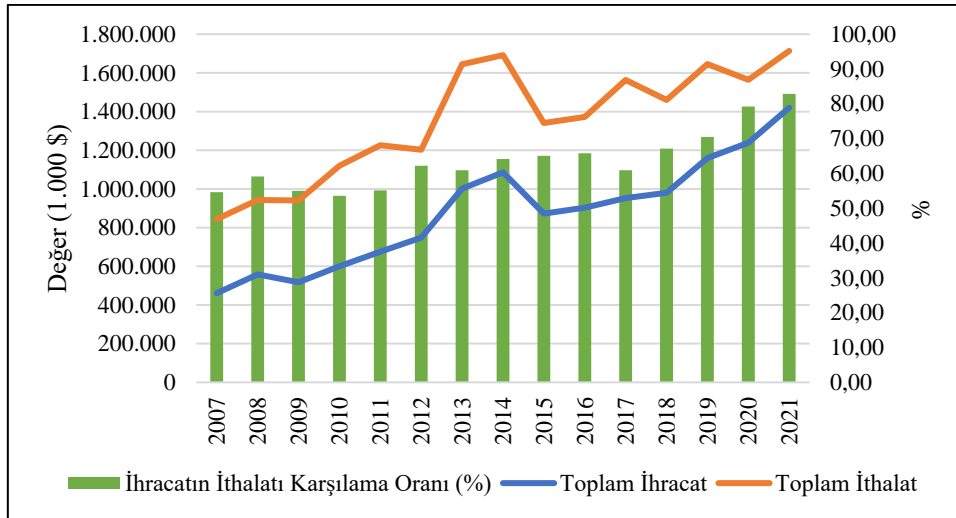
gelmiştir. Dünya toplam ithalat değeri son 15 yılda %128,08 artmış, bu artışın %24,46'lık kısmı Çin'in ithalatının artışından kaynaklanmıştır. İlk on ülke ithalatın yarısından fazlasını (%51,91) karşılamaktadır. Türkiye'nin de bu süreçte ithalat değeri %67,2 oranında artmıştır. İthalat değerinin %18,30'unu Fransa'dan, %13,98'ini Almanya'dan, %11,83'ünü İrlanda'dan ve %8,13'ünü İsviçre'den yapmıştır.

Çizelge 7. Dünya uçucu yağlar ve resinoidler ithalat değerleri (1.000 \$)

Ülkeler	2007	2014	2021	Pay (%)	Değişim (%)
Çin	809.799	3.372.164	24.117.402	14,21	2.878,20
ABD	7.691.684	11.546.996	16.512.895	9,73	114,69
Hong Kong	1.499.753	3.711.598	8.799.993	5,19	486,76
Almanya	4.934.778	7.266.602	8.517.759	5,02	72,61
Fransa	4.510.494	5.795.746	6.808.434	4,01	50,95
İngiltere	5.523.112	6.618.062	6.282.941	3,70	13,76
Singapur	1.543.232	2.728.286	4.703.427	2,77	204,78
Hollanda	2.059.367	3.096.825	4.416.259	2,60	114,45
Kanada	2.373.274	3.175.784	3.976.519	2,34	67,55
İspanya	2.707.667	3.432.088	3.959.547	2,33	46,23
İlk 10 Ülke	33.653.160	50.744.151	88.095.176	51,91	161,77
Türkiye	754.550	1.460.255	1.261.587	0,74	67,20
Diğer Ülkeler	39.998.748	61.788.650	80.351.726	47,35	100,89
Dünya	74.406.458	113.993.056	169.708.489	100,00	128,08

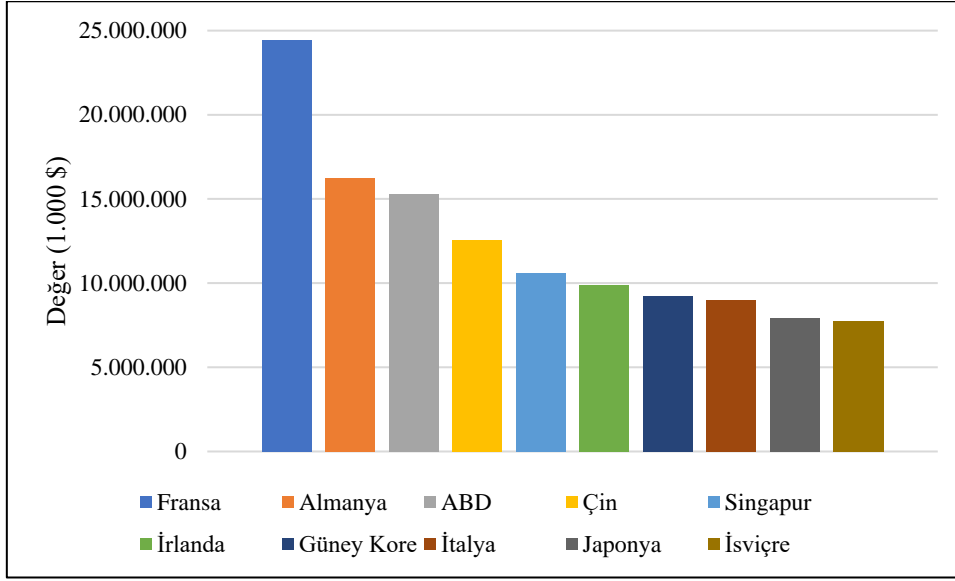
Kaynak: ITC-TRADE MAP, 2023.

Türkiye'nin yıllara göre toplam tıbbi ve aromatik bitkiler ihracat, ithalat ve ihracatın ithalatı karşılama oranı Şekil 1'de verilmiştir. Yıllara göre değişmekle birlikte genel olarak hem ihracat hem ithalat hem de ihracatın ithalatı karşılama oranı bir artış eğilimine sahiptir. 2007 yılında ihracatın ithalatı karşılama oranı yaklaşık %55 iken, 2021 yılında bu oran %83'lere yükselmiştir.



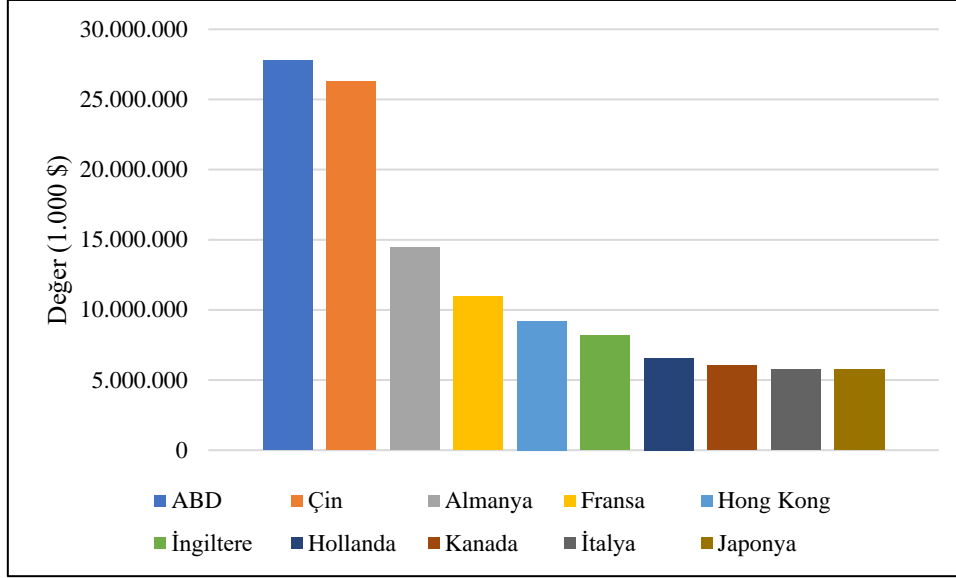
Şekil 1. Türkiye tıbbi ve aromatik bitkiler ihracat ve ithalat değerleri ve ihracatın ithalatı karşılama oranı

Toplam ihracat değerleri bakımından değerlendirildiğinde 2021 yılında Fransa, Almanya, ABD, Çin, Singapur, İrlanda, Güney Kore, İtalya, Japonya ve İsviçre lider ülkeler olarak karşımıza çıkmaktadır (Şekil 2). Fransa toplam 24,5 milyar dolarlık ihracat değeriyle toplam ihracat değerinin %10,36'sını tek başına almaktadır. İhracat değeri bakımından ilk on ülke toplam ihracat değerinin %52,09'unu oluşturmaktadır. Türkiye ise toplam ihracat değerinin %0,60'ına karşılık gelen 1,42 milyar dolarlık ihracat yapmıştır.



Şekil 2. Tıbbi ve aromatik bitki ihracatında lider ülkeler ve ihracat değerleri

Toplam ithalat değerleri bakımından 2021 yılında ABD, Çin, Almanya, Fransa, Hong Kong, İngiltere, Hollanda, Kanada, İtalya ve Japonya en önemli ithalatçı ülkelerdir (Şekil 3). ABD, Çin ve Almanya sırasıyla 27,8 milyar dolar, 26,3 milyar dolar ve 14,4 milyar dolarlık ithalat yapmıştır. Türkiye ise 1,71 milyar dolarlık tıbbi ve aromatik bitki ithalatı yapmıştır.



Şekil 3. Tıbbi ve aromatik bitki ithalatında lider ülkeler ve ithalat değerleri

Sonuç ve Öneriler

Tıbbi ve aromatik bitkilerin toplanarak ve yetiştiriciliği yapılarak üretiliyor olmasının yanında bu grup altında çok çeşitli sayıda bitkinin bulunması sağlıklı istatistiklere ulaşmada en büyük sorundur. Özellikle tıbbi ve aromatik bitkilerin farklı başlıklar altında sınıflandırılması, ulusal ve uluslararası arenada sağlıklı istatistiklere ulaşmanın zorluğu, bu alan için doğru tahmin ve politika yapmayı engellemektedir. Tüm kısıtlara rağmen, son 15 yıllık verilerden hareketle bu çalışmada Türkiye ve dünya tıbbi aromatik bitkilerinin dış ticareti değerlendirilmiştir. Sonuçlar Türkiye'nin bulunduğu konumunu ve mevcut potansiyelini istenilen düzeyde kullanamadığını göstermiştir. Çünkü tıbbi ve aromatik bitkiler konusunda yapılan benzer bir çok çalışmada Türkiye'nin önemli bir potansiyele sahip olduğu bildirilmiştir (Karik ve Öztürk, 2009; Bayram vd., 2010; Arslan vd., 2015; Mert ve Dağistan, 2016; Acıbuca ve Budak, 2018; Boztaş vd., 2021).

Tıbbi ve aromatik bitkilerin kullanım alanlarının genişliği, son yıllarda sağlıklı tedavi kaynağı olarak görülmesi ve tavsiye edilmesi bu ürünlere olan talebi beklenilenin çok üzerinde artırmıştır. Nitekim 2007 yılında 108 milyar dolar olan tıbbi aromatik bitkiler dış ticaret hacmi 2021 yılında 236 milyar doları aşmıştır. Ancak aşırı talep, toplama yoluyla elde edilen bitkilerin bilinçsiz ve kontrolsüzce toplanması türlerin sürdürülebilirliğini tehdit etmeye başlamıştır. Tıbbi ve aromatik bitkileri doğadan toplayan toplayıcıların eğitilmesi, kültüre alınabilecek türlerin zaman kaybetmeden kültüre alınması ve ıslah çalışmalarının desteklenerek hızlandırılması önemli konular olarak değerlendirilmektedir.

Son 15 yıllık veriler tıbbi aromatik bitki ticaretinin artış eğilimini açıkça ortaya koymaktadır. Dünya toplam ihracat ve ithalat değerleri Fransa, Almanya, ABD, Çin, İtalya ve Japonya'nın hem ihracatta hem de ithalatta ilk on ülke arasında yer aldığını göstermektedir. Türkiye'de de benzer artış eğilimi söz konusu olmakla birlikte son yıllarda makasın daralmasına rağmen tıbbi ve aromatik bitki ithalat değeri ihracat değerinden daha yüksektir. Bu durum Türkiye'nin bu sektörde ithalatçı bir ülke olduğunun göstergesidir. Ancak bu konuda yapılacak planlı çalışma ve eğitimler Türkiye'nin ihracatçı bir ülke olarak üst sıralarda yer almasına katkı sunacaktır.

Kaynaklar

- Acıbuca, V., Bostan Budak, D., 2018. Dünya’da ve Türkiye’de Tıbbi ve Aromatik Bitkilerin Yeri ve Önemi. Çukurova Tarım ve Gıda Bilimleri Dergisi, 33(1) , 37-44.
- Andel, T., Myren, B., Onselen, S., 2012. Ghana's herbal market. Journal of Ethnopharmacology, 140(2), 368-378. <https://doi.org/10.1016/j.jep.2012.01.028>
- Arslan, N., Baydar, H., Kızıl, S., Karık, Ü., Şekeroğlu, N., Gümüşçü, A., 2015. Tıbbi ve Aromatik Bitkiler Üretiminde Değişimler ve Yeni Arayışlar. VII. Türkiye Ziraat Mühendisliği Teknik Kongresi, 15 Ocak 2015, Ankara, Türkiye, 483-507.
- Bayram, E., Kırıcı, S., Tansı, S., Yılmaz, G., Arabacı, O., Kızıl, S., Telci, İ., 2010. TMMOB, Ziraat Mühendisleri Odası 7. Teknik Kongresi, 11 Ocak 2010, Ankara, Türkiye.
- Bhat, J. A., Kumar, M., Bussmann, R. W., 2013. Ecological status and traditional knowledge of medicinal plants in Kedarnath Wildlife Sanctuary of Garhwal Himalaya, India. J Ethnobiology Ethnomedicine 9, 1. <https://doi.org/10.1186/1746-4269-9-1>
- Boztaş, G., Avcı, A. B., Arabacı, O., Bayram, E., 2021. Tıbbi ve aromatik bitkilerin dünyadaki ve Türkiye’deki ekonomik durumu. Theoretical and Applied Forestry, 1(1), 27–33. <https://doi.org/10.53463/tafor.2021vol1iss1pp27-33>
- Chen, C., Mohamad Razali, U. H., Saikim, F. H., Mahyudin, A., Mohd Noor, N. Q., 2021. Morus alba L. Plant: Bioactive Compounds and Potential as a Functional Food Ingredient. Foods, 10(3), 689. <https://doi.org/10.3390/foods10030689>
- FAO, 2023. Birleşmiş Milletler Gıda ve Tarım Örgütü. <http://www.fao.org/faostat/en/#data> Erişim Tarihi: 10.04.2023.
- Güneri, E., Türkoğlu, T., Yıldıztekin, M., 2023. Köyceğiz-Dalyan Özel Çevre Koruma Bölgesinde Geleneksel Olarak Kullanılan Şifalı Bitkilerin Sürdürülebilirliğinin Araştırılması. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 13(1), 130-142. <https://doi.org/10.21597/jist.1196305>
- ITC-TRADE MAP, 2023. Uluslararası Ticaret Merkezi. <https://www.trademap.org/>. Erişim Tarihi: 10.04.2023.
- Karadağ, A., 2019. Türkiye’deki Bazı Tıbbi ve Aromatik Bitkilerin Antioksidan Potansiyelleri ve Fenolik Kompozisyonları. Avrupa Bilim ve Teknoloji Dergisi, (16), 631-637. <https://doi.org/10.31590/ejosat.592711>
- Karık, Ü., Öztürk, M., 2009. Türkiye Dış Ticaretinde Tıbbi ve Aromatik Bitkiler. Bahçe, 38(1), 21-31.
- Kuniyal, C. P., Rawat, Y. S., Oinam, S. S., Kuniyal, J. C., Vishvakarma, S. C. R., 2005. Kuth (Saussurea lappa) cultivation in the cold desert environment of the Lahaul valley, northwestern Himalaya, India: arising threats and need to revive socio-economic values. Biodiversity & Conservation, 14, 1035–1045. <https://doi.org/10.1007/s10531-004-4365-x>
- Mert, A., Dağıstan, E., 2016. Tıbbi ve Aromatik Bitkilerin Ekonomik Önemi. XII. Ulusal Tarım Ekonomisi Kongresi, Tarımsal İşletmecilik, Cilt 3, 1525-1532, 25-27 Mayıs 2016, Isparta, Türkiye.
- Mohtashami, S., Babalar, M., Tabrizi, L., Ghani, A., Rowshan, V., Shokrpour, M., 2021. Essential oil constituents and variations in antioxidant compounds of dried summer savory (Satureja hortensis cv. Saturn) affected by storage conditions and ammonium sulfate. Food Science & Nutrition, 9, 4986– 4997. <https://doi.org/10.1002/fsn3.2451>
- Ozkutlu, F., Sekeroglu, N., Koca, U., Yazıcı, G., 2011. Selenium Concentrations of Selected Medicinal and Aromatic Plants in Turkey. Natural Product Communications, 6(10). <https://doi.org/10.1177/1934578X1100601015>

- Schippmann, U., Leaman, D. J., Cunningham, A. B., 2002. Impact of Cultivation and Gathering of Medicinal Plants on Biodiversity: Global Trends and Issues. Biodiversity and the Ecosystem Approach in Agriculture, Forestry and Fisheries. Satellite event on the occasion of the Ninth Regular Session of the Commission on Genetic Resources for Food and Agriculture. Rome, 12-13 October 2002. Inter-Departmental Working Group on Biological Diversity for Food and Agriculture, Rome. <http://fao.org/docrep/0/20fao/005/aa010e/AA010E00.pdf>
- Temel, M., Tımmaz, A. B., Öztürk, M., Gündüz, O., 2018. Dünyada ve Türkiye’de tıbbi-aromatik bitkilerin üretimi ve ticareti. Kahramanmaraş Sütçü İmam Üniversitesi Tarım ve Doğa Dergisi, 21(Özel Sayı), 198-214. <https://doi.org/10.18016/ksutarimdoga.vi.473036>
- Therkleson, T., 2013. Topical Ginger Treatment With a Compress or Patch for Osteoarthritis Symptoms. Journal of Holistic Nursing, 32(3), 173-182. <https://doi.org/10.1177/0898010113512182>
- Zeng, Y., Guo, LP., Chen, BD., Haoi ZP., Wang, JY., Huang, LQ., Yang, G., Cui, MX., Yang, L., Wu, ZX., Chen, LM., Zhang, Y., 2013. Arbuscular mycorrhizal symbiosis and active ingredients of medicinal plants: current research status and prospectives. Mycorrhiza, 23, 253–265. <https://doi.org/10.1007/s00572-013-0484-0>

HEALTH BENEFITS OF THYME ESSENTIAL OIL

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ABSTRACT

Thyme (*Thymus vulgaris* L.) is an aromatic herb from the Lamiaceae family. It is extensively used in the food and pharmaceutical industries in the world due to having antimicrobial, antioxidative, antihelminthic, expectorant, antiseptic, antispasmodic, antifungal, hypocholesterolemic, immunostimulants, carminative, antiviral, diaphoretic, and sedative effects. These beneficial effects can be attributed to its essential oil (1-2.5% in thyme dry matter). Thyme essential oil contains mainly thymol and its phenol isomer carvacrol. It contains also γ -terpinene, p-cymene, linalool, β -myrcene, and terpinene-4-ol. Essential oil components especially phenolic compounds act as free radical scavengers, inhibitors of oxidative enzymes, and metal ion chelators. Lipopolysaccharide-induced inflammation and oxidative stress can be detoxified by the essential oil. Thyme essential oil has the strongest antibacterial activity due to its bioactive constituents, especially carvacrol, and thymol. Thyme essential oil may enhance the activities of intestinal and pancreatic trypsin, protease, and lipase activity. It is also highly effective in several intestinal infections and infestations. It plays an important role in tissue repair. Thyme oil can be used in oils, fats, and oil-fat-containing foods to prevent or delay some chemical deteriorations as a natural preservative due to having lipophylic properties. Thyme essential oil can be encapsulated to mask the flavor and improve the stability of the volatile compounds in essential oils. As a conclusion thyme essential oil has a high potential for health benefits. It could be utilized as a good source in producing novel natural antioxidants and antimicrobial products. However further research could be carried out to understand the efficacy, safety, and mechanism of action of the compounds in essential oil.

Keywords: Thyme essential oil, health benefits, antioxidant property, functional food

INTRODUCTION

Aromatic plants have attracted considerable attention due to having antioxidant, antimicrobial, anti-inflammatory characteristics, and digestion stimulator potential. Among aromatic herbs, thyme (*Thymus vulgaris* L.), a member of the Lamiaceae family, is used extensively in food to add a distinctive flavor and aroma all over the world. It has antihelminthic, expectorant, antiseptic, antispasmodic, antimicrobial, immunostimulants, hypocholesterolemic, antioxidative, antiviral, antifungal, carminative, sedative, and diaphoretic effects. Essential oils are very complex natural nutraceutical mixtures and contain about 30-70 components with different concentrations. Two or three major components are found at higher concentrations (20-70%) compared to other components present in trace amounts. Biological properties of essential oils are due to these components, especially major components. There are two groups of distinct biosynthetic origin; the group of terpenes and terpenoids and the other group is aliphatic and aromatic compounds (Agili, 2014; Dauqan and Abdullah, 2017; Salehi et al., 2018; Wesolowska and Jadcak, 2019).

CHARACTERISTICS OF THYME ESSENTIAL OIL

Essential oil concentration is about 1-2.5% in thyme dry matter. It is a mixture of monoterpenes, especially thymol, and its phenol isomer, carvacrol. Phenolics such as p-cymene-2,3-diol, caffeic acid, and some biphenylic, and flavonoid compounds (flavonoid glycosides, flavonoid aglycones) show antioxidative effects. Essential oil components especially phenolic compounds act as free radical scavengers, inhibitors of oxidative enzymes, and metal ion chelators. Essential components can detoxify lipopolysaccharide-induced inflammation and oxidative stress (Agili, 2014; Dauqan and Abdullah, 2017; Salehi et al., 2018; Wesolowska and Jadcak, 2019).

Thyme essential oil enhances the activities of enzymes such as intestinal and pancreatic trypsin, protease, and lipase activity. It is highly effective in several intestinal infections and infestations. It plays an important role in tissue repair (Salehi et al., 2018).

Thyme essential oil can be used in oils, fats, and oil-fat-containing foods to prevent or delay some chemical deteriorations as a natural preservative due to having lipophylic properties. It can be encapsulated to mask the flavor and improve the stability of the volatile compounds in it (Salehi et al., 2018).

Yalçın et al. (2020) demonstrated that the essential oil of dried thyme (*T. vulgaris* L.) leaves (from Turkey) contain 54.70% carvacrol and 37.34% 4'-methylacetophenone p-cymene as given in Table 1. Fachini-Queiroz et al. (2012) indicated that the essential oil of *T. vulgaris* leaves collected from Brazil contains 45.5% carvacrol, 22.9% α -terpineol and 14.3% endo-Borneol as shown in Table 2. Agili (2014) identified 42 components in the essential oil of *T. vulgaris* leaves (from Jazan-Saudi Arabia), it consists of 54.26% thymol, 9.50% γ -terpinene, and 7.61% p-cymene as shown in Table 3. These differences in the studies are due to the origin, developmental stage of the sourcing plant material, and environmental conditions (Agili, 2014).

Wesolowska and Jadczyk (2019) indicated the amounts of main components of the essential oils from the thyme (*T. vulgaris* L., English winter cultivar) were 44.97 and 38.06% thymol, 7.61 and 10.34% p-cymene, 7.08 and 6.66% γ -terpinene and 5.11 and 8.27% carvacrol and another cultivar thyme (*T. vulgaris* L., Summer Thyme de Provence) were 36.82 and 37.32% thymol, 15.73 and 11.20% p-cymene, 5.34 and 11.09% γ -terpinene and 6.50 and 5.35% carvacrol in the years of 2016 and 2017, respectively. Thymol was found to be major essential oil components in *T. vulgaris* as 44.7% from Brazil (Porte et al., 2008), 52.13-61.92% from Czech Republic (Duskova et al., 2016), 47.06% from France (Satyal et al., 2016), 47.59% from Romania (Boruga et al., 2014), 49.9-61.2% from Poland (Zawislak, 2007), 46.2% from Turkey (Ozcan and Chalchat, 2004), 51.34% from North Yemen (Maqtari et al., 2011) and 68.91% from Slovenia (Anzlovar et al., 2014). However carvacrol was detected to be major essential oil components in *T. vulgaris* as 78.4% from Morocco (El Hattabi et al., 2016) and 54.7% from Turkey (Yalçın et al., 2020).

Table 1. Composition of essential oil of thyme leaves collected from Turkey (Yalçın et al., 2020)

Component	g/100 g
Carvacrol	54.70
α -Pinene	1.83
4'-Methylacetophenone p-cymene	37.34
Camphene	1.54
2-Isopropyl-5-methylbenzoquinone	0.98
Myrcene	0.96
γ -Terpinene	0.92
Caryophyllene	0.68
Isoborneol (Isomer 2)	0.86
α -Terpinene	0.42
4-Carvomenthenol; terpinene-4-ol	0.39
α -Caryophyllene	0.30

Table 2. Composition of essential oil of thyme leaves collected from Brazil (Fachini-Queiroz et al., 2012)

Component	g/100 g		Component	g/100 g
α -Pinene	1.9		α -Terpineol	22.9
p-Cymene	0.6		Carvacrol methyl ether	1.3
Limonene	0.6		Thymol	0.9
γ -Terpinene	1.1		Carvacrol	45.5
Linalool	0.2		Geranyl acetate	0.3
Camphor	0.1		Caryophyllene	3.2
<i>endo</i> -Borneol	14.3		Caryophyllene oxide	2.9
4-Terpineol	0.7		Germacrene-D	1.8

HEALTH EFFECTS OF THYME ESSENTIAL OIL

There are many studies showing health effects of thyme essential oil. It has many beneficial effects on health due to its pharmacological and biological properties. The beneficial activities of some compounds in thyme essential oil are given in Table 4 (Ocano and Reglero, 2012; Dauqan and Abdullah, 2017; Balahbib et al., 2021).

The antioxidant properties of thyme essential oil may be related to its phenolic structure, that adsorb and neutralize free radicals and show redox properties (Yu et al., 2016). Thymol scavenges hydroxyl free radicals and produces phenoxyl radicals (Nagoor Meeran et al., 2017). Thymol improves the activity of endogenous antioxidant enzymes such as glutathione peroxidase, catalase, superoxide dismutase, glutathione-S-transferase, and the other non-enzymatic antioxidants such as vitamin E, vitamin C, and reduced glutathione (Nagoor Meeran and Prince, 2012).

Youdim and Deans (2000) reported that rats fed diets supplemented with thyme or thyme oil had higher antioxidant enzyme activities and total antioxidant status than untreated rats with age.

Table 3. Essential oil composition of thyme leaves from Jazan-Saudi Arabia (Agili, 2014)

Component	Formula	g/100 g		Component	Formula	g/100 g
3-Hexenol	C ₆ H ₁₂ O	0.10		α-Terpinolene	C ₁₀ H ₁₆	3.27
α-Tujene	C ₁₀ H ₁₆	1.52		Linalool	C ₁₀ H ₁₈ O	0.93
α-Pinene	C ₁₀ H ₁₆	1.31		Terpineol	C ₁₀ H ₁₈ O	1.37
Camphene	C ₁₀ H ₁₆	0.75		Carene	C ₁₀ H ₁₆	0.35
Sabinene	C ₁₀ H ₁₆	0.84		E-Citral	C ₁₀ H ₁₆ O	0.54
3-Otenol	C ₈ H ₁₆ O	0.36		3,4-Octadienal	C ₈ H ₁₄ O	0.23
3-Otanone	C ₈ H ₁₆ O	0.20		Verbenol	C ₁₀ H ₁₆ O	0.12
β-Myrcene	C ₁₀ H ₁₆	0.67		endo-Borneol	C ₁₀ H ₁₈ O	0.10
3-Otanol	C ₈ H ₁₈ O	0.21		4-Terpineol	C ₁₀ H ₁₈ O	1.44
α-Pellandrene	C ₁₀ H ₁₆	0.10		α-Terpineol	C ₁₀ H ₁₈ O	1.63
δ-3-Carene	C ₁₀ H ₁₆	0.11		Dihydrocarvone	C ₁₀ H ₁₆ O	0.10
α-Terpinene	C ₁₀ H ₁₆	2.36		Decanal	C ₁₀ H ₂₀ O	0.12
p-Cymene	C ₁₀ H ₁₄	7.61		9-p-Menthenol	C ₁₀ H ₁₆ O	0.23
Sylvestrene	C ₁₀ H ₁₆	0.34		2,6-Octadienal	C ₈ H ₁₂ O	0.14
1,8-Cineol	C ₁₀ H ₁₈ O	0.57		Anisole	C ₇ H ₁₈ O	0.23
cis-Oimene	C ₁₀ H ₁₆	0.22		Geraniol	C ₁₀ H ₁₈ O	0.10
β-Oimene	C ₁₀ H ₁₆	0.20		Citral	C ₁₀ H ₁₆ O	0.24
γ-Terpinene	C ₁₀ H ₁₆	9.50		Thymol	C ₁₀ H ₁₄ O	54.26
cis-Sabinene	C ₁₀ H ₈ O	0.10		Carvacrol	C ₁₀ H ₁₄ O	4.42
3-Noneol	C ₉ H ₂₀ O	0.12		Octadienoic acid	C ₁₈ H ₁₂ O ₂	0.10
3-Nonene	C ₉ H ₁₈	0.22		Geranic acid	C ₁₀ H ₁₆ O ₂	0.30

Table 4. Biological activities of some compounds in the essential oil of *Thymus vulgaris* (Ocano and Reglero, 2012; Dauqan and Abdullah, 2017; Balahbib et al., 2021)

Compound	Biological activities
Thymol	Antibacterial, antioxidant, antiseptic, antifungal, anti-inflammatory, immunomodulating, free radical scavenging properties
Carvacrol	Antioxidant, antimicrobial, anti-inflammatory, antifungal, antithrombotic, antimutagenic, anticarcinogenic, acetylcholinesterase inhibitory properties
Linalool	Anti-inflammatory, antiviral effect, antioxidant, anti-nociceptive, analgesic activity
p-Cymene	Anti-inflammatory, antioxidant, antibacterial, antiviral, antidiabetic, antitumor, antifungal, antiparasitic, analgesic, anti-nociceptive, immunomodulatory, vasorelaxant, neuroprotective activities

Alsaraf et al. (2020) found the IC₅₀ value of thyme essential oil as 23.64 µg/ml which indicates a good antioxidant potential. Alsaraf et al. (2020) reported that its antioxidant activity could be due to its major phenolic compound carvacrol and therefore it can be utilized as an alternative source for natural antioxidants.

Thymol and carvacrol reduced the oxidative damage, and improved the antioxidative and sperm quality parameters in rats (Güvenç et al., 2018).

Thymol has a function for the protection of the intestinal barrier. It defends against pathogen invasion, promotes mucus secretion, and improves intestinal barrier integrity. Therefore it can be used as a dietary supplement to prevent inflammatory bowel disease by improving gut integrity, decreasing oxidative stress in the gut, enhancing immune responses, and maintaining a good microenvironment in the intestine through its antibacterial effects (Liu et al., 2022).

Thyme essential oil, carvacrol, and thymol inhibited inflammatory edema (Fachini-Queiroz et al., 2012). Thyme essential oil decreased production and gene expression of the proinflammatory mediators IL-1B, TNF- α , and IL-6 and increased these parameters on the inflammatory IL-10 cytokine. Therefore thyme essential oils can be used for the treatment of chronic diseases with inflammatory processes (Ocano and Reglero, 2012).

The study of Alsaraf et al. (2020) shows the inhibition of bacterial growth by the usage of thyme essential oil as a powerful antimicrobial source. Yamazaki et al. (2004) found that thyme oil shows high antibacterial activity against *E. coli* O157:H7 and they reported that the antibacterial effects of thyme essential oil were due to the presence of phenolic components such as carvacrol and thymol. Phenolic compounds such as carvacrol cause bactericidal effects by disrupting the cytoplasmic membrane (Xu et al., 2008).

Thymol is a useful compound in relieving respiratory infections and intestinal problems due to its strong antiseptic characteristics. Thymol has a great expectorant property. It helps ease the cough and sore throat and breakdown the mucus, thereby clearing the airways (Salehi et al., 2018).

CONCLUSION

Thyme essential oil may have beneficial health effects on the treatment of some disorders belonging to the cardiovascular, respiratory, and nervous systems. It also shows antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, and antispasmodic properties due to having bioactive compounds. Thyme essential oil could be utilized as a good source in producing novel natural antioxidants and antimicrobial products. However further research could be carried out to understand the efficacy, safety, and mechanism of action of the compounds in essential oil.

REFERENCES

- Agili, F.A. (2014). Chemical composition, antioxidant and antitumor activity of *Thymus vulgaris* L. essential oil. Middle-East Journal of Scientific Research, 21(10), 1670-1676.
- Alsaraf, S., Hadi, Z., Al-Lawati, W.M., Al Lawati, A.A. & Khan, S.A. (2020). Chemical composition, in vitro antibacterial and antioxidant potential of Omani Thyme essential oil along with in silico studies of its major constituent. Journal of King Saud University-Science, 32, 1021-1028.
- Anzlovar, S., Baricevic, D., Avgustin, J.A. & Koce, J.D. (2014). Essential oil of common thyme as a natural antimicrobial food additive. Food Technology and Biotechnology, 52(2), 263-268.
- Balahbib, A., El Omari, N., El Hachlafi, N., Lakhdar, F., El Menyiy, N., Salhi, N., Mrabti, H.N., Bakrim, S., Zengin, G. & Bouyahya, A. (2021). Health beneficial and pharmacological properties of *p*-cymene. Food and Chemical Toxicology, 153, 112259.
- Boruga, O., Jianu, C., Misca, C., Golet, I., Gruia, A.T. & Horhat, F.G. (2014). *Thymus vulgaris* essential oil: chemical composition and antimicrobial activity. Journal of Medicine and Life, 7(3), 56-60.
- Dauqan, E.M.A. & Abdullah, A. (2017). Medicinal and functional values of thyme (*Thymus vulgaris* L.) herb. Journal of Applied Biology and Biotechnology, 5, 02, 017-022.
- Duskova, E., Dusek, K., Smekalova, K., Nosalkova, M. & Benicka, S. (2016). ESL 2: Genetic resources of *Thymus vulgaris* L. and *T. vulgaris* x *T. Marschallianus* Willd. in the Czech Republic. In: 6th International Symposium Breeding Research on Medicinal and Aromatic Plants, BREEDMAP 6, Quedlingburg, Germany, pp 56-58.
- El-Hattabi, L., Talbaoui, A., Amzazi, S., Bakri, Y., Harhar, H., Costa, J., Desjobert, J.M. & Tabyaoui, M. (2016). Chemical composition and antibacterial activity of three essential oils from South of Morocco (*Thymus satureoides*, *Thymus vulgaris* and *Chamaelum nobilis*). Journal of Materials and Environmental Science, 7(9), 3110-3117.
- Fachini-Queiroz, F.C., Kummer, R., Estevao-Silva, C.F., de Barros Carvalho, M.D., Cunha, J.M., Grespan, R., Bersani-Amado, C.A. & Cuman, R.K.N. (2012). Effects of thymol and carvacrol, constituents of *Thymus vulgaris* L. essential oil, on the inflammatory response. Evidence-Based Complementary and Alternative Medicine, 2012, 657026.
- Güvenç, M., Cellat, M., Gökçek, İ., Yavaş, İ. & Yurdagül Özsoy, Ş. (2018). Effects of thymol and carvacrol on sperm quality and oxidant/antioxidant balance in rats. Archives of Physiology and Biochemistry, 1476979
- Liu, Y., Yan, H., Yu, B., He, J., Mao, X., Yu, J., Zheng, P., Huang, Z., Luo, Y., Luo, J., Wu, A. & Chen, D. (2022). Protective effects of natural antioxidants on inflammatory bowel disease: Thymol and its pharmacological properties. Antioxidants, 11, 1947.
- Maqtari, M.A.A., Alghalibi, S.M. & Alhamzy, E.H. (2011). Chemical composition and antimicrobial activity of essential oil of *Thymus vulgaris* from Yemen. Turkish Journal of Biochemistry, 36(4), 342-349.
- Nagoor Meeran, M.F., Javed, H., Al Tae, H., Azimullah, S. & Ojha, S.K. (2017). Pharmacological properties and molecular mechanisms of thymol: Prospects for its therapeutic potential and pharmaceutical development. Frontiers in Pharmacology, 8, 380.

- Nagoor Meeran, M.F. & Prince, P.S.M. (2012). Protective effects of thymol on altered plasma lipid peroxidation and nonenzymic antioxidants in isoproterenol-induced myocardial infarcted rats. *Journal of Biochemical and Molecular Toxicology*, 26(9), 368-373.
- Ocana, A. & Reglero, G. (2012). Effects of thyme extract oils (from *Thymus vulgaris*, *Thymus zygis*, and *Thymus hyemalis*) on cytokine production and gene expression of oxLDL-stimulated THP-1-macrophages. *Journal of Obesity*, 2012, 104706.
- Ozcan, M. & Chalchat, J-C (2004). Aroma profile of *Thymus vulgaris* L. growing wild in Turkey. *Bulgarian Journal of Plant Physiology*, 30(3-4), 68-73.
- Porte, A., Ronoel, L. & Godoy, O. (2008). Chemical composition of *Thymus vulgaris* L. (thyme) essential oil from Rio de Janeiro State (Brazil). *Journal of the Serbian Chemical Society*, 73(3), 307-310.
- Salehi, B., Mishra, A.P., Shukla, I., Sharifi-Rad, M., del Mar Contreras, M., Segura-Carretero, A., Fathi, H., Nasrabadi, N.N., Kobarfard, F. & Sharifi-Rad, J. (2018). Thymol, thyme, and other plant sources: Health and potential uses. *Phytotherapy Research*, 1-19.
- Satyaj, P. Murray, B.L., McFeeters, R.I. & Setzer, W.N. (2016). Essential oil characterization of *Thymus vulgaris* from various geographical locations. *Foods*, 5(70), 1-12.
- Wesolowska, A. & Jadczyk, D. (2019). Comparison of the chemical composition of essential oils isolated from two thyme (*Thymus vulgaris* L.) cultivars. *Not Bot Horti Agrobi*, 47(3), 829-835.
- Xu, J., Zhou, F., Ji, B.P., Pei, R.S. & Xu, N. (2008). The antibacterial mechanism of carvacrol and thymol against *Escherichia coli*. *Letters in Applied Microbiology*, 47, 174-179.
- Yalçın, S., Eser, H., Onbaşlar, İ. & Yalçın, S. (2020). Effects of dried thyme (*Thymus vulgaris* L.) leaves on performance, some egg quality traits and immunity in laying hens. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, 67, 303-311.
- Yamazaki, K., Yamamoto, T., Kawai, Y. & Inoue, N. (2004). Enhancement of antilisterial activity of essential oil constituents by nisin and diglycerol fatty acid ester. *Food Microbiology*, 21, 283-289.
- Youdim, K.A. & Deans, S.G. (2000). Effect of thyme oil and thymol dietary supplementation on the antioxidant status and fatty acid composition of the ageing rat brain. *British Journal of Nutrition*, 83, 87-93.
- Yu, Y.-M., Chao, T.-Y., Chang, W.-C., Chang, M.J. & Lee, M.-F. (2016). Thymol reduces oxidative stress, aortic intimal thickening, and inflammation-related gene expression in hyperlipidemic rabbits. *Journal Food and Drug Analysis*, 24(3), 556-563.
- Zawislak, G. (2007). Analysis of chemical composition of essential oil in the herb of thyme (*Thymus vulgaris* L.) grown in south-eastern Poland. *Herba Polonica*, 53(3), 241-245.

**KÜLTÜREL MİRAS FARKINDALIĞI ÜZERİNE BİR ARAŞTIRMA: KARACASU
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ÖZET

Kültürel miras kaynakları, ülkelerin geçmişini yansıtan en önemli değerlerdir. Karacasu ilçesi başta Afrodias Antik Kenti olmak üzere çömlekçilik gibi birçok önemli kültürel miras değerlerine sahiptir. Kültürel miras değerlerinin gelecek kuşaklara aktarılması için her şeyden önce toplumların farkındalık düzeyinin artırılması ile mümkündür. Bu önemden hareketle çalışmada Karacasu 5. sınıf öğrencilerinin kültürel miras kaynaklarına yönelik farkındalık düzeyinin belirlenmesi amaçlanmıştır. Bu amaç doğrultusunda Karacasu ilçesinde bulunan okullarda eğitim alan tüm 5. sınıf öğrencilerine ilçedeki kültürel miras kaynaklarına yönelik bilinirlik ve deneyimle ölçeği yüz yüze uygulanmıştır. 2022-2023 eğitim öğretim yılı itibariyle ilçede eğitim alan tüm 5. sınıf öğrencilerinin toplam sayısı 166 dır. Yüz yüze anket uygulaması sonucunda toplam 125 kişiye ulaşılmıştır. Araştırmadan elde edilen veriler sonucunda betimleyici analizler ve bilinirlik-deneyimleme analizi yapılmıştır. Araştırma sonucunda öğrencilerin birçok kültürel miras kaynağına yönelik bilinirlik düzeyinin orta düzeyde olduğu, ancak kültürel miras kaynaklarını deneyimlemedikleri tespit edilmiştir. Araştırma yerel paydaşlara önerilerle son bulmuştur.

Anahtar kelimeler: Kültürel miras, kültürel miras farkındalığı, Karacasu.

A STUDY ON CULTURAL HERITAGE AWARENESS: THE CASE OF KARACASU

ABSTRACT

Cultural heritage resources are the most important values that reflect the past of the countries. Karacasu district, especially the Ancient City of Aphrodisias, has many important cultural heritage values such as pottery. First of all, it is possible to transfer cultural heritage values to future generations by increasing the awareness level of societies. Based on this importance, in this study, it is aimed to determine the awareness level of the five grade students of school in Karacasu about cultural heritage resources. For this purpose, the awareness and experience scale for the cultural heritage resources in Karacasu was applied to all the 5th grade students of school in the district. As of the 2022-2023 academic year, the total of all 5th grade students in the district is 166. As a result of the face-to-face survey application, 125 students were reached in total. Descriptive analyzes and awareness-performance analysis of the data obtained from the study were made. As a result of the research, it was determined that the level of awareness of the students for many cultural heritage resources in the district is moderate, but they did not experience these cultural heritage resources. The study concluded with suggestions to local stakeholders.

Keywords: Cultural heritage, cultural heritage awareness, Karacasu.

Giriş

Kültürel miras kaynakları, ülkelerin geçmişini yansıtan en önemli değerlerdir. Şüphesiz ki; bir toplumda yaşayan insanların bu değerleri korumak ve gelecek kuşaklara aktarmak en önemli görevleri arasındadır (Alptürker vd., 2021). Kültürel miras değerlerinin gelecek kuşaklara aktarılması her şeyden önce toplumların farkındalık düzeyinin artırılması ile mümkündür. Farkındalık düzeylerinin gelişmesi ise en başta eğitimle başlar. Kültürel miras ile ilgili küçük yaşlarda alınan eğitim, ileride kişilerin kültürel miras kaynaklarına yönelik bakış açılarını ve tutumlarını etkileyebilir. Bu nedenle, koruma bilinci ile nesillerin gelişmesi için bir toplumda yaşayan insanlara erken yaştan itibaren kültür varlıkları öğretilmeli ve öncelikle çevresindeki sonra ülkesindeki ve dünya kültür varlıklarını benimsemeleri için gereken çaba sarf edilmelidir. Ülkemizde de bu bilincin erken yaşlarda alınması için 14 Nisan 1982 yılında 2658 sayılı kanunla belirtilen UNESCO'nun *“Dünya Kültürel ve Doğal Mirasın Korunması Sözleşmesi”* nin *“Eğitim Programları”* başlığı altındaki 27.1 maddesi *“Bu Sözleşmeye taraf devletler, kendi halklarının sözleşmenin 1. ve 2. maddelerinde tanımlanan kültürel ve doğal mirasa karşı bağlılık ve saygı hislerini güçlendirmek için, bütün uygun araçlarla ve özellikle eğitim ve tanıtma programlarıyla çaba göstereceklerdir”* hükmü uyarınca kültür varlıklarını eğitime dahil etme ve tanıtma programlarının gerçekleştirilmesi kabul edilmiştir (<https://teftis.ktb.gov.tr>). Kültürel miras kaynaklarını öğrenerek bağlılık geliştiren nesillerin oluşması için mutlaka öncelikle yaşadıkları bölgenin, ülkenin daha sonra tüm dünyadaki kültür varlıkları değerleri ve koruma ilkeleri öğretilmelidir. Bu kapsamda da ülkemiz Millî Eğitim Bakanlığı, Sosyal bilgiler dersi 4. Sınıf müfredatına *“Kültür ve Miras”* öğrenme alanında *“Geçmiş Öğreniyorum”* ünitesi, 5. Sınıf müfredatına ise *“Kültür ve Miras”* öğrenme alanında *“Adım Adım Türkiye”* ünitesini eğitim kapsamına almıştır.

Yukarıda belirtilen önem ve gerekçelerden hareketle bu çalışmada, Karacasu ilçesinin kültürel miras kaynaklarına yönelik ilköğretim 5. sınıf öğrencilerinin farkındalık düzeyini tespit etmek amaçlanmıştır. Çalışmanın ilk bölümünde kültürel miras kavramı ve kültürel miras kaynakları hakkında bilgi verilmiştir. İkinci bölümde Karacasu ilçesinin kültürel miras kaynaklarına ve bu kaynakların önemine değinilmiştir. Daha sonra, çalışmanın metodolojisine ilişkin bilgi sunulmuş ve veri toplamada kullanılan Gök (2020) ün Önem Performans Analizinden uyarlayarak oluşturduğu Bilinirlik-Deneyimleme analizine başvurulmuştur. Son bölümde elde edilen bulgular ışığında, her bir kültürel miras kaynağına ilişkin değerlendirme yapılmıştır. Çalışmanın kültürel miras konusunda Karacasu ilçesine fayda sağlaması beklenmektedir.

Kültürel Miras

Kültür kavramı tarih boyunca tartışılmış ve birçok tanımı yapılmıştır. Dönmez ve Yeşilbursa (2014:423)'nın aktarımına göre 1952'de A.L.Krober ve Clyde Kluckhohn'un birlikte yaptıkları bir alan yazın taramasında kültürün 164 tane tanımını derlemişlerdir.

T.C. Kültür ve Turizm Bakanlığı'nın internet sitesinde kültür şu şekilde tanımlanmıştır (ktb.gov.tr, 2023): *“Kültür, bir toplumu diğer toplumlardan farklı kılan, geçmişten beri değişerek devam eden, kendine özgü, sanatı, inançları, örf ve adetleri, anlayış ve davranışları ile onun kimliğini oluşturan yaşayış ve düşünüş tarzıdır. Topluma bir kimlik kazandıran, dayanışma ve birlik duygusu verdiği toplumda düzeni de sağlayan maddi ve manevi değerlerin bütünüdür.”*

Türk Dil Kurumu, bakanlığın tanımına benzer şekilde “kültür” kavramını, *“Tarihsel, toplumsal gelişme süreci içinde yaratılan bütün maddi ve manevi değerler ile bunları yaratmada, sonraki nesillere iletmede kullanılan, insanın doğal ve toplumsal çevresine egemenliğinin ölçüsünü gösteren araçların bütünü, ekin”* şeklinde tanımlamaktadır (sozluk.gov.tr, 2023). Türkçede kültür teriminin karşılığı olarak önerilen ekin teriminin tarımla ilgili işlemek, ekip biçmek gibi anlamları sonraları ona yüklenen diğer anlamları ve kullanımları da etkilediği bir gerçektir (Oğuz, 2011:125). Çünkü insan ve onun paralelinde oluşturduğu toplumlar, var oldukları sürece çevresini işler, dönüştürür, biriktirir, nesilden nesile aktarır ve bunları yaparken de kendilerine özgü kimliklerini meydana getirirler. İşte bu toplumları kimi zaman birbirinden farklı kılan kimi zaman da bir potada eriten manevi ve maddi değerler kültürel mirasın temelini oluşturmaktadır.

Kültürel miras, nesilden nesile aktarılan maddi ve manevi tüm kültür öğelerini kapsayan geniş bir kavramdır. (Atak vd, 2017:1398). Kültürel miras; peyzajlar, tarihi alanlar, sitler ve yapıları çevrelerin yanı sıra, biyolojik çeşitlilik, koleksiyonlar, geçmişte kalan ve süregelen kültürel uygulamalar, bilgi ve yaşam deneyimlerini içine alır (ICOMOS,1999:1).

Kültürel miras kaynakları somut kültürel miras ve somut olmayan kültürel miras şeklinde iki gruba ayrılabilir (Tablo 1). Bu ayrım Birleşmiş Milletler Eğitim, Bilim ve Kültür Örgütü (UNESCO)'nun yayınladığı 1972 ve 2003 tarihli sözleşmelerde yapılmıştır. Türkiye bu sözleşmelere sırasıyla 1983 ve 2006 yıllarında taraf olmuştur. UNESCO (1972) somut kültürel mirası oluşturan kaynaklar olarak anıtları, yapı toplulukları, sit alanlarını ve doğal anıtları kabul ederken; somut olmayan kültürel miras kaynakları ise toplumların ve grupların meydana getirdikleri uygulamaları, temsilleri, anlatımları, bilgileri, becerileri ve bazen kişileri ve

bunlarla ilişkili araçları, nesnelere ve eserleri saymıştır. Aynı zamanda yaşayan miras olarak da kabul edilmektedir (UNESCO, 2003).

Tablo 1. Kültürel Miras Kaynakları Sınıflandırılması (Koç Altuntaş ve Onur, 2021:2587)

Kültürel Miras Kaynakları		
Somut Kültürel Miras Kaynakları		Somut Olmayan Kültürel Miras Kaynakları
Taşınmaz Kültürel Miras Kaynakları	Taşınır Kültürel Miras Kaynakları	
Mimari Eserler	Resimler	Müzik
Anıtlar	Heykeller	Halk Dansları
Arkeolojik sitler	Kütüphane eserleri	Tiyatro
Tarihi merkezler	Arşivler	Edebiyat
Bina grupları	Takılar ve süs eşyaları	Sözlü gelenekler
Kültürel manzaralar	Eski paralar	Törenler, Şölenler
Tarihi parklar, bahçeler	Günlük eşyalar	Gelenekler
Kanallar, Köprüler,	Müzik aletleri	Görenekler
Yel değirmenleri v.b.	Fotoğraflar v.b.	El sanatları geleneği
		Geleneksel oyunlar v.b.

Kültürel mirası oluşturan Tablo 1'deki somut ve somut olmayan kaynakların gelecek nesillere aktarılması önem arz etmektedir. Adı üstünde atalarımızdan kalan bu mirasın (değerlerin) geleceğe taşınması toplumu oluşturan kurum ve kuruluşların, bireylerin görevidir. Çünkü kültürel mirasın aktarılmadığı toplumlarda uygarlığın öldüğü, gelecek nesillerin her şeyi baştan öğrenmesi sonucunda bu toplumlarda hiçbir gelişmenin yaşanmayacağı varsayılabilir (Atak vd, 2017:1398). Bu nedenle yaşadığımız bölgelerdeki kültürel miras kaynaklarının korunması ve yaşatılabilmesi gereklidir. Bu da ancak toplumdaki farkındalığın artırılması ve deneyimlenmesi ile mümkün olabilir ki eğitim ve koruma da bu yollardan bazılarıdır. Zira aksi durumda kültürel mirasımızı oluşturan öğeler zamanla unutulacak, yitip gidecektir.

Kültürel mirasın korunması ve yaşatılması uygar olmanın ön şartlarından biridir. Ayrıca bireylerin toplumla ve kurumlarla ilişkilerini güçlendiren, yaşanılan çevreye saygıyı duyma duygusunu güçlendiren bir araçtır. Bir toplum, ancak yaşadığı toprakların önceki uygarlıklarının ürünlerini koruyabildiği ve bu ürünlere yeniden yaşama koşulları sağladığı ölçüde uygardır (İslamoğlu, 2018:19). Kültürel miras kaynaklarının korunması için farklı uygulamalar mevcuttur (Yüce, 2022).

Tablo 2. Kültürel Miras Kaynaklarının Korunması (Yüce, 2022)

Kültürel Miras Kaynaklarının Korunması	
Somut Kültürel Miras Kaynaklarının Korunmasına yönelik bazı uygulamalar	Somut Olmayan Kültürel Miras Kaynaklarının Korunmasına yönelik bazı uygulamalar
Arşiv bilimi	Dil korunması
Müzecilik	Sözlü tarih
Restorasyon ve konservasyon	Gelenekler
Sanatsal, arkeolojik ve mimari korunma	Folklor
Folklor kayıtlarının korunması	
Filmin korunması ve dijital ortama aktarılması	
Dijital koruma	

Tablo 3. Kültürel Miras Kaynaklarının Korunmasına Dair Uluslararası Sözleşmelerden Bazıları (Koçak ve Can, 2018:153)

1954 tarihli UNESCO Sözleşme	Sözleşmeye taraf olan devletler kültür varlıklarının korunması için çalışmalar yapacaklarına dair taahhüt vermişlerdir.
1964 tarihli Venedik Tüzüğü	Kültür varlığının kapsamı oluşturulma çalışılmıştır.
1972 tarihli UNESCO Dünya Kültür ve Doğa Mirasının Korunmasına Dair Sözleşmesi	Ülkeler sınırları içindeki kültürel mirasın korunmasına dair söz vermişlerdir. Türkiye bu sözleşmeyi 1983 tarihinde imza atmıştır.
1975 tarihli Avrupa Konseyi tarafından hazırlanan “Avrupa Mimari Miras Tüzüğü”	
2001 tarihli UNESCO Sualtı Kültürel Mirasın Korunması Sözleşmesi	
2003 tarihli UNESCO Somut Olmayan Kültürel Mirasın Korunması Sözleşmesi	Türkiye bu sözleşmeyi 2006 yılında imza atmıştır.
2005 tarihli UNESCO Kültürel Anlatımların Çeşitliliğinin Korunması ve Geliştirilmesi Sözleşmesi	

Kişilerin geçmişten günümüze taşınan “kültürü idrak etmesi, anlamlandırması ve mevcut kültürel varlıkların üzerine yeni somut veya somut olmayan şeyler eklemesinin yöntemlerinden biri de yaşadığı topraklardaki kültürel varlıklara yönelik farkındalık oluşturulmasıdır” (Bülbül, 2016, s. 681). Bu farkındalığın oluşmasında eğitimin rolü yadsınamaz. Bu amaçla eğitim araçları özellikle ders kitapları okullarda kültürel miras farkındalığının oluşmasında temel araçlar olarak kullanılmakta ve ülkemizde ilk ve ortaokul düzeyi Sosyal Bilgiler dersi kapsamında kültürel miras eğitime önem verildiği söylenebilir (Demir, 2023:44-45). Kültürel miras eğitimi öğrencilerin tarih ve kültüre ilişkin temel kavram ve ilkeleri kavramasını amaçlarken; öğrencilerin yaşadığı çevrenin doğal, beşeri, tarihi değerlerine yönelik bilgisinin, farkındalığının ve koruma duygusunun artırılmasını hedeflemektedir (Namlı vd, 2022:2371). Bu hedef aynı zamanda çalışmamızın da itici güçlerinden biri olmuştur.

Türkiye’de kültürel mirasla ilgili eğitim alanında yapılan çalışmalardan bazıları şunlardır:

Sağ ve Ünal (2019), Safranbolu’da eğitim veren bir ilkokulda 4. sınıf öğrencilerine yönelik bir çalışma yapmışlardır. Çalışma, öğrencilerin yaşadıkları çevrenin somut olmayan kültürel mirasına ilişkin farkındalık düzeylerinin belirlenmesine yöneliktir. Çalışmada nitel araştırma yöntemlerinden durum çalışması tercih edilirken; verilerin analizinde betimsel analiz yöntemi kullanılmıştır. Çalışma sonuçlarına göre öğrencilerin somut olmayan kültürel mirasa ilişkin farkındalık düzeyleri sınırlıdır. Ek olarak öğrencilerin çok büyük bir bölümünün de somut olmayan kültürel mirasa ilişkin farkındalıklarının olmadığı söylenebilir.

Tuncel ve Altuntaş (2020), İstanbul’da ilköğretim 4. sınıf öğrencilerini kapsayan bir çalışma yapmışlardır. Çalışma öğrencilerin Sosyal Bilgiler dersinde işlenen kültürel miras konularına ilişkin algılarını tespit etmeye yöneliktir. Araştırmanın yöntemi göstergebilimsel analizdir. Çalışmada, öğrencilerin algılamalarını analiz edebilmek için kültürel mirasa ilişkin resim çizimleri istenmiştir. Ardından öğrencilerle resimleri hakkında görüşmeler yapılmıştır. Çalışmanın sonuçlarına göre öğrencilerin kültürel miras algıları somut kültürel miras varlıkları (müze, tablo, halı gibi) ve soyut kültürel miras varlıkları (gelenek, düğün ve bayram gibi) olarak mevcuttur.

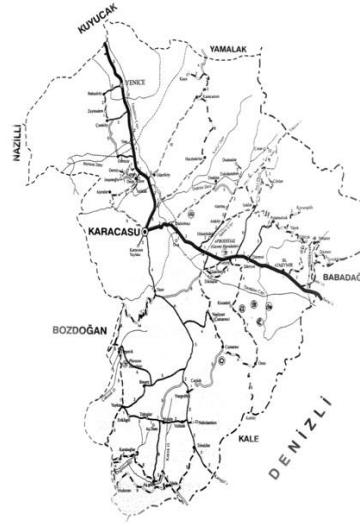
Namlı ve arkadaşları (2022), ortaokul öğrencilerinin kültürel mirasa duyarlılıklarını belirlemeye yönelik bir ölçek geliştirmişlerdir. Çalışma ortaokul öğrencileri üzerinde yürütülmüştür.

Bülbül (2016), müzelerin kültürel mirası aktarmadaki rolleri araştırılmıştır. Çalışma ortaokul öğrencileri arasında yapılmıştır. Çalışmada nitel araştırma olup tümevarımsal bir yaklaşım benimsenmiştir. Verilerin toplanmasında kullanılan teknik ise doküman incelemesidir.

Özcan ve arkadaşları (2022)’da ortaokul öğrencilerini temel bir çalışma yapmışlardır. Çalışmanın konusu öğrencilerin ebru sanatı ile ilgili farkındalık durumunu medya araçları kullanarak tespit etmeye çalışmışlardır. Çalışmanın sonucuna göre somut olmayan kültürel mirasın korunması ve aktarılmasında okulların devam etmektedir. Fakat sosyal medya araçlarının rolü giderek artmaktadır.

Karacasu İlçesinin Kültürel Miras Kaynakları

Araştırma alanı olan Karacasu, Dandalas Vadisi yolunda Babadağ ve Karıncalı Dağı arasında yer alan Aydın iline bağlı bir ilçedir (Şekil 1) (Başaran, 2000, s.15).



Şekil 1. Karacasu yerleşim haritası (Demir, 2003, s. 16-17)

Karacasu tarihinin Afrodisias Antik Kentindeki kazılarda 5 bin yıldır yaşamış insanlığın izlerinden çok eski tarihlere dayandığı bilinmektedir. İlçe 1867 yılında Aydın iline dahil edilmiştir. Karacasu; farklı dönemlere ait camileri, hamamları, çeşmeleri, geleneksel evleri ile yüzlerce kültürel tarihe ev sahipliği etmiştir (Kuruüzüm, 2011, s. 52). Afrodisias Antik Kenti başta olmak üzere Etnografya Müzesi, çömlekçilik, demircilik, dericilik, Dedebağı Keşkek hayrı, geleneksel konutlar, Süleyman Rüşdi Türbesi ve tarihi camiler ilçenin önemli kültürel miras kaynaklarıdır (Tablo 4).

Tablo 4. Karacasu Kültürel Miras Kaynakları

Afrodiasias Antik Kenti		2017 yılında Dünya Miras Listesi'ne alınan Aphrodisias, MÖ 6. yüzyılda küçük bir köy görünümünde iken, MÖ 2. yüzyılda Menderes Vadisi'ndeki yoğun kentleşme döneminde kent devleti (polis) ünvanını kazanmıştır. Roma İmparatorluğu döneminde mermer sanatı ve mimarisinin tüm açılarıyla irdelenip yaşatılmasını sağlayan kentlerden biri haline gelmiştir. (https://kvmgm.ktb.gov.tr)
Etnografya Müzesi	 (https://visitaydin.com/)	Karacasu Etnografya Müzesi, 2007 yılında Aphrodisias Müzesi Müdürlüğüne bağlı olarak açılmıştır. Müzede temel sergi elemanları, ilçenin tarihini yansıtan çömlekçilik, demircilik, dericilik vemel sanatları ile ilgili etnografik eserleri sergilemektedir. (https://aydin.ktb.gov.tr)
Çömlekçilik	 (https://www.kulturportali.gov.tr , 2023)	Karacasu da çömlekçilik sanatının ne zaman başladığı tam olarak bilinmese de Neolitik çağdan bu yana çömlek üretiminin yapıldığı Afrodisias Müzesinde sergilenen seramik kalıntılarında bilinmektedir (Yardımcı ve Bardak, 2019). Eski çağlardan günümüze kadar gelebilmiş kültür mirası çömlekçiliği hala yapan ilçede toplam 25 Atölye bulunmaktadır. Bu atölyelerden 20 tanesi aynı bölgede konumlanmaktadır.
Demircilik	 (https://static.daktilo.com , 2023)	Demircilik, ilçede öncelikle ekonomik faaliyet amacıyla başlamış daha sonra kültürel miras olarak ustadan çırağa aktarılarak yeni kuşaklara öğretilmiş bir zanaattır (Yılmaz Özbilgi ve Özbilgi, 2022). Antik dönemlerden itibaren yapıldığı bilinen demircilik faaliyeti ile günümüzde bıçak, nacak, hediyelik eşya, tarım aleti üretimi gerçekleştirilmektedir. (http://www.karacasu.gov.tr , 2023).
Dericilik		El sanatlarının bir dalı ve en eski el sanatları ham maddesi olarak bilinen dericilik, ilçede Osmanlı İmparatorluğu döneminden itibaren süregelen bilinen dericilik (Özdemir ve Karatekin, 2019). İlçede tabakhaneler ilk olarak Karıncalı Dağından gelen dere üzerinde yer almaktaydı. Daha sonra dere etrafında tabakhaneler artmıştır (Özilhan, 2004). 15 tabakhanelenin yer aldığı ilçede zamanla tabakhane sayısı azalarak günümüze 3 tabakhane gelebilmiştir.

Dedebağı Keşkek Hayrı	 (https://www.naztic.org.tr/) , 2023)	Dedebağı Keşkek Hayrı Dedebağı yaylası olarak bilinen Dedebağ'ın kabrinin de yer aldığı alanda yapılmaktadır. Keşkek geleneği ilçede 700 yıldır devam eden bir gelenektir. Her yıl ağustos ayının son haftası gerçekleşen keşkek hayrı, 2021 yılınca coğrafi işaret almıştır. (https://www.naztic.org.tr/) , 2023)
Geleneksel Konutlar		İlçe, ortadan tabakhane deresi (vadi) ayrılarak Karşıyaka ve Çarşıyaka olarak bilinen iki yerleşim yerinden oluşmaktadır. Geleneksel tarihi konutlar her iki yerleşim yerinde de yer almaktadır. Karşıyaka bölgesi daha eski yerleşim yeri olup, tarihi evlerin dağılımı açısından daha fazladır. XIX. Yüzyıldan günümüze kadar gelebilmiş evlerin mimari özelliklerini incelediğimizde, evlerin hepsinin bahçe içerisinde konumlandığı ve bir cephelerinin bahçeye baktığı görülmektedir. Geleneksel Türk Evi plan tipinde oluşturulan evler dış sofalı yapılmıştır.
Süleyman Rüşdi Türbesi	 https://kulturenvanteri.com , 2023)	Yemez-zâde Süleymân Rüşdi Bey Karacasu da 1184/1770'te doğmuştur (Kuruüzüm 1991: 2-3). Uşşaki tarikatından olduğu bilinen Süleyman Rüşdi Bey Türk Edebiyatının önemli tasavvuf şairlerindedir. Karacasu merkezde yer alan türbe her yıl yerli yabancı turisti ağırlamaktadır.
Tarihi Camiler	 https://www.aydinhedef.com.tr , 2023)	İlçede; Cumaönü Cami (1768), Hacı Arap Cami, Çarşı (Hacı Ali Ağa) Cami, Halil İbrahim Kuduğ Cami ve Burmalı Mescid olmak üzere görülmeğe değer koruma altında 5 adet dini kültür mirası bulunmaktadır. Bu yapılardan sadece Halil İbrahim Kuduğ Cami Cumhuriyet dönemi yapısı olup diğerleri Osmanlı mimarisine aittir.

Metodoloji

Bu çalışmada, Karacasu ilçesinin kültürel miras kaynaklarına yönelik 5. Sınıf öğrencilerinin farkındalık düzeylerinin belirlenmesi hedeflenmiştir. Çalışmada nicel araştırma

yöntemlerinden anket tekniğine başvurulmuştur. Anket uygulaması yüz yüze iletişimle gerçekleştirilmiştir. Anket formu üç bölümden oluşmaktadır. İlk bölümde ikamet yerlerini belirlemek için katılımcılara tek bir soru sorulmuştur. İkinci bölümde, Karacasu ilçesinin kültürel miras değerlerine yönelik farkındalık düzeyini belirlemek amacıyla Gök (2020) çalışmasından uyarlanan bilinirlik-deneyimleme ölçeğine yer verilmiştir. Likert tipi 5'li ölçek olarak hazırlanan Bilinirliği ölçeğine yanıt kategorileri 1: Hiç Bilmiyorum, 5: Çok İyi Biliyorum şeklinde oluşturulmuştur. Benzer şekilde, 5'li Likert tipinde oluşturulan deneyimleme ölçeğine ilişkin yanıt kategorileri ise 1: Hiç, 5: Her Zaman olarak derecelendirilmiştir.

Araştırma evreni, Karacasu ilçesindeki tüm ilköğretim okullarında eğitim alan 5. Sınıf öğrencilerinden oluşmaktadır. Karacasu İlçe Milli Eğitim Müdürlüğü'nden alınan bilgiler doğrultusunda 5. Sınıfta eğitim alan toplam 166 öğrenci olduğu tespit edilmiştir. 1 - 10 Nisan 2023 tarihinde öğrencilerle yüz yüze gerçekleştirilen anket uygulaması sonucunda analiz için kullanılabilir 125 anket elde edilmiş ve bu sayı çalışmanın örneklemini oluşturmuştur. Evren sayısına göre örneklem belirlenmesinde Krejcie ve Morgan (1970) tarafından önerilen örneklem belirleme tablosundan faydalanılmıştır. Tabloya göre, %95 güvenilirlik ve %5 hata payı ile 166 kişilik bir evren için azami 116 örneklem sayısına ulaşılması gerekmektedir. Bu doğrultuda, ulaşılan örneklem sayısının yeterli olduğunu söylemek mümkündür.

Araştırma verilerinin analizi SPSS 22.0 istatistik programında gerçekleştirilmiştir. Analiz sürecinde öncelikle kullanılan ölçeklerin güvenilirlik ve betimsel analizleri (frekans, yüzde, aritmetik ortalama ve standart sapma) yapılmış, daha sonra çalışmanın temel amacı doğrultusunda elde edilen veriler üzerinde bilinirlik-deneyimleme analizi gerçekleştirilmiştir.

Bulgular

Araştırma örnekleminde yer alan öğrencilerin ikamet yeri ile ilgili dağılım incelendiğinde, Öğrencilerin %52,8'nin (n=66) ilçe merkezinde ikamet ettiği, kalan kısmının (n=59) ise köyde yaşadığı görülmektedir.

Tablo 5. Aritmetik Ortalama Aralıkları

Aritmetik Ortalama	Değer
1- 1,79	Çok Düşük
1,80-2,59	Düşük
2,60-3,39	Orta
3,40-4,19	Yüksek
4,20-5,00	Çok Yüksek

Özdamar (2003) ın aritmetik ortalamaların yorumlanmasına ilişkin önerdiği tablo göz önüne alınarak bulgular yorumlanmıştır (Tablo 5).

Afrodisias Antik kenti yüksek bilinirlik düzeyine sahip olan tek kültürel miras değeri olarak göze çarpmaktadır. Çömlekçilik, Dedebağ Keşkek Hayrı, Karacasu Tarihi Camileri ve Etnografya müzesine ilişkin bilinirlik düzeyi orta düzeydedir. Demircilik, Dericilik, Süleyman Rüşdi Türbesi ve Geleneksel Konutlara yönelik bilinirlik düzeyi ise düşük seviyededir. Genel olarak, bilinirlik düzeyi ile karşılaştırıldığında, öğrencilerin kültürel miras kaynaklarını deneyimleme düzeyinin düşük olduğu söylemek mümkündür. Afrodisias Antik kentine yönelik deneyimleme düzeyi orta düzeyde iken, diğer miras kaynaklarına yönelik deneyimin düşük olduğu görülmektedir.

Tablo 6. Öğrencilerin Karacasu Kültürel Miras Kaynaklarının Bilinirlik Düzeyi

Sıra No	Karacasu Kültürel Miras Kaynakları	n	Ortalama	Std. Sapma
1	Afrodisias Antik Kenti	125	3,48	1,400
2	Çömlekçilik	125	2,74	1,349
3	Demircilik	125	2,28	1,248
4	Dericilik	125	1,83	1,162
5	Dedebağ Keşkek Hayrı	125	2,60	1,513
6	Karacasu Geleneksel Konutlar	125	2,49	1,394
7	Süleyman Rüşdi Türbesi	125	2,01	1,379
8	Karacasu Tarihi Camileri	125	2,72	1,483
9	Karacasu Etnografya Müzesi	125	2,73	1,503

Genel olarak, bilinirlik düzeyi ile karşılaştırıldığında, öğrencilerin kültürel miras kaynaklarını deneyimleme düzeyinin düşük olduğu söylemek mümkündür. Afrodisias Antik kentine yönelik deneyimleme düzeyi orta düzeyde iken, diğer miras kaynaklarına yönelik deneyimin düşük olduğu görülmektedir.

Tablo 7. Öğrencilerin Karacasu Kültürel Miras Kaynaklarını Deneyimleme Düzeyi

Sıra No	Karacasu Kültürel Miras Kaynakları	n	Ortalama	Std. Sapma
1	Afrodias Antik Kenti	125	2,69	1,210
2	Çömlekçilik	125	1,93	1,209
3	Demircilik	125	1,51	,912
4	Dericilik	125	1,40	,934
5	Dedebağ Keşkek Hayrı	125	2,19	1,268
6	Karacasu Geleneksel Konutlar	125	1,84	1,107
7	Süleyman Rüşdi Türbesi	125	1,67	1,075
8	Karacasu Tarihi Camileri	125	2,28	1,353
9	Karacasu Etnografya Müzesi	125	2,19	1,268

Önem Performans Analizi

Önem Performans Analizi (ÖPA) Martilla ve James (1977) tarafından pazarlama alanında müşteri memnuniyetini yükseltmek amacıyla hangi ürün niteliklerine önem ve öncelik gösterilmesi gerektiğinin belirlenmesi için geliştirilmiş bir tekniktir (Albayrak ve Caber, 2011). Müşterilerin ürün veya hizmetlere yönelik gerçekte neyi talep ettiği ve bu talebin önem sırası ÖPA'nın temel odağındadır (Öztürk ve Türkmen, 2022). Analiz ayrıca, ürün veya hizmet özelliklerinin güçlü ve zayıf yönlerini ortaya çıkararak, hangilerinin elde tutulması, geliştirilmesi, gözden çıkarılması gerekliliğine ilişkin yöneticilere yol gösterebilmektedir (Alptürker vd., 2021).

Önem Performans Analizinde ilk olarak araştırmaya konu olan her özellik ile ilgili önem performans skorları hesaplanmaktadır. Elde edilen skorlar her bir özelliğe ait x ve y koordinat değerlerini oluşturur. Bu değerler x ekseninde performansın, y ekseninde önemin yer aldığı matrisin üzerinde gösterilir. Analizde yer alan tüm özelliklerin önem ve performanslarının ortalaması ayrı ayrı hesaplanarak eksenlerin kesişme noktası tespit edilmektedir. Kesişme noktası ortalama ve medyan hesabıyla yapılır. Elde edilen değerlerin birbirine yakın olması durumunda, daha fazla bilgi içerdiği için ortalama kullanılır (Tetik, 2012).

Önem Performans Analizine ilişkin oluşturulmuş matris Şekil 1. de gösterilmektedir (Martilla ve James, 1977; Zhang ve Chow, 2004; Albayrak ve Caber, 2011; Tetik, 2012; Alptürker vd., 2021). Önem-performans analizine dayanarak oluşturulan matris dört alandan oluşmaktadır. Matriste yer alan her bir alan şu şekilde yorumlanmaktadır (Albayrak ve Caber, 2011):

ALAN I (Koruması Gerekenler): Tüketiciler ürün veya hizmet seçiminde bu alanda yer alan ürünleri önemli bulmaktadır. Bunun yanında, ürünlerin performanslarına yönelik yüksek algıya sahiptirler.

ALAN II (Yoğunlaşılması Gerekenler): Bu alanda yer alan ürünler tüketiciler tarafından önemli görülmektedir. Ancak ürünlerin performansına ilişkin algı düzeyi düşüktür. Bu nedenle, yöneticilerin bu alanda yer alan ürün özelliklerinin performansını arttırmak için çaba sarfetmelidirler.

ALAN III (Düşük Öncelikler): Düşük önem verilen ürünler bu alanda yer almaktadır. Ayrıca, ürünlerin performansına ilişkin algı da düşüktür.

ALAN IV (Olası Aşırılıklar): Tüketiciler tarafından düşük öneme sahip ancak performansı yüksek algılanan ürünlerin yer aldığı alandır. Yöneticilerin ürün özelliklerini arttırmak için gereğinden fazla kaynak kullandığını söylemek mümkündür.

ÖNEM	II. ALAN Yüksek Önem Düşük Performans (Yoğunlaşılması Gerekenler)	I. ALAN Yüksek Önem Yüksek Performans (Korunması Gerekenler)
	III. ALAN Düşük Önem Düşük Performans (Düşük Öncelikler)	IV. ALAN Düşük Önem Yüksek Performans (Olası Aşırılıklar)
	PERFORMANS	

Şekil 2. Önem-Performans Analiz Alanları

Basit ve kolay uygulanabilir yapısı ile önem performans analizi, otomotiv (Albayrak ve Caber, 2011), turizm (Saltık, 2017; Chen vd., 2022; Tetik, 2012), eğitim (Doğantan, 2021; O’Neil ve Palmer, 2004) gibi birçok farklı alan araştırmacıları tarafından kullanılmıştır (Öztürk ve Türkmen, 2022). Ayrıca, literatürde önem performans analizinden uyarlanarak yapılan farklı çalışmalara (Gök, 2020; Alptürker vd., 2021) da rastlanmaktadır.

Karacasu Kültürel Miras Kaynaklarına Yönelik Bilinirlik-Deneyimleme Analizi

Çalışmanın amacı doğrultusunda Karacasu’nun kültürel miras kaynaklarına ilişkin Gök (2020) tarafından önem performans analizinden uyarlanarak gerçekleştirilen bilinirlik-deneyimleme analizi sonuçları Şekil 3’de gösterilmiştir. Analiz sonucunda miras kaynaklarının konumlandıkları alanlara göre yapılan değerlendirmeler aşağıdaki gibidir:

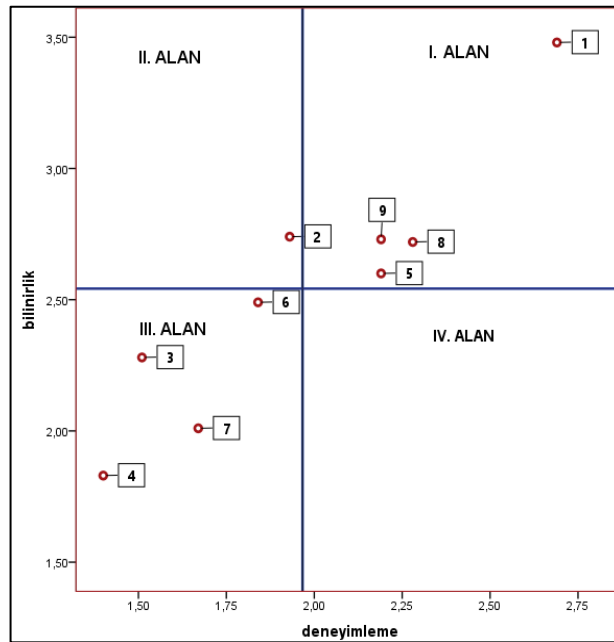
ALAN I (Yüksek Bilinirlik Yüksek Deneyimleme): Öğrencilerin Afrodisias Antik Kenti (1), Dedebağ Keşkek Hayrı (5), Karacasu Tarihi Camileri (8) ve Karacasu Etnografya Müzesine (9) yönelik bilinirlik düzeyi yüksektir. Ancak deneyimlenme düzeyi bilinirlik düzeyine kıyasla

düşüktür. Genel olarak, öğrencilerin belirtilen miras kaynaklarına yönelik farkındalık düzeylerinin yüksek olduğu söylenebilir.

ALAN II (Yüksek Bilinirlik, Düşük Deneyimleme): Bu alanda sadece bir tane miras kaynağı bulunmaktadır. Çömlekçiliğe (2) ilişkin bilinirlik seviyesi yüksek olmasına rağmen; deneyimlenme düzeyi düşüktür. Öğrencilerin çömlekçiliğe yönelik kısmi bir farkındalığa sahip oldukları söylemek mümkündür. Çömlekçilikle ilgili deneyimleme düzeylerinin geliştirilmesine yönelik seminer, atölye uygulamaları ve seramik ocaklarına gezi gibi çalışmalar yapılabilir.

ALAN III (Düşük Bilinirlik, Düşük Deneyimleme): Öğrencilerin Demircilik (3), Dericilik (4), Karacasu Geleneksel Konutları (6), Süleyman Rüşdi Türbesi (7) bilinirlik ve deneyimleme düzeyleri düşük kültürel miras kaynakları olarak tespit edilmiştir. Demircilik ve dericilik atölyeleri ilkökul 5. sınıf öğrencilerinin tek başlarına kolaylıkla ziyaret edebileceği konumda değildir. Karacasu Geleneksel Konutlarının ise sayısı sınırlıdır ve etkin olarak halk tarafından bilinseler bile deneyim olanakları maalesef uzaktır. Süleyman Rüşdi Türbesi merkezde olmasına karşın okul bölgelerine uzak sayılabilir. Bu nedenlerle öğrencilerin belirtilen miras kaynaklarına yönelik düşük farkındalığa sahip olmaları doğal bir sonuç olarak söylemek mümkündür.

ALAN IV (Düşük Bilinirlik Yüksek Deneyimleme): Bu alanda herhangi bir kültürel miras kaynağı yer almamaktadır.



Şekil 3. Öğrencilerin Karacasu Kültürel Miras Kaynaklarına yönelik bilinirlik-deneyimleme analizi

Sonuç ve Öneriler

Bu çalışmada, Karacasu ilçesinin kültürel miras kaynaklarına ilişkin farkındalık düzeyinin tespit edilmesi amaçlanmıştır. Bu amaç doğrultusunda, ilköğretim 5. sınıf öğrencileri araştırma kapsamına alınmış ve Önem Performans Analizinden uyarlanan “Bilinirlik-Deneyimleme” analizi ile öğrencilerin kültürel miras kaynaklarına yönelik farkındalık düzeyi ortaya konmuştur.

Araştırmadan elde edilen bulgular ışığında ortaya çıkan sonuçlar aşağıda sıralanmaktadır:

Öğrencilerin en yüksek farkındalığa sahip olduğu kültürel miras değeri Afrodisias Antik Kentidir. Bu durumun antik kente düzenlenen gezi programlarından kaynaklandığı düşünülmektedir. Öğrencilerin UNESCO Dünya Miras listesinde yer alan Afrodisias a yönelik yüksek farkındalığa sahip olması ilçe açısından sevindiricidir. Çünkü, bu önemli değer gelecek nesillere aktarılması için zemin hazırlandığı söylemek mümkündür. Bununla birlikte, öğrencilerin antik kentle ilgili bildiklerini çevrelerine yayma olasılığı da yükselecektir. Öte yandan, bu durum öğrencilerde antik kenti koruma bilincinin artmasını da sağlayabilir.

Dedebağ Keşkek Hayrı, Karacasu Tarihi Camileri ve Karacasu Etnografya Müzesinin bilinirlik düzeyinin yüksek ama deneyimleme düzeylerinin düşük olduğu gözlemlenmiştir. Bu sebeple, okullarda öğrencilere bu değerler hakkında detaylı bilgi verilmeli, geziler düzenlenmeli ve özellikle yaklaşık 740 yıllık bir geçmişe sahip Dedebağ Keşkek Hayrına öğrencilerin katılımı sağlanmalıdır.

Öğrencilerin çömlekçiliğe ilişkin bilinirlik düzeyleri yüksek, deneyimleme düzeyleri ise düşüktür. Bilinirlik düzeyinin yüksek çıkmasının nedeni çömlekten yapılan malzemelerin Karacasu'daki yaşamın içinde yer almasından kaynaklandığı söylenebilir. İlçenin coğrafi işaretli önemli bir değeri olan çömlekçiliğin gelecek nesillere aktarılması için öğrencilere deneyim olanaklarının sağlanması elzemdir. Bu nedenle, okul yönetimleri tarafından öğrencileri için ilçe merkezinde yer alan çömlek atölyelerine geziler düzenlenmesi ve öğrencilerin çömlek eşya yapımında yer almasının sağlanması gereklidir. Ayrıca seçmeli ders olarak çömlekçilik, el sanatları vb dersler eğitim müfredatına eklenebilir. Çömlek atölyelerinde çiraklık eğitimi teşvik edilebilir.

Demircilik, Dericilik, Karacasu Geleneksel Konutları ve Süleyman Rüşdi Türbesinin bilinirlik ve deneyimleme düzeyleri düşük olduğu tespit edilmiştir. Demircilik ve dericiliğe yönelik farkındalığın düşük çıkması, esnafların ilçede sadece üretim odaklı çalışmaları,

paylaşımına açık olmamalarına ve ilçe merkezinde satış yerlerinin olmamasına bağlanabilir. Dericilik Karacasu'da işleme üzerine uzmanlaşmıştır. Tabakhaneler İlçe merkezine uzaktır. İlçede deri malzemelerinden çanta, cüzdan vb üreten işyeri sadece 1 tanedir. Demir ustaları ise atölyelerini küçük sanayi sitesine kurmuşlardır ve öğrencilerin tek başlarına bu atölyeleri ziyaret etmeleri mümkün değildir. Bu nedenle, her iki miras değerinin unutulmaması ve yaşatılması için Kaymakamlık ve Belediye merkezli etkinlikler düzenlenebilir, satış yerleri ve sergileme alanları açılabilir. Her iki değer Karacasu'da hayatın içinde daha fazla kendine yer bulmalıdır. Öğrencilere ilçede dericiliğin ve demirciliğin seminer ve uygulamaya esaslı dersler ile geçmişi hakkında bilgi verilebilir.

Karacasu Geleneksel Konutların farkındalığı ile ilgili olarak ilçede konutların restorasyon süreçlerinin yeni başlamış olması ve bu konutların halka kapalı olması nedeniyle bilinirlik düzeylerinin düşük olduğu söylenebilir. Farkındalığın artırılması için bu yapıların atıl kalmadan, yeniden işlevlendirilerek halka açık bir şekilde kullanılması gerekmektedir.

Süleyman Rüşdi Türbesinin merkezi konumda olmasına rağmen bilinirlik ve deneyimleme düzeyinin düşük olması beklenmeyen bir bulgudur. 250 yıllık bir geçmişe sahip olmasına ve ilçeye önemli katkısı olmasına rağmen türbenin bilinmemesi ilçenin Süleyman Rüşdiye olan gerek değeri vermediği söylenebilir. Önem değerinin artması için ilçe yönetimleri tarafından Süleyman Rüşdiye yönelik keşkek hayrı ve lokma hayrı gibi dini hayırlar yapılabilir.

Genel bir değerlendirmeye, 5. sınıf öğrencilerinin Karacasu ilçesinin kültürel miras kaynaklarına yönelik farkındalıklarının düşük olduğunu söylemek mümkündür. Alptürker vd. (2021)'in belirttiği gibi, bir toplumda yaşayan insanların en temel görevlerinden birisi kendi kültürlerini korumaları, yaşatmaları ve gelecek nesillere aktarmalarıdır. Bu nedenle, Karacasu'da Milli Eğitim başta olmak üzere yerel paydaşlara büyük iş düşmektedir. İlçede kültürel mirasın tanıtılması, korunması ve yaşatılması için ilköğretim düzeyinde çeşitli projeler ve faaliyetler gerçekleştirilebilir. Katılımcı yaklaşımla da öğrencilere deneyim kazandırılabilir.

Bu araştırma sadece 5. sınıf öğrencileri üzerinde gerçekleştirilmiştir. Gelecekte yapılacak çalışmalar da farklı eğitim seviyesindeki öğrencilere ve yerel halka yönelik araştırmalar yapılarak daha kapsamlı sonuçlara ulaşılabilir.

Kaynakça

- Akkuş, G., Karaca, Ş. ve Polat, G. (2015). Miras Farkındalığı ve Deneyimi: Üniversite Öğrencilerine Yönelik Keşifsel Bir Çalışma. Akademik Bakış Uluslararası Hakemli Sosyal Bilimler Dergisi, (50), 71-81.
- Albayrak, T. ve Caber, M. (2011). Importance-Performance Analysis: A Sample About Destination Management. Ege Academic Review, 11(4-2011):625–636.
- Alptürker, İ. G., Gök, T. ve Alptürker, H. (2021). Somut Olmayan Kültürel Miras Farkındalığının Bilinirlik ve Deneyimleme Açısından Değerlendirilmesi. Milli Folklor. 132(17): 16-31.
- Atak, O., Tatar, S. ve Tunaseli, A. (2017), Kültürel Miras Oluşumunda Festivallerin Yeri Ve Önemi: Fethiye Müzik Köyü Üzerine Bir Değerlendirme, Uluslararası Sosyal Araştırmalar Dergisi, 10(52), 1396-1409, <http://dx.doi.org/10.17719/jisr.2017.1989>
- Başaran, M. (2000). 19. Yüzyılda Karacasu, Temettuat Defterleri ve Salnameler Kapsamında Aydın. Karacasu Geliştirme ve Eğitim Vakfı Yayınları. Türkiye. 15.
- Başçı Namlı, Z., Karakuş Yılmaz, T. & Meral, E., (2022). Ortaokul öğrencileri için kültürel mirasa duyarlılık ölçeğinin geliştirilmesi. Kırşehir Eğitim Fakültesi Dergisi, 23 (3), 2369-2398,
- Bülbül, H. (2016). Müze ile eğitim yoluyla ortaokul öğrencilerinde kültürel miras bilinci oluşturma. Ordu Üniversitesi Sosyal Bilimler Araştırmaları Dergisi, 6(3), 681-694
- Chen, J., Becken, S., & Stantic, B. (2022). Assessing Destination Satisfaction by Social Media: An Innovative Approach Using Importance-Performance Analysis. Annals of Tourism Research, 93, 103371.
- Demir, M. (2003). Karacasu. Karacasu Geliştirme ve Eğitim Vakfı Dergisi. Yıl:15. Sayı:15. 16-17
- Demir, Y. (2023). Kültürel Miras Farkındalık Ölçeği: Geçerlik ve Güvenirlik Çalışması. Erzincan Üniversitesi Eğitim Fakültesi Dergisi, 25(1), 44-56. <https://doi.org/10.17556/erziefd.963374>
- Doğantan, E. (2021). Turizm Programlarında Sunulan E-Öğrenme Araçlarının Önem-Performans Analiziyle Değerlendirilmesi. Türk Turizm Araştırmaları Dergisi, 5(1), 767-782.
- Dönmez, C. ve Yeşilbursa, C. C. (2014), Kültürel Miras Eğitiminin Öğrencilerin Somut Kültürel Mirasa Yönelik Tutumlarına Etkisi, İlköğretim Online, 13(2), 425-442
- Gök, T. (2020). Üniversite Öğrencilerinin Kültürel Miras Farkındalığını Değerlendirmede Önem-Performans Analizinin (ÖPA) Kullanımı. Uluslararası Türk Dünyası Turizm Araştırmaları Dergisi, 5 (2), 325-341 . DOI: 10.37847/tdtad.838415
- ICOMOS, (1999), Uluslararası Kültürel Turizm Tüzüğü, http://www.icomos.org.tr/Dosyalar/ICOMOSTR_tr0300983001536913522.pdf, erişim tarihi: 12/04/2023
- İslamoğlu, Ö. (2018), The Importance of Cultural Heritage Education in Early Ages, International Journal of Science Education, 22(1-3), 19-25. DOI: 10.31901/24566322.2019/23.1-3.1064
- Koç Altuntaş, S. ve Onur, M. (2021), Kültürel Mirasın Sürekliliği Bağlamında Yerel Bir Dinamik: Kırıkkale-Keskin Rahmi Pehlivanlı Konağı, Uluslararası Sosyal ve Beşeri Bilimler Araştırma Dergisi, 8(75), 2585-2595, <http://dx.doi.org/10.26450/jshsr.2736>
- Koçak, B. ve Can, H. (2018), Kültürel Mirasın Korunmasında Belediye Birliklerinin Rolü: Koca Yusuf Projesi Örneği, Balkan Sosyal Bilimler Dergisi, 7(14), 148-164
- Krejcie, R.V. & Morgan, D.W. (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement, 30, 607-610.

- Kuruüzüm, H. (2011). Kültürel Mirasın Yaşadığı Müze. Aydın Kültür ve Turizm Dergisi. Yıl:1. Sayı:4. 52.
- Kuruüzüm, H. (1991). *Süleyman Rüşdî*. Denizli: Merhaba Dizgi Merkezi.
- Martilla, J. A. & James, J. C. (1977). Importance-Performance Analysis. Journal of Marketing. 41, 77-79.
- O'Neill, M. & Palmer, A. (2004). "Importance-Performance Analysis: A useful Tool for Directing Continuous Quality Improvement in Higher Education", Quality Assurance in Education, Vol. 12 No. 1, 39-52
- Oğuz, E. S. (2011), Toplum Bilimlerinde Kültür Kavramı, Edebiyat Fakültesi Dergisi, 28(2),123-132
- Özcan, N., Uzak, E. D., Subaşıoğlu, A., Tekinal, M. A. (2022) "Somut Olmayan Kültürel Miras Unsurlarından Ebru Sanatının Ortaokul Öğrencilerindeki Farkındalık Durumunda Medyanın Etkisi, Bilim Armonisi Dergisi, 5 (1): 54-64. doi: 10.37215/bilar.1039421
- Özdamar, K. (2003). Modern Bilimsel Araştırma Yöntemleri. Eskişehir: Kaan Kitabevi.
- Özdemir, M. ve Karatekin, D. (2019). Aydın İli Karacasu İlçesinde Deri Üretimi. International Social Sciences Studies Journal, 5(40), 4057-4075.
- Özilhan, H. (2004). Karacasu'da Dericilik. I. Uluslararası Deri Sempozyumu Bildiri Kitabı. İzmir.
- Öztürk, L. S ve Türkmen, M. (2022). Tekstil Sektöründe Önem Performans Analizi Uygulaması İle Üretime Dayalı Stratejik Öncelik Alanlarının Belirlenmesi. Selçuk Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Dergisi, 25 (25. Yıl Özel Sayısı), 415-432.
- Sağ, Ç. & Ünal, F. (2019). Öğrencilerin somut olmayan kültürel mirasa ilişkin farkındalıklarının belirlenmesi. Bolu Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 19(4), 1550-1560.
- Tetik, N. (2012). Turist Rehberlerinin Ekoturizm Alanındaki Yeterliliklerinin Önem Performans Analizi. Seyahat ve Otel İşletmeciliği Dergisi. 9 (3). 6-24.
- Tuncel G. ve Altuntaş, B. (2020). İlköğretim 4. Sınıf Öğrencilerinin Kültürel Miras Algısı: Göstergebilimsel Bir Analiz, International Jurnal of Field Education, 6 (1), 123-140
- UNESCO (1972), Convention Concerning the Protection of the World Cultural and Natural Heritage, UNESCO, Paris
- UNESCO (1972), Convention Concerning the Protection of the World Cultural and Natural
- UNESCO (2023), <https://www.unesco.org.tr/Pages/161/177>, erişim tarihi: 10/04/2023
- UNESCO (2003), Convention for the Safeguarding of the Intangible Cultural Heritage, UNESCO, Paris, <https://www.unesco.org.tr/Pages/52/19/Somut-Olmayan-K%C3%BCI%C3%BCrel-Miras-%C4%B0htisas-Komitesi>, erişim tarihi: 10/04/2023
- Yardımcı, İ. ve Bardak, M. (2019). Geleneksel Karacasu Çömlekçiliği ve Gelin Testisinin Gelişimi ve Günümüz Yorumlamaları, Uşak Üniversitesi Sosyal Bilimler Dergisi, 12 (2), 82-89.
- Yılmaz Özbilgi, T. ve Özbilgi, M.Z. (2022). Karacasu Ekoturizm Hedef Pazar Analizi, Güney Ege Kalkınma Ajansı, https://geka.gov.tr/uploads/current_publications_v/63440bd3314ed-karacasu-ekoturizm-hedef-pazar-analizi.pdf
- <https://teftis.ktb.gov.tr/TR-263665/dunya-kulturel-ve-dogal-mirasin-korunmasi-sozlesmesi.html>, erişim tarihi: 12.04.2023
- Yüce, İ. (2022), Kültürel Miras Hukuku, <https://www.sanathukukuenstitusu.com/post/k%C3%BCI%C3%BCrel-miras-hukuku>, erişim tarihi: 15/04/2023
- <https://sozluk.gov.tr/>, erişim tarihi: 08/04/2023
- <https://www.ktb.gov.tr/TR-96254/kultur.html>, erişim tarihi: 08/04/2023

<https://kvmgm.ktb.gov.tr/TR-44400/afrodisias-antik-kenti-aydin.html>,

erişim tarihi: 12.04.2023

<https://aydin.ktb.gov.tr/TR-64424/karacasu-etnografya-muzesi.html>, erişim tarihi: 12.04.2023

<http://www.karacasu.gov.tr/karacasuda-demircilik>, erişim tarihi: 13.04.2023

<https://static.daktilo.com/sites/298/uploads/2021/07/09/demirci-225340>

d532ff7237179acb834793c842dd1008.jpg, erişim tarihi: 13.04.2023

<https://visitaydin.com/media/2022/05/YENI45-Tunay-Ates-Karacasu-Muze-scaled.jpg>, erişim tarihi: 13.04.2023

<https://www.kulturportali.gov.tr/turkiye/aydin/nealinir/çömlekçilik>, erişim tarihi: 13.04.2023

<https://www.naztic.org.tr/karacasu-keskegi-dedebag-keskegi/>, erişim tarihi: 13.04.2023

[https://kulturenvanteri.com/tr/yer/yemezzade-suleyman-rusdi-](https://kulturenvanteri.com/tr/yer/yemezzade-suleyman-rusdi-turbesi/#16/37.729443/28.607583)

[turbesi/#16/37.729443/28.607583](https://kulturenvanteri.com/tr/yer/yemezzade-suleyman-rusdi-turbesi/#16/37.729443/28.607583), erişim tarihi: 13.04.2023

<https://www.aydin hedef.com.tr/tarihi-cami-tum-ihtisamiyla-gorenleri-buyuluyor-10058h.htm>,

erişim tarihi: 13.04.2023

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Özet

Bu çalışmada beden eğitimi öğretmeni adaylarının erkeğe yönelik cinsiyetçi tutumlarının çeşitli değişkenler açısından betimlenmesi amaçlanmıştır. Araştırma beden eğitimi öğretmeni adaylarının erkeğe yönelik cinsiyetçi tutumlarını betimlemesi bakımından tarama modelinde dizayn edilmiştir. Araştırma verilerinin toplanmasında Fiske ve Glick (1996) tarafından geliştirilen ve Sakallı Uğurlu (2008) tarafından Türkçe'ye uyarlanan Erkeğe İlişkin Çelişik Duygular Ölçeği ve araştırmacılar tarafından hazırlanan kişisel bilgi formu kullanılmıştır. Erkeklere İlişkin Düşmanca Tutumlar ve Erkeklere İlişkin Korumacı Tutumlar olmak üzere iki alt boyuta sahip Erkeğe İlişkin Çelişik Duygular Ölçeğinin Cronbach Alpha güvenirlik katsayısı ölçeğin bütünü ve alt ölçekler için sırasıyla r.82, r.82, r.83 olarak bulunmuştur. Çalışmanın verileri 86 erkek, 47 kız olmak üzere toplam 133 beden eğitimi ve spor öğretmenliği bölümü öğrencisinden toplanmıştır. Veriler SPSS 26.00 istatistik paket programı kullanılarak analiz edilmiştir. Verilerin analizinde tanımlayıcı istatistikler, bağımsız gruplar t-testi, tek yönlü varyans analizi istatistiksel teknikleri kullanılmıştır. Araştırma sonucunda beden eğitimi öğretmeni adaylarının erkeğe yönelik cinsiyetçi tutumlarının düşmanca cinsiyetçilik boyutunda cinsiyete, en uzun süre yaşanan yere ve spor geçmişine göre farklı olduğu bulunmuştur.

Anahtar Kelimeler: Erkek, Spor, Cinsiyetçilik

GENDER TOWARDS MEN

Abstract

In this study, it was aimed to describe the sexist attitudes of prospective physical education teachers towards men in terms of various variables. The research was designed in the survey model in terms of describing the sexist attitudes of prospective physical education teachers towards men. In the collection of the research data, the Conflicting Emotions Related to Men Scale developed by Fiske and Glick (1996) and adapted into Turkish by Sakallı Uğurlu (2008) and the personal information form prepared by the researchers were used. The Cronbach Alpha reliability coefficient of the Contradictory Emotions Towards Men Scale, which has two subscales, Hostile Attitudes Towards Men and Protective Attitudes Towards Men, was found to be r.82, r.82, and r.83 for the whole scale and subscales, respectively. The data of the study were collected from a total of 133 physical education and sports teaching students, 86 male and 47 female. The data were analyzed using SPSS 26.00 statistical package program. Descriptive statistics, independent groups t-test, one-way analysis of variance statistical techniques were used to analyze the data. As a result of the research, it was found that the sexist attitudes of prospective physical education teachers towards men were different in the hostile sexism dimension according to gender, place of residence for the longest time and sports background.

Keywords: Male, Sport, Sexism

GİRİŞ

Bir ayrımcılık türü olarak cinsiyetçilik, bir cinsiyetin diğerine göre daha üstün ya da öncelikli olduğunu ifade eden heteronormatif yapıyı işaret eden bir kavramdır (Bozok,2011). Her ne kadar cinsiyetçiliğin tanımları değişse de birçok tanımda patriyarkal yapıyı ifade eden bir çerçeve dikkati çekmektedir. Çünkü toplumsal cinsiyet anlamında birçok toplumda kadını ikincilleştiren, ötekileştiren bir anlayış daha çok öne çıkmaktadır. Dolayısıyla cinsiyetçiliğin mağduru daha çok kadınlar iken erkekler bu mağduriyetin kaynağı olarak görülmüştür. Oysa bu tür bir mağduriyet söz konusu olduğunda, bu durum kendi karşıtını da üretecek ve erkeğe yönelik cinsiyetçi tutumlarda farklı biçimlerde karşımıza çıkacaktır. Erkeği fizisel olarak güç gerektiren işlere yöneltme, toplumda biyolojik cinsiyetten bağımsız kadın ve erkeğe ilişkin tanımlanmış olan roller, cinsiyetler arası eşitsizliğin ve ayrımcılığın temelini atmaktadır. Cinsiyetler arasındaki önyargı ve ayrımcılık gerçekte var olan durumdan, sahip olunan özelliklerden bağımsız biçimde her iki cinsiyetin de birbirine düşmanca ya da koruyucu bir tavır içinde yaklaşması olarak ifade edilebilir. Kadının korunmaya muhtaç ikincil bir konumda, erkeğin ise üstün ve her şeye muktedir olarak algılanması kadına ilişkin bir mağduriyet doğururken, kadının da erkeğe ilişkin farklı değerler atfetmesine neden olmaktadır. Kadın erkeği bir taraftan güçlü, yetkin olarak (sözde sığınılacak bir liman gibi) görürken, diğer taraftan erkeğin bu gücü kendisi üzerinde kontrol mekanizması olarak kullanan acımasız, kaba, güvenilmeyecek bir otorite figürü olarak görmesi erkeğe yönelik çelişkili bir algı ortaya çıkarmaktadır. Erkeğe yönelik düşmanca ve korumacı cinsiyetçilik olarak tanımlayabileceğimiz bu durum literatürde erkeğe yönelik çelişik duygulu cinsiyetçilik olarak da karşılığını bulur. Alan yazında erkeklere ilişkin cinsiyetçi tutumların yeterli düzeyde tespit edilemediği düşüncesinden yola çıkılarak toplumdaki cinsiyetçi tutumları daha net bir biçimde ortaya koyabilmek adına bu çalışmada erkeklere ilişkin cinsiyetçi tutumların ortaya konulması amaçlanmıştır (Glick vd., 2004; Villemez&Touhey, 1977)

YÖNTEM

Araştırmanın Modeli

Araştırma Beden Eğitimi ve Spor Öğretmenliği Bölümü öğrencilerinin erkeklere yönelik cinsiyetçi tutum düzeylerini betimlemesi bakımından, nicel veri toplama tekniğinin kullanıldığı tarama modelinde betimsel bir çalışmadır. Tarama modeli geçmişte ya da günümüzde var olan bir durumu değiştirmeden ortaya koyan bir araştırma yaklaşımıdır.

Evren ve Örneklem

Çalışma Adnan Menders Üniversitesi Spor Bilimleri Fakültesi Beden Eğitimi ve Spor Eğitimi Bölümü öğrencilerini kapsamaktadır. Çalışmanın örneklem seçiminde kolayda ulaşılabilir örneklem seçimi tercih edilmiş ve 133 gönüllü öğrenciye ulaşılmıştır.

Veri Toplama Araçları

Araştırmada katılımcıların erkeğe ilişkin cinsiyetçi tutumlarını belirlemek için Glick ve Fiske (1999), tarafından geliştirilen Sakallı-Uğurlu (2008) tarafından Türkçe'ye uyarlaması yapılan Erkelere İlişkin Çelişik Duygular Ölçeği kullanılmıştır. 5'li likert tipindeki ölçek Erkelere İlişkin Düşmanca Tutumlar ve Erkelere İlişkin Korumacı Tutumlar olmak üzere iki alt boyuttan oluşmaktadır. Araştırma sürecinde yapılan güvenilirlik analizinde ölçeğin tamamı ve alt boyutları için Cronbach Alfa güvenilirlik katsayıları sırasıyla .82,.82,.83 olarak belirlenmiştir ($p<.001$). Araştırmada kişisel bilgilerin toplanmasında araştırmacılar tarafından düzenlenen kişisel bilgi formu kullanılmıştır.

Verilerin Analizi

Araştırma verileri SPSS (Statistical Package For Social Sciences) 26.00 paket programında analiz edilmiştir. Çalışmaya katılanların ölçekte bulunan sorulara verdiği cevapların normal dağılım gösterip göstermediği Kolmogorov-Smirnov testi ile incelenmiş katılımcıların ölçeğe verdikleri cevapların çarpıklık ve basıklık değerlerinin normal dağılıma uygun olduğu bu puanların arasındaki farkın anlamlı olmadığı görülmüştür. Literatürde normal dağılıma ilişkin çarpıklık ve basıklık değerleri puanların ± 1 aralığında olması gerektiği vurgulanmıştır (George & Mallery, 2016). Dolayısıyla araştırma verilerinin analizinde betimleyici istatistikler (frekans, yüzde, aritmetik ortalama, standart sapma) t-testi, anova testi istatistiki teknikler kullanılmıştır. Anlamlılık düzeyi $p <.05$ olarak alınmıştır.

BULGULAR

Araştırmada Beden Eğitimi ve Spor Eğitimi Bölümü öğrencilerinin erkelere yönelik toplumsal cinsiyet algısı düzeyleri cinsiyet değişkenine göre t-testi ile analiz edilmiş, analiz sonuçları Tablo.1. de verilmiştir.

Tablo.1. Beden Eğitimi ve Spor Eğitimi Bölümü Öğrencilerinin Erkeklerle Yönelik Toplumsal Cinsiyet Algısı Düzeylerinin Cinsiyet Değişkenine Göre t-testi Sonuçları

Ölçek Alt Boyut	Cinsiyet	N	\bar{X}	SS	t	P
Düşmanca Cinsiyetçilik	Kadın	86	37.72	10.16	5.51	.00
	Erkek	47	47.44	8.87		
Korumacı Cinsiyetçilik	Kadın	86	39.12	5.90	.94	.34
	Erkek	47	38.08	6.34		

Tablo.1. incelendiğinde Beden Eğitim ve Spor Eğitimi Bölümü öğrencilerinin erkeklerle yönelik toplumsal cinsiyet algısı düzeylerinin cinsiyet değişkenine göre düşmanca cinsiyetçilik alt boyutunda farklı olduğu görülmektedir. Nitekim kadın ve erkek öğrencilerinin düşmanca cinsiyetçilik ortalamalarının kadın öğrenciler lehine yüksek olduğu gözlenmiştir.

Araştırmada Beden Eğitimi ve Spor Eğitimi Bölümü öğrencilerinin erkeklerle yönelik toplumsal cinsiyet algısı düzeyleri spor deneyimi değişkenine göre anova analizi ile incelenmiş, analiz sonuçları Tablo.2. de verilmiştir.

Tablo.2. Beden Eğitimi ve Spor Eğitimi Bölümü Öğrencilerinin Erkeklerle Yönelik Toplumsal Cinsiyet Algısı Düzeylerinin Spor Deneyimi Değişkenine Göre Anova Analizi Sonuçları

Ölçek Alt Boyut	Spor Deneyimi	N	\bar{X}	SS	F	P	Scheffe (Fark Grupları)
Düşmanca Cinsiyetçilik	1-2	13	37.84	9.19	4.91	.00	3-5 yıl/10 yıl ve üstü
	3-5	29	46.17	10.84			
	6-10	50	42.32	10.31			
	10 yıl ve üstü	41	37.24	10.23			
Korumacı Cinsiyetçilik	1-2	13	37.76	4.38	.29	.83	
	3-5	29	38.17	5.75			
	6-10	50	39.06	6.67			
	10 yıl ve üstü	41	38.75	6.06			

Tablo.3. incelendiğinde Beden Eğitim ve Spor Eğitimi Bölümü öğrencilerinin erkeklerle yönelik toplumsal cinsiyet algısı düzeylerinin spor deneyimi değişkenine göre düşmanca cinsiyetçilik alt boyutunda farklı olduğu görülmektedir. Nitekim öğrencilerin düşmanca cinsiyetçilik ortalamaları incelendiğinde puan ortalamalarının 3-5 yıl arası spor deneyimine sahip olan öğrenciler lehine daha yüksek olduğu gözlenmiştir.

Araştırmada Beden Eğitimi ve Spor Eğitimi Bölümü öğrencilerinin erkeklere yönelik cinsiyetçilik algısı düzeylerinin toplumun kadınların spora katılımını desteklemesine ilişkin bakış açısı değişkenine göre anova analizi ile incelenmiş, analiz sonuçları Tablo.3. de verilmiştir.

Tablo.3. Beden Eğitimi ve Spor Eğitimi Bölümü Öğrencilerinin Erkeklere Yönelik Toplumsal Cinsiyet Algısı Düzeylerinin Toplumun Kadınların Spora Katılımını Desteklemesine İlişkin Bakış Açısı Değişkenine Göre Anova Analizi Sonuçları

Ölçek Alt Boyut	Toplumun Kadınların Spora Katılımına Verdiği Destek	N	\bar{X}	SS	F	P	Scheffe (Fark Grupları)
Düşmanca Cinsiyetçilik	Destekliyor	39	41.64	10.59	51.4	.59	
	Olumsuz Karşılıyor	41	42.17	10.80			
	Umursamıyor	53	40.01	10.93			
Korumacı Cinsiyetçilik	Destekliyor	39	39.53	5.96	3.47	.03	Olumsuz değerlendirenler/Umursamayanlar
	Olumsuz Karşılıyor	41	40.14	5.81			
	Umursamıyor	53	37.11	6.04			

Tablo.3. incelendiğinde Beden Eğitimi ve Spor Eğitimi Bölümü öğrencilerinin erkeklere yönelik cinsiyetçilik algısı düzeylerinin toplumun kızların spora katılımını desteklemesine ilişkin bakış açısı değişkenine göre korumacı cinsiyetçilik alt boyutunda farklı olduğu görülmüştür. Nitekim öğrencilerin korumacı cinsiyetçilik ortalamaları incelendiğinde puan ortalamalarının toplumun kadınların spora katılımını olumsuz karşıladığını düşünen öğrenciler lehine daha yüksek olduğu gözlenmiştir.

Araştırmada Beden Eğitimi ve Spor Eğitimi Bölümü öğrencilerinin erkeklere yönelik cinsiyetçilik algısı puanlarının branşa, spor yapma nedenine, profesyonel ya da amatör spor yapma durumuna göre değişip değişmediği t-testi ve anova analizi ile incelenmiş hem ölçeğin bütününde hem de alt boyutlarında anlamlı düzeyde fark bulunmadığı görülmüştür.

SONUÇ VE TARTIŞMA

Araştırmada kadın öğrencilerin erkeklere yönelik düşmanca cinsiyetçilik ortalamalarının erkek öğrencilere göre daha yüksek olmasının toplumda kadınların yoğun bir biçimde maruz kaldığı cinsiyetçiliğin sonucu ya da ona karşı geliştirilen bir tepki olduğu düşünülmektedir. Erkekler üzerinde yapılan bir çalışmada cinsiyetçi tutma sahip erkeklerin daha çok cinsiyetçiliğe maruz

kaldığı ancak bunu daha çok görmezden geldikleri ortaya konulmuştur (Cengiz & Özdemir, 2020; Sakallı-Uğurlu & Beydoğan, 2002; Becker & Wright, 2011).

Araştırmada spor deneyimine göre erkeklere ilişkin cinsiyetçilik puan ortalamalarının düşmanca cinsiyetçilik alt boyutunda 10 yıl ve üstü spor deneyimine sahip öğrenciler aleyhine olması spor yılı arttıkça toplumun olumsuz tepkisine maruz kalma süresinin de artması ile ilişkili olduğu düşünülmektedir.

Araştırmada toplumun kadınların spora katılımı konusundaki bakış açısına göre erkeklere yönelik cinsiyetçilik algısı puan ortalamalarının, korumacı cinsiyetçilik alt boyutunda kadınların spora katılımını olumsuz karşılayanlarla umursamayanlar arasında gözlenen anlamlı farkın olumsuz karşılayanların, kadınlara karşı korumacı tavrının sonucu olduğu söylenebilir. Maruz kaldıkları cinsiyetçiliği kadınlara göre daha düşük düzeyde fark eden erkeklerin tepki verme konusunda da çok istekli olmadıkları bazı çalışmalarda ortaya konulmuştur (Becker & Wright, 2011; Iyer & Ryan, 2009). Ancak bu tutumlar toplumda cinsiyetçi kalıp yargıların artmasına ve meşrulaşmasına neden olmaktadır. Bu nedenle her iki cinsiyetinde mağduru olduğu cinsiyetçi kalıp yargıların kırılmasına yönelik tedbirlere eğitim sisteminin bir parçası olarak yer açılmalıdır.

KAYNAKÇA

- Becker, J. C. & Wright, S. C. (2011). Yet another dark side of chivalry: Benevolent sexism undermines and hostile sexism motivates collective action for social change. *Journal of Personality and Social Psychology*, 101(1), 62-77. <https://doi.org/10.1037/a0022615>
- Bozok, M. (2011). Soru ve cevaplarla erkeklikler. Sosyal Kalkınma ve Cinsiyet Eşitliği Politikaları Merkezi Derneği, İstanbul. s. 94.
- Cengiz, A. A. & Özdemir, A. (2020). Kadın yöneticilere yönelik tutumların oluşumunda çelişik duygulu cinsiyetçilik ve narsisizmin etkisi. *Çalışma ve Toplum*, 4(67), 2123 - 2143. <https://www.calismatoplum.org/makale/kadin-yoneticilere-yonelik-tutumlarin-olusumunda-celisikduygulu-cinsiyetcilik-ve-narsizmetkisi>
- George, D., & Mallery, P. (2016) *IBM SPSS Statistics 23 Step by Step: A Simple Guide and Reference.*(14. ed.) New York: Routledge.
- Glick, P. ve Fiske, T. S. (1999). The ambivalence toward men inventory: Differentiating hostile and benevolent beliefs about men. *Psychology of Women Quarterly*, 23, 519- 536.
- Glick, P., Lameiras, M., Fiske, S. T., Eckes, T., Masser, B., Volpato, C., Manganelli, A. M., Pek, J., Huang, L., Sakallı-Uğurlu, N., Castro, Y. R., Luiza, M., Pereira, D., Willemson, T. M., Brunner, A., Materna, I. ve Wells, R. (2004). Bad but bold: Ambivalent attitudes toward men predict gender inequality in 16 nations. *Journal of Personality and Social Psychology*, 86 (5), 713-728.
- Iyer, A. & Ryan, M. K. (2009). Why do men and women challenge gender discrimination in the workplace? The role of group status and in-group identification in predicting pathways to collective action. *Journal of Social Issues*, 65(4), 791-814. <https://doi.org/10.1111/j.1540-4560.2009.01625.x>
- Sakallı-Uğurlu, N. (2008) Erkeklere İlişkin Çelişik Duygular Ölçeği'nin Türkçe'ye Uyarlanması *Türk Psikoloji Yazıları*, Haziran 2008, 11 (21), 1-11
- Sakallı-Uğurlu, N. & Beydoğan, B. (2002). Turkish college students' attitudes toward women managers: The effect of patriarchy, sexism, and gender differences. *Journal of Psychology*, 136(6), 647-656.
- Villemez, W. J. & Touhey, J. C. (1977). A measure of individual differences in sex stereotyping and sex discrimination: The "macho" scale. *Psychological Reports*, 41, 411-415.

**BASELINE MONITORING OF CACOPSYLLA PYRICOLA (HEM.:PSYLLIDAE)
WHEN TESTED AGAINST SPINETORAM**

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ABSTRACT

Pear psylla *Cacopsylla pyricola* (Hemiptera:Psylliade) is one of the most important pests that impact the production of pears. It causes severe wilting and defoliation, which reduces yields and weakens the trees. Spinetoram is a mixture of two synthetically modified spinosyns (Spinosyn J and Spinosyn L), which are metabolites of the bacterium *Saccharopolyspora spinosa* Mertz and Yao (Bacteria: Actinobacteridae) is effective against many pests also *Cacopsylla pyricola*. This study was carried out to determine the LC₅₀-LC₉₀ values of Spinetoram on native populations of *C. pyricola* collected from different four locations (Bursa; Gürsu, Kestel, Osmangazi, İnegöl) in pear producing areas in July-August 2022 in Turkey. In this study, the methodology was used by IRAC Susceptibility Test Methods Series Method No: 002 Version: 3 (June 2009). All treatments were placed in Entomology laboratory at Muğla Sıtkı Kocman University, Science Faculty with a controlled environment (25 ± 2°C, 60–65% RH, 16:8 h L:D) for 24 hours. In the study, the percentage effectiveness of different concentration. Spinetoram against *C. pyricola* brought from different locations was used. In these locations, LC₅₀ and LC₉₀ values and RF values were calculated. Poloplus software program was used in these calculations. As a result of this study, the LC₅₀ values of Spinetoram on *C. pyricola* populations collected from Gürsu, Kestel, Osmangazi and İnegöl were 7.51, 13.15, 9.81, and 8.5 ppm respectively. The RF value was found below 2 in all locations. it can be said that there is no important resistance between the different provinces and their different insect populations against Spinetoram.

Keywords: *Cacopsylla pyricola*, spinoteram, pesticide resistance

INTRODUCTION

Cacopsylla pyricola is one of the most important pests that impact the production of pears parentage. It causes severe wilting and defoliation, which reduces yields and weakens the trees (Nin et al., 2012). At high densities, *C. pyricola* causes losses in fruit size and yield (Westigard and Zwick, 1972). Although *C. pyricola* transmits 'a virus' capable of causing Pear decline (PD) disease (Carraro et al., 2001). Agricultural control and toxicology studies against pear psyllid are very important due to the damage it causes.

Spinetoram is a mixture of two synthetically modified spinosyns (Spinosyn J and Spinosyn L). They were metabolites of the bacterium *Saccharopolyspora spinosa* Mertz and Yao (Bacteria: Actinobacteridae). Spinetoram has the same mechanism of action as spinosad but is faster than it (Dripps et al., 2008). Also, studies have shown that spinetoram is effective against many pests (Saglam et al., 2006).

This experiment was carried out to determine the LC₅₀-LC₉₀ values of Spinetoram on native populations of *Cacopsylla pyricola* collected from different four locations in pear-producing areas in Turkey.

MATERIAL AND METHOD

Six concentrations (1.56 ppm Delegate 250 WG, 6.25 ppm Delegate 250 WG, 12.5 ppm Delegate 250 WG, 25 ppm Delegate 250 WG, 100 ppm Delegate 250 WG, 400 ppm Delegate 250 WG and an untreated Control (0) were used with 4 replicates. For each replicate, 20 nymphs were placed per replicate to plastic boxes containing leaf discs placed on agar. A series of Psyllid populations of the species *C. pyricola* was sampled from four different locations of Bursa (Gürsu, Kestel, Osmangazi, İnegöl) in Turkey. Groups of 20 nymphs were collected in the field and sent quickly to the laboratory of the University with the lowest possible impact on the Psyllids. Laboratory conditions, at 25 ± 2°C, 65% relative humidity and 16:8 (light: dark) photoperiod and petri dishes were closed with perforated cheesecloth to allow an exchange. Leaf-dip bioassay (IRAC Susceptibility Test Method 002). All treatments were placed in Entomology laboratory with a controlled environment (25 ± 2°C, 60–65% RH, 16:8 h L: D) for 24 hours. Mortality was evaluated after 24 h of exposure to the treated leaves by checking each psyllid's ability to show coordinated movement in response to touch with a paintbrush. In this study, the relationship between treatment dose and mortality using the probit model of log-transformed dose (the slope parameter). A significant difference between LC₅₀ values was conducted as described by Robertson et al. (2017).

Resistance factors (RFs) were calculated by using the POLOPLUS version 2.0 (LeOra Software, U.S.A.).

Resistances were classified to Khan et al. (2013) and Abbas et al. (2015) as absent (RF = 1), very low (RF = 2–10), low (RF = 11–20), moderate (RF = 21–50), high (RF = 51–100), and very high (RF >100) (Esmaeily et al, 2020).

RESULTS AND DISCUSSION

Results are given in Tables 1-3 (Application time; 27.06.2022 for Bursa population with Spinetoram);

Table 1. Effect of Spinetoram in different location

Concentration (ppm)	Location / Effect (%) of Spinetoram			
	Gürsu	Kestel	Osmangazi	İnegöl
0				
1.56	5	3.75	10.26	8.75
6.25	28.75	21.25	12.82	62.5
12.5	86.25	67.5	79.49	76.25
25	85	75	83.33	80
80	92.5	81.25	89.74	86.25
100	100	98.75	100	97.5

In Table 1, the percentage effects of different doses of spinoteram in 4 different locations are given. The percentage effects were calculated by Abbott's formula (Abbott,1925). According to this, Spinetoram was tested at six concentration determined in pilot experiments to cause mortalities across 3.75%-100% range.

Table 2. Probit analyzes results for different locations

Population	N	LC50 (95%confidence interval [CI])	LC90	Heterogeneity
Gürsu	560	7.51(4.79-10.86)	37.37 (18.64-252.75)	9.79
Kestel	560	13.15(6.25-25.33)	92.69 (42.61-555.26)	7.16
Osmangazi	560	9.81(2.35-22.39)	53.07 (23.07-996.12)	11.20
İnegöl	560	8.50 (3.91-15.31)	35.90-340.51	5.40

Table 3. Resistance rates of four different locations (LC₅₀ of first location/ LC₅₀ of second location)

Population	N	LC50 (95%confidence interval Slope±SE [CI])	X ² (df)	RF(CI)	
Gürsu	80	7.51(4.79-10.86)	2.59±0.23	19.69(4)	1
Kestel	80	13.15(6.25-25.33)	1.51±0.12	28.66 (4)	1.75
Osmangazi	80	9.81(2.35-22.39)	1.74±0.16	44.81 (4)	1.30
İnegöl	80	8.50 (3.91-15.31)	1.35±0.11	21.60 (4)	1.13

Mortality data from concentration-response assays fitted the Polo Leora Software program and the LC₅₀ values of populations showed close values to each other (7.51-13.15 ppms) for the same insecticide in different locations (Table 2-3).

Result of this study, the LC₅₀ values of Spinetoram on *C. pyricola* populations collected from Gürsu, Kestel, Osmangazi and İnegöl were 7.51, 13.15, 9.81, and 8.5 ppm respectively (Table 2-3).

Gürsu population showed the lowest level of resistance to spinetoram, Kestel population was the most resistant to it. But there is no resistance was observed for insecticides test. In this study, The RF value was found below 2 in all locations. According to Khan et al. (2013) and Abbas et al. (2015), resistance did not develop for the pesticide when the RF values was less than 2.

As we know, in order to be able to say that pesticide resistance develops in any different provinces, the resistance rate value (ratio of LC₅₀ values of different provinces according to each other) should be at least 4 times different from each other (Erdoğan & Gürkan 1997). Table 3 shows that the resistance rate values are less than 4, which shows us that there is no increase in insecticide resistance between populations of different provinces.

Another statistical data that supports our report scientifically is “slope” values. The slope value obtained from probit analysis gives information about the variance of the population. The slope value obtained from probit analysis gives information about the variation of the population. If the population produces a high slope it's an indication of homogeneous population ($b > 2$). The line shows a low slope ($b < 1$) is indicative of a heterogeneous population showing large variation in its response (Yu, 2015; Satar, 2018). In this study, the slopes of most dose-mortality curves were very little high and were very close to 2 value (bigger than >1,5 (Table 3)) indicating homogeneity in spinetoram resistance in these populations. As a result, it can be

said that there is no important resistance between the different provinces and their different insect populations against Spinetoram. There are studies in the literature that some pests develops resistance against spinetoram (Li et al., 2022; Bilbo et al., 2023). For this reason, it is important to be careful when deciding on chemical control in order not to develop resistance to spinetoram, and to take the necessary precautions to prevent long-term exposure to the pest to pesticides.

REFERENCES

- Abbott, W.S. (1925). A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology*, 18: 265-267.
- Abbas, N., Shad, S. A., İsmail, M. (2015). Resistance to conventional and new insecticides in house flies (Diptera: Muscidae) from poultry facilities in Punjab, Pakistan. *Journal of Economic Entomology*, 108: 826-833.
- Bilbo, T.R., Kennedy, G.G., Walgenbach, J.F. (2023). Western flower thrips (*Frankliniella occidentalis*) field resistance to spinetoram in North Carolina. *Crop Protection*, 165:2023, doi:106168.
- Carraro, L., Loi, N., Ermacora, P. (2001). The Life Cycle of Pear Decline Phytoplasma in the vector *Cacopsylla pyri*. *Journal of Plant Pathology*, 83(2): 87-90.
- Dripps, J., Olson, B., Sparks, T., & Crouse, G. (2008). *Plant Health Progress*, doi: 10.1094/PHP-2008-0822-01- PS.
- Erdoğan, C., Gürkan, O.M. (1997). Investigations on the susceptibilities of different Colorado potato beetle (*Leptinotarsa decemlineata*) (Say) (Coleoptera: Chrysomelidae) populations against some insecticides. *Türkiye Entomoloji Dergisi*, 21(4): 299-309.
- Esmaily, M., Talebi, K., Hosseiniaveh, V., Nozari, J. (2019). Seasonal variation in susceptibility of the pear psyllid, *Cacopsylla permixta* (Hemiptera: Psyllidae) to selected insecticides. *Journal Of Applied Entomology*, 143(6): 644-651.
- Khan, H. A. A., Shad, S.A., Akram, W. (2013). Resistance to new chemical insecticides in the house fly *Musca domestica* L., from dairies in Punjab. Pakistan. *Parasitology Research*, 112: 2049-2054.
- Li, D., Zhi, J., Yue, W., Zhang, T., Liu, L. (2022). Resistance to Spinetoram Affects Host Adaptability of *Frankliniella occidentalis* (Thysanoptera: Thripidae) Based on Detoxifying Enzyme Activities and an Age-Stage-Two-Sex Life Table. *Environmental Entomology*, 51(4): 780-789.
- Nin, S., Ferri, A., Sacchetti, P., Giordani, E. (2012). Pear Resistance to Psylla (*Cacopsylla pyri* L.): a Review. *Advances in Horticultural Science*, 26 (2):59-74.
- Robertson, J.L., Jones, M.M., Olguin, E., Alberts, B. (2017). *Bioassays with arthropods*. New York: CRC Press.
- Sağlam, Ö., Tunaz, H., Er, M.K. (2016). Residual toxicity of Spinetoram against to bean weevil, *Acanthocelides obtectus* Say. (Coleoptera: Bruchidae) on bean. *Turkish Journal of Entomology*, 40(1):23-32.
- Satar, G., Ulusoy, R.M., Nauen, R., Dong, K. (2018). Neonicotinoid insecticide resistance among populations of *Bemisia tabaci* in the Mediterranean region of Turkey. *Bulletin of Insectology*, 71 (2): 171-177.
- Westigard, P. H., Zwick, R.W. (1972). The pear psylla in Oregon. *Oregon Agric. Exp. Stn. Tech. Bull.*, 122.
- Yu, S. J. (2015). *The Toxicology and Biochemistry of Insecticides*. CRC Press, Boca Raton, 380p., USA.

BASELINE MONITORING OF *Frankliniella occidentalis* Pergande (Thysanoptera: Thripidae) WHEN TESTED AGAINST SPINETORAM

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ABSTRACT

The western flower thrips, *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae), is an important pest of crops. Spinetoram is a mixture of two synthetically modified spinosyns (Spinosyn J and Spinosyn L), which are metabolites of the bacterium *Saccharopolyspora spinosa* Mertz and Yao (Bacteria: Actinobacteridae) and is effective against many pests also *F. occidentalis*. This experiment was carried out to determine the LC₅₀-LC₉₀ values of Spinetoram on native populations of *F. occidentalis* collected from different eight locations (Antalya; Kumluca, Demre-Köşkerler; Demre-Beymelek, Kaş, Serik, Aksu, Mersin; Adanlıoğlu, Kazanlı) in pear producing areas in 2022 in Turkey. In this study, the methodology was used by IRAC Susceptibility Test Methods Series Method No: 002 Version: 3. All treatments were placed in the Entomology laboratory at Muğla Sıtkı Kocman University, Science Faculty with a controlled environment (25 ± 2°C, 60–65% RH, 16:8 h L:D) for 24 hours. In the study, the percentage effectiveness of different concentration. Spinetoram against *F.occidentalis* brought from different locations was used. In these locations, LC₅₀ and LC₉₀ values and RF values were calculated. Poloplus software program was used in these calculations. As a result of this study, the LC₅₀ values of Spinetoram on *F. occidentalis* populations collected from Kumluca, Demre 1, Demre 2, Kaş, Serik, Aksu, Mersin 1 ve Mersin 2 were 62.61, 63.35, 59.86, 63.45, 95.86, 51.75, 1135.24 and 1320.68 ppm respectively. In this study, the slopes of most dose-mortality curves were higher than 2. There are studies in the literature that *F. occidentalis* develops resistance against spinetoram. Considering the heterogeneity of the population at the same time, it seems likely that the resistance rate will increase in other regions in the coming years.

Keywords: *Frankliniella occidentalis*, spinoteram, pesticide resistance.

INTRODUCTION

The western flower thrips, *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae), is an important pest of crops (Tommasini & Mainini, 1995). It's first recorded in Turkey in 1993 (Tunç & Göçmen, 1995). It is polyphagous and leads to economic losses widespread the world (Dağlı & Tunç, 2006; Yıldırım & Başpınar, 2013; Civelek et al., 2017). It's highly productive and damage by all production seasons. Adults and nymphs pierce the epidermis of leaves, flowers or stems and feed by sucking the oozing sap. In addition to economic damage to fruits, it may also play a role in the transport of viruses (Hen et al., 2020). Due to the behavioral characteristics of the insect, the success rate of chemical control is low (Robb & Parella, 1995). Recently, study results have been reported in Turkey, Israel, America and many European countries indicating insecticide resistance to *F. occidentalis* (Bielza et al., 2007; Dağlı, 2018).

Spinetoram is a mixture of two synthetically modified spinosyns (Spinosyn J and Spinosyn L). They were metabolites of the bacterium *Saccharopolyspora spinosa* Mertz and Yao (Bacteria: Actinobacteridae). Spinetoram has the same mechanism of action as spinosad but is faster than it (Dripps et al., 2008). Also, studies have shown that spinetoram is effective against many pests (Saglam et al., 2006).

This experiment was carried out to determine the LC₅₀-LC₉₀ values of Spinetoram on native populations of *F. occidentalis* collected from different eight locations in pear producing areas in Turkey.

MATERIAL AND METHOD

Seven concentrations (0.9375ppm Radiant 120 SC, 3.75 ppm Radiant 120 SC, 15 ppm Radiant 120 SC, 60 ppm Radiant 120 SC, 240 ppm Radiant 120 SC, 960 ppm Radiant 120 SC, 3840 ppm Radiant 120 SC) and an untreated Control (0) were used with 5 replicates. *F. occidentalis* was sampled from eight different locations of Antalya (Kumluca, Demre I, Demre II, Kaş, Serik, Aksu) and Mersin (Adanalıoğlu, Kazan) in Turkey.

F. occidentalis was grown in the laboratory on bean leaves, transparent plastic containers (18x11cm) were used for this purpose. (Dağlı, 2018). The leaf dipping method was used based on IRAC Susceptibility Test Method to determine the population LC 50 and LC 90 values. Twenty thrips were used in each replicate. Mortality was recorded after 48 h with the aid of a microscope. Thrips were recorded as dead if they did not respond when prodded with a pin or

brush. All treatments were placed in Entomology laboratory with a controlled environment ($25 \pm 2^{\circ}\text{C}$, 60–65% RH, 16:8 h L:D) for 24 hours.

In this study, the relationship between treatment dose and mortality using the probit model of log-transformed dose (the slope parameter). A significant difference between LC50 values was conducted as described by Robertson et al. (2017). Resistance factors (RFs) were calculated by using the POLOPLUS version 2.0 (LeOra Software, U.S.A.). Resistances were classified to Khan et al. (2013) and Abbas et al. (2015) as absent (RF = 1), very low (RF = 2–10), low (RF = 11–20), moderate (RF = 21–50), high (RF = 51–100), and very high (RF >100) (Esmaily et al, 2020). The percentage effects of spinetoram were calculated by Abbott's formula (Abbott,1925).

RESULTS AND DISCUSSION

Results are given in Tables 1-3 ;

Table 1. Probit analyzes results for different locations

Population	N	LC50(95%confidence [CI])	interval	LC90 (95%)	Heterogeneity
<i>Frankliniella occidentalis</i>					
Kumluca (TSR01C)	800	62.61 (42.07-91.56)		237.47 (151.44-497.28)	2.02
Demre 1 (TSR02C)	800	63.35 (461.11-86.19)		228.15(156.27-405.26)	1.41
Demre 2 (TSR03C)	800	59.86 (46.46-76.52)		215.01(156.83-334.88)	0.92
Kaş (TSR04C)	800	63.45 (53.40-75.25)		223.5 (177.21-300.56)	0.46
Serik (TSR05C)	800	95.86 (63.64-142.41)		448.69(276.63-968.42)	1.93
Aksu (TSR06C)	800	51.75 (43.24-61.77)		162.11(128.06-221.18)	0.54
Mersin 1(TSR07C)	800	1135.24 (460.15-2611.92)		4040.02(1919.13-34651.18)	7.42
Mersin 2(TSR08C)	800	1320.68 (896.73-1922.42)		5326.72(3394.59-10913.53)	1.91

Table 2. Resistance rates of four different locations (LC₅₀ of first location/ LC₅₀ of second location)

Population	N	LC50 (95%confidence interval [CI])	Slope±SE	X ² (df)	RF(CI)
<i>Frankliniella occidentalis</i>					
Kumluca (TSR01C)	800	62.61 (42.07-91.56)	2.21± 0.19	10.13 (5)	1.21
Demre 1 (TSR02C)	800	63.35 (46.11-86.19)	2.30±0.20	7.07 (5)	1.22
Demre 2 (TSR03C)	800	59.86 (46.46-76.52)	2.31±0.21	4.60 (5)	1.16
Kaş (TSR04C)	800	63.45 (53.40-75.25)	2.34±0.21	2.30 (5)	1.22
Serik (TSR05C)	800	95.86 (63.64-142.41)	1.91±0.15	9.64 (5)	1.85
Aksu (TSR06C)	800	51.75 (43.24-61.77)	2.58±0.24	2.72 (5)	1
Mersin 1(TSR07C)	800	1135.24(460.15-2611.92)	2.32±0.20	37.10 (5)	21.93
Mersin 2(TSR08C)	800	1320.68(896.73-1922.42)	2.11±0.17	9.54 (5)	25.52

Mortality data from concentration-response assays fitted the Polo Leora Software program and the LC₅₀ values of populations showed close values to each other (51.75-1320.68 ppm) for the same insecticide in different locations (Table 1-2).

As a result of this study, the LC₅₀ values of Spinetoram on *F. occidentalis* populations collected from Kumluca, Demre 1, Demre 2, Kaş, Serik, Aksu, Mersin 1 and Mersin 2 were 62.61, 63.35, 59.86, 63.45, 95.86, 51.75, 1135.24 and 1320.68 ppm respectively (Table 1-2).

While the Aksu population showed the lowest level of resistance to spinetoram, the Mersin 1(TSR07C) and Mersin 2 (TSR08C) populations were the most resistant to it. Resistances were classified according to Khan et al. (2013) and Abbas et al. (2015) as absent (RF = 1), very low (RF = 2–10), low (RF = 11–20), moderate (RF = 21–50), high (RF = 51–100), and very high (RF >100). As a result of this study, there is moderate resistance to Spinetoram in Mersin1 and Mersin 2 populations. The resistance in Mersin 1 and Mersin 2 populations was 21.93 and 25.52 times more than the Aksu population, respectively.

Table 3. The resistance level of different populations for spinetoram and Mortality on recommend dose (%)

Population	RF	Mortality on recommend dose (%)
<i>Frankliniella occidentalis</i>		
Kumluca (TSR01C)	1.21	93.75
Demre 1 (TSR02C)	1.22	95
Demre 2 (TSR03C)	1.16	95
Kaş (TSR04C)	1.22	97.5
Serik (TSR05C)	1.85	85
Aksu (TSR06C)		98.75
Mersin 1(TSR07C)	21.93	17.50
Mersin 2(TSR08C)	25.52	17.55

As resistance rates in populations increase, mortality rates at the recommended dose appear to decrease. Similar results are observed in Ünsal (2019) in tests performed with Spinetoram, the LC50 values of the populations are between 1.0 and 35 mg (e.m)/l. The resistance in populations is in the range of 5 – 175 times.

Another statistical data that supports our report scientifically is “slope” values. The slope value obtained from probit analysis gives information about the variance of the population. The slope value obtained from probit analysis gives information about the variation of the population. If the population produces a high slope it's an indication of homogeneous population ($b > 2$). The line shows a low slope ($b < 1$) indicative of a heterogeneous population showing large variation in its response (Yu, 2015; Satar, 2018).

In this study, the slopes of most dose-mortality curves were higher than 2. There are studies in the literature that *F. occidentalis* develops resistance against spinetoram (Li et al., 2022; Bilbo et al., 2023). Considering the heterogeneity of the population at the same time, it seems likely that the resistance rate will increase in other regions in the coming years.

REFERENCES

- Abbott, W.S. (1925). A method of computing the effectiveness of an insecticide. *Journal of Economic Entomology*, 18: 265-267.
- Abbas, N., Shad, S.A., İsmail, M. (2015). Resistance to conventional and new insecticides in house flies (Diptera: Muscidae) from poultry facilities in Punjab, Pakistan. *Journal of Economic Entomology*, 108:826-833.
- Bielza, P., Quinto, V., Contreras, J., Torné, M., Martín, A., Espinosa, P.J. (2007). Resistance to spinosad in the western flower thrips, *Frankliniella occidentalis* (Pergande), in greenhouses of south-eastern Spain. *Pest Management Science*, 63: 682-687.
- Bilbo, T.R., Kennedy, G.G., Walgenbach, J.F. (2023). Western flower thrips (*Frankliniella occidentalis*) field resistance to spinetoram in North Carolina. *Crop Protection*, 165:2023, doi:106168.
- Civelek, H.S., Demiral, O., Yıldırım, E.M. (2017). Effects Of Methyl-Isonicotine With Blue Sticky Trap on *Frankliniella occidentalis* Pergande (Thysanoptera: Thripidae) on Pepper Greenhouse. *Agriculture & Food*, 5: 2017 ,571-578.
- Dağlı, F., Tunç, İ. (2006). *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) üzerinde farklı gruplardan insektisidlerle yaprak kalıntı testleri. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi*, 19 (1): 9-14.
- Dağlı, F. (2018). Spinosad resistance in a population of *Frankliniella occidentalis* (Pergande, 1895) from Antalya and its cross resistance to acrinathrin and formetanate. *Türkiye Entomoloji Dergisi*, 2018, 42 (4): 241-25
- Dripps, J., Olson, B., Sparks, T., Crouse, G. (2008). *Plant Health Progress*, doi: 10.1094/PHP-2008-0822-01- PS.
- Khan, H. A. A., Shad, S.A., Akram, W. (2013). Resistance to new chemical insecticides in the house fly *Musca domestica* L., from daries in Punjab. Pakistan. *Parasitology Research*, 112: 2049-2054.
- Li, D., Zhi, J., Yue, W., Zhang, T., Liu, L. (2022). Resistance to Spinetoram Affects Host Adaptability of *Frankliniella occidentalis* (Thysanoptera: Thripidae) Based on Detoxifying Enzyme Activities and an Age-Stage-Two-Sex Life Table. *Environmental Entomology*, 51(4): 780-789.
- Robb, K.L., Parella, M.P. (1995). IPM of Western Flower Thrips. In: B.L, Parker, M. Skinner and T. Lewis. (Editors), *Thrips Biology and Management*. Plenum Press. Newyork pp. 365-370.
- Robertson, J.L., Jones, M.M., Olguin, E., Alberts, B. (2017). *Biossays with arthropods*. New York: CRC Press.
- Sağlam, Ö., Tunaz, H., Er, M.K. (2016). Residual toxicity of Spinetoram against to bean weevil, *Acanthocelides obtectus* Say. (Coleoptera: Bruchidae) on bean. *Turkish Journal of Entomology*, 40(1):23-32.
- Satar, G., Ulusoy, M.R., Nauen, K.D. (2018). Neonicotinoid insecticide resistance among populations of *Bemisia tabaci* in the Mediterranean region of Turkey. *Bulletin of Insectology*, 71 (2): 171-177.
- Tommasini, M. G., Cravedi, P., Mazzoni, E., Burgio, G., 2004, The damage of thrips on nectarine: sampling methods of populations and injury levels. *Bulletin OILB-SROP*, 27(5): 35-47.

- Tunç, İ., Göçmen, H. 1995. Antalya’da bulunan iki sera zararlısı *Polyphagatarsonemus latus* (Banks) (Acarina, Tarsonemidae) ve *Frankliniella occidentalis* (Pergande) (Thysanoptera, Thripidae) üzerine notlar. Turkish Journal of Entomology, 19 (2): 101-109.
- Ünsal, B. (2019). Determination of Current Resistance Status to Spinosad And Spinetoram in *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) Populations Collected From Protected Crop Regions in Antalya. Akdeniz University, MSc Thesis in Plant Protection, 42p.
- Yıldırım, E. M., Başpınar, H. (2013). Aydın ili çilek alanlarında *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae)’nin popülasyon dalgalanmaları. Türkiye Entomoloji Bülteni, 3 (4): 135-138.
- Yu, S. J. (2015). The Toxicology and Biochemistry of Insecticides. CRC Press, Boca Raton, 380p., USA.

**STRUCTURAL PERFORMANCE AND ANALYSIS OF TRIANGULAR PRISMATIC
FACADE CLADDING SYSTEMS**

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ABSTRACT

Aluminum facade systems have become a popular choice in modern architecture due to their durability, versatility, and aesthetic appeal. These systems are designed to meet the demands of variable-shaped architectural designs. Nowadays, prismatic facade cladding systems have emerged as a leading option for original facade designs. These systems consist of triangular-shaped panels that are installed on the exterior of a building to create a three-dimensional, prismatic effect. This study aims to investigate the structural performance of triangular prismatic facade cladding systems and to examine the advantages and disadvantages of this system. To accomplish this goal, a triangular prismatic exterior cladding system was developed for a sample project, and numerical analyses were conducted to evaluate the performance of the system. The results of the study show that triangular prismatic facade cladding systems are a viable option for building exteriors. The system offers unique design possibilities and can create a distinctive look for a building. Additionally, the system can provide energy efficiency benefits by allowing natural light to enter the building and reducing the need for artificial lighting. However, the study also identified some potential disadvantages of triangular prismatic facade cladding systems. The triangular shape of the panels can make installation more challenging, and the triangular shape can make maintenance and cleaning more difficult. Overall, the study provides valuable insights into the structural performance and design considerations of triangular prismatic facade cladding systems. This information can be useful for architects, engineers, and builders who are considering this type of exterior cladding for their projects.

Keywords: Aluminum facade systems, prismatic facade cladding, triangular prismatic panels, building exteriors, structural performance, energy efficiency, design considerations.

Introduction

Over the past few years, the popularity of aluminum facade systems has been on the rise in modern architecture. This is due to the fact that these systems offer a combination of durability, versatility, and aesthetic appeal that traditional cladding systems simply cannot match. One of the most innovative and exciting developments in aluminum facade systems is the emergence of prismatic facade cladding systems (Dogru et al., 2022). These systems consist of triangular-shaped panels that are installed on the exterior of a building to create a unique, three-dimensional, prismatic effect that is visually stunning. Prismatic facade cladding systems are a welcome departure from traditional flat facades. This type of cladding system offers a range of design possibilities that were previously unavailable with traditional cladding systems. The triangular shape of the panels allows for a wide variety of design options, and this flexibility in design can lead to truly innovative and exciting building exteriors. Prismatic cladding systems are designed to meet the demands of variable-shaped architectural designs, offering architects and designers greater freedom in their creative vision. One of the key advantages of triangular prismatic facade cladding systems is their ability to create a distinctive and visually striking appearance for a building. This can be particularly beneficial for buildings that are designed to stand out from their surroundings, such as commercial or public buildings. The three-dimensional, prismatic effect that is achieved with these systems can make a building appear as though it is constantly changing, depending on the viewer's perspective. This creates a dynamic and captivating appearance that draws attention and interest to the building. Another advantage of prismatic facade cladding systems is their potential to provide energy efficiency benefits. These systems allow natural light to enter the building, reducing the need for artificial lighting and providing a more comfortable and energy-efficient environment for the occupants. Additionally, prismatic cladding systems can help to reduce the solar heat gain of a building, which can lead to further energy savings. However, there are also some potential disadvantages to consider when it comes to prismatic facade cladding systems. The triangular shape of the panels can make installation more challenging, and the triangular shape can also make maintenance and cleaning more difficult. It is important to carefully consider these factors before choosing to use a prismatic facade cladding system for a building.

The prismatic facade cladding system represents an exciting and innovative development in modern architecture. These systems create a visually striking, three-dimensional prismatic effect for buildings while offering potential energy efficiency benefits. It is important to consider that prismatic cladding systems offer some potential disadvantages, but their flexibility

and design possibilities make them a compelling option for architects and designers who are seeking to push the boundaries of building exteriors. The purpose of this study is to investigate the structural performance of triangular prismatic facade cladding systems and to examine the advantages and disadvantages of this system. To accomplish this goal, a triangular prismatic exterior cladding system was developed for a sample project, and numerical analyses were conducted to evaluate the performance of the system.

Prismatic Facade Cladding System

Aluminum prismatic facade cladding systems are an innovative exterior building cladding solution that utilizes triangular-shaped aluminum panels to create a visually striking, three-dimensional effect on a building's façade (Figure 1). The use of aluminum as the primary material offers several advantages, including its lightweight nature, durability, and resistance to corrosion (Abdullah and Ronnett, 2010). This ensures that the building's exterior remains visually appealing and can withstand harsh weather conditions over time.



Figure 1. Prismatic Facade Cladding System

The design flexibility provided by the triangular panels allows architects and designers to create unique and eye-catching facades that stand out from traditional rectangular panel systems. This flexibility in design is complemented by the excellent structural performance of aluminum prismatic facade cladding systems. The panels are engineered to distribute loads evenly across the facade, ensuring that the system can withstand wind loads and other external forces. One of the key benefits of prismatic facade cladding systems is their potential to improve a building's energy efficiency. By allowing natural light to enter the building, the need for artificial lighting is reduced, resulting in energy savings. Additionally, the aluminum panels can help regulate the

building's temperature by reflecting sunlight and providing insulation (Lee et al. 2021). The distinctive and modern aesthetic offered by prismatic facade cladding systems can enhance the overall appearance of a building, adding depth and visual interest to the facade. While the triangular shape of the panels can make maintenance and cleaning more challenging, the use of aluminum as a material requires minimal upkeep. Regular inspections and cleaning can help ensure the system remains in good condition. Furthermore, aluminum is a recyclable material, making prismatic facade cladding systems an environmentally friendly option. When the building reaches the end of its life, the aluminum panels can be recycled and used to create new products, reducing waste and promoting sustainability.

Design Considerations of Prismatic Facade Cladding Systems

When planning a building that incorporates a triangular prismatic facade cladding system, architects and engineers need to consider several aspects to ensure the system's visual appeal, functionality, and structural integrity. One of the main factors to think about is the layout and configuration of the triangular panels. These panels can be organized in a variety of patterns, offering a high level of design versatility and the ability to create distinctive and attention-grabbing facades. However, it's crucial to make sure that the chosen pattern provides sufficient structural support and evenly distributes loads across the facade.

Another vital design consideration is choosing the right materials for the panels and connection systems. Although aluminum is a popular choice due to its lightweight, durable, and corrosion-resistant properties, other materials might also be appropriate depending on the specific needs of the project. The connection systems that attach the panels to the building must be meticulously designed to hold the panels securely while allowing for necessary movement and adjustments (Figure 2). Besides the structural components, designers should also take into account the energy efficiency and eco-friendliness of the triangular prismatic facade cladding system. By integrating features such as sunshades or reflective coatings, the system can help control the building's temperature and decrease energy usage. Moreover, opting for recyclable materials like aluminum can enhance the project's overall environmental sustainability. Moreover, maintenance and accessibility should be considered during the design phase. The unique shape of the triangular panels can make maintenance and cleaning more difficult, so it's important to plan how these tasks will be carried out and whether specialized equipment or methods will be needed. Designers should also make sure that the panels are easily accessible for inspection, repair, or replacement when necessary. Therefore, when planning a triangular

prismatic facade cladding system, architects and engineers must take into account various factors, including panel layout (Figure 3), material selection, connection systems, energy efficiency, environmental sustainability, and maintenance. By carefully addressing these design considerations, a visually appealing, functional, and structurally sound facade cladding system can be achieved.



Figure 2. Application of Prismatic Facade Cladding Systems

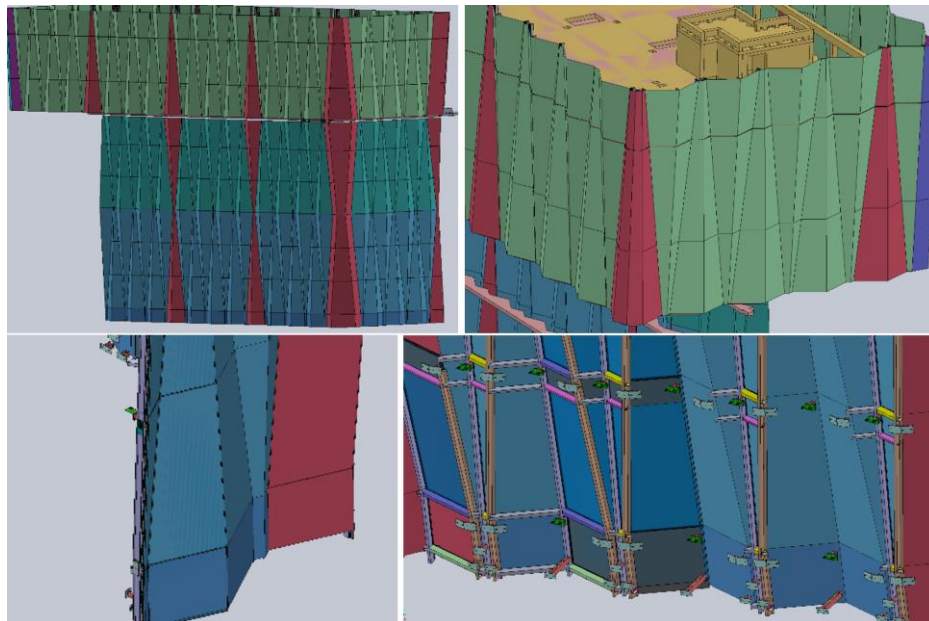


Figure 3. Panels of Prismatic Facade Cladding Systems

Structural Performance of Prismatic Facade Cladding System

The structural performance of aluminum prismatic facade cladding systems is a crucial aspect to consider when evaluating their suitability for a building project. These systems are

designed to withstand various external forces, such as wind loads, seismic activity, and thermal expansion, while maintaining their integrity and appearance.

Load Distribution: Load distribution is a crucial aspect in the design of any building system, especially when it comes to facades. Facades play a vital role in protecting the building and its occupants from external elements such as wind, rain, and snow. Therefore, it is essential to ensure that the facade system can withstand these forces without compromising its structural integrity. The triangular panels used in prismatic facade cladding systems are specifically engineered to distribute loads evenly across the facade. This even distribution of loads helps to minimize stress concentrations and ensures that the system can withstand external forces without any failure or damage. Each panel is designed with a particular shape and size that allows it to interlock with adjacent panels and form a seamless facade. The distribution of loads across the facade is not only important for the safety and structural integrity of the building, but it also plays a significant role in the aesthetic appeal of the building. The even distribution of loads ensures that there are no visible distortions or deformations in the facade, which can affect the overall appearance of the building.

Wind Resistance: Wind resistance is a crucial factor to consider when designing a facade system, particularly in areas that are prone to high winds. Facade systems that are not designed to resist wind loads can be subject to damage, compromising the safety and structural integrity of the building. Aluminum prismatic facade cladding systems are an excellent choice when it comes to wind resistance. These systems are specifically designed and engineered to withstand wind loads effectively. The panels used in these systems are tested and rated for specific wind speeds, ensuring that they can withstand the forces exerted by high winds. The panels used in aluminum prismatic facade cladding systems have an aerodynamic shape that helps to reduce wind resistance. This design feature enables the panels to deflect wind around the building, rather than causing it to directly impact the facade. The reduced wind resistance, in turn, reduces the load on the facade system and enhances its overall performance.

Seismic Performance: The forces exerted on a building during an earthquake can be extremely strong and can cause significant damage to the building's structure. This is why it is essential for building designers and engineers to consider the seismic performance of facade cladding systems. Aluminum prismatic facade cladding systems are highly resistant to seismic activity due to their unique design (Nardini and Doebbel, 2016). They are composed of interlocking panels that allow for movement and flexibility during an earthquake. This

flexibility helps to absorb the impact of the seismic forces and distribute the load throughout the building structure, thereby minimizing damage.

Thermal Expansion: Thermal expansion and contraction are natural phenomena that occur in most materials when they are exposed to changes in temperature. Aluminum, being a highly conductive metal, is particularly susceptible to these changes. However, the unique design of aluminum prismatic facade cladding systems allows them to accommodate these changes and maintain their structural integrity and appearance over time. When the temperature of the aluminum panels in a cladding system increases, the metal expands, causing the panels to expand as well. This expansion can cause stress on the panel's connections to the building, potentially leading to damage or detachment. Similarly, when the temperature decreases, the panels will contract, potentially leaving gaps and compromising the building's thermal insulation. To prevent these issues, aluminum prismatic facade cladding systems are designed to accommodate thermal expansion and contraction. The interlocking panel system allows for small amounts of movement, while still maintaining a secure connection to the building. This design ensures that the panels remain in place and maintain their appearance, even as the temperature changes.

Connection Systems: The structural performance of aluminum prismatic facade cladding systems is not solely dependent on the panels themselves, but also on the connection systems used to attach the panels to the building. These connection systems play a critical role in ensuring that the panels remain securely in place, while also allowing for necessary movement and adjustments. Typically, aluminum prismatic facade cladding systems are attached to the building using a combination of brackets, anchors, and fasteners. The brackets serve as the primary support for the panels, while the anchors provide additional reinforcement and help to distribute the load across a wider area. The fasteners, such as screws or bolts, are used to securely attach the panels to the brackets and anchors (Figure 4).

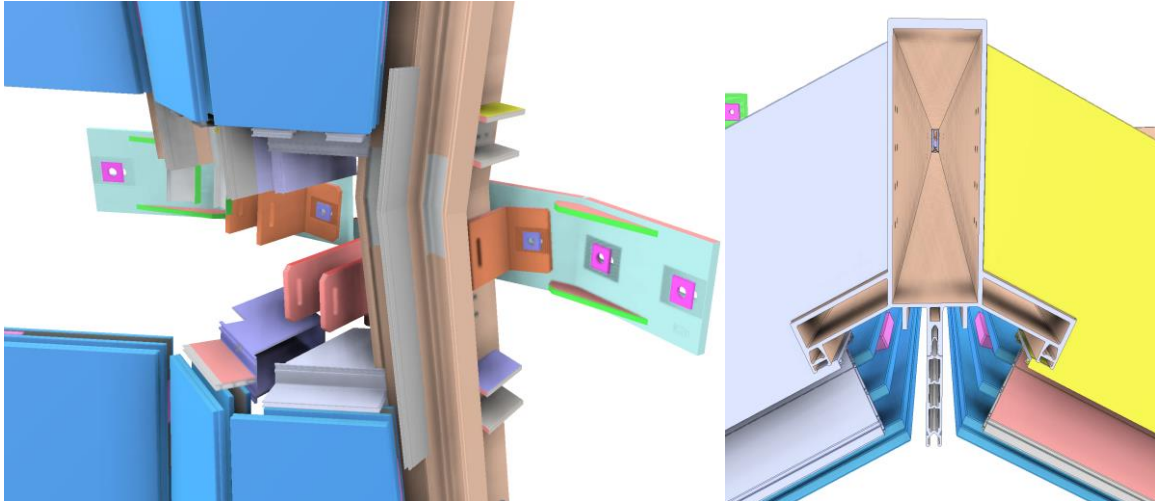


Figure 4. Connection Details of Prismatic Facade Cladding System

Durability: Aluminum is a corrosion-resistant material, which contributes to the long-term structural performance of prismatic facade cladding systems. In addition to its resistance to corrosion, aluminum is also a lightweight and durable material. These properties make it an ideal choice for use in prismatic facade cladding systems, as it can withstand the forces of wind and seismic activity without adding excessive weight to the building. The use of aluminum in prismatic facade cladding systems provides a range of benefits, including long-term structural performance, reduced maintenance costs, and visual appeal. The resistance to corrosion and harsh weather conditions ensures that the building's facade remains durable and attractive for years to come, while the lightweight and durable properties of aluminum help to ensure the system's overall structural integrity.

Conclusion

In recent years, aluminum facade systems have become increasingly popular in modern architecture due to their durability, versatility, and aesthetic appeal. These systems are designed to meet the demands of variable-shaped architectural designs and offer a range of benefits over traditional cladding systems. One of the most innovative and exciting developments in aluminum facade systems is the emergence of prismatic facade cladding systems. These systems consist of triangular-shaped panels that are installed on the exterior of a building to create a unique, three-dimensional, prismatic effect. This type of cladding system offers a range of design possibilities that were previously unavailable with traditional cladding systems. One of the key advantages of triangular prismatic facade cladding systems is their ability to create a

distinctive and visually striking appearance for a building. This can be particularly beneficial for buildings that are designed to stand out from their surroundings, such as commercial or public buildings. Additionally, the system can provide energy efficiency benefits by allowing natural light to enter the building and reducing the need for artificial lighting.

The structural performance of aluminum prismatic facade cladding systems is a critical factor to consider when evaluating their suitability for a building project. These systems are designed to withstand various external forces, such as wind loads, seismic activity, and thermal expansion, while maintaining their integrity and appearance. The even load distribution, wind resistance, seismic performance, thermal expansion accommodation, connection systems, and durability of the aluminum panels all contribute to the overall structural performance of these innovative facade cladding systems.

This study provides valuable information on the structural performance and design considerations of triangular prismatic facade cladding systems. This information can be useful for architects, engineers, and builders who are considering this type of exterior cladding for their projects and can help to ensure that the system is installed and maintained effectively to achieve its full potential.

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References

- Abdullah A, Ronnett M. (2010). Exploration of Curtain Wall Solutions. Perkins+Will Research Journal, 2010, 2, 33-55.
- Dogru, S., Cakir, F., & Akbas, B. (2022). Structural evaluation of unitized curtain wall systems by using inter-story Drift Test. Challenge Journal of Structural Mechanics, 8(1), 17. <https://doi.org/10.20528/cjsmec.2022.01.003>
- Lee H, Oh M, Seo J, Kim W. (2021). Seismic and Energy Performance Evaluation of Large-Scale Curtain Walls Subjected to Displacement Control Fasteners. Applied Sciences, 11(15), 6725.
- Nardini V, Doebbel F (2016). Performance-Based Concept for Design of Structural Silicone Joints in Façades Exposed to Earthquake. In Challenging Glass Conference Proceedings, Vol. 5, 283-294.

Importance, Impact, And Future Potential Of Extended Reality Applications In The Metaverse

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ABSTRACT

In recent years, the Metaverse and Extended Reality (XR) have attracted considerable interest in the technology and industries. Extended Reality refers to the integration of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) technologies, offering an immersive experience to users. The integration of XR with the Metaverse has opened up new possibilities for applications in various fields, such as education, gaming, healthcare, and marketing. This study emphasizes the significance and impact of XR applications in the Metaverse, as well as their potential to change the way we communicate, learn, and work. The study also discusses the effects of XR on different industries and offers instances of successful real-world implementations. As a result, this study encourages further exploration and research into the possibilities of XR in the Metaverse.

Keywords: Metaverse, extended reality, mixed reality, augmented reality, virtual reality

1. INTRODUCTION

The concept of the Metaverse has gained considerable attention in recent years as an advanced virtual environment that enables users to interact with digital representations of the real world (Kipper & Rampolla, 2012). Extended Reality (XR), which encompasses Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), plays a crucial role in the development of the Metaverse, as it provides users with immersive experiences that blend physical and virtual environments (Milgram & Kishino, 1994). Several studies have explored the potential of XR technologies in various fields, such as education (Billinghurst & Duenser, 2012), gaming (Carmigniani et al., 2011), healthcare, and marketing (Alem & Tecchia, 2011). The integration of XR within the Metaverse promises to revolutionize these industries and redefine the way we communicate, learn, and work (Wang et al., 2021).

Extended Reality has the potential to revolutionize various industries, ranging from education and healthcare to gaming and marketing. The integration of XR with the Metaverse allows for the creation of rich, immersive, and interactive experiences that were previously unimaginable. This has led to a surge in research and development efforts, as well as investments in XR and the Metaverse from both the private and public sectors.

This study aims to provide an overview of the impact and significance of XR applications in the context of the Metaverse, exploring their potential to disrupt traditional industries and create new possibilities for human interaction. Drawing on a range of academic literature, this paper will discuss the various aspects of XR technologies, their applications, and the challenges they face. By doing so, this study hopes to encourage further exploration and research into the potential of XR in the Metaverse and contribute to the ongoing dialogue on this topic.

In the following sections, this paper will delve into the research and findings surrounding XR applications in the Metaverse, discussing their implications for various industries and providing examples of real-world implementations. The paper will conclude with a summary of the findings and insights, as well as recommendations for future research and development in this rapidly evolving field.

2. RESEARCH AND FINDINGS

The literature review revealed the main dynamics of the interaction between the concepts of metaverse and augmented reality, and several frameworks for modeling this interaction were proposed (Azuma, 1997; Milgram & Kishino, 1994). The current usage areas of augmented reality applications in the Metaverse were identified, with several successful examples

presented, such as in education, gaming, and marketing (Billinghurst & Duenser, 2012; Carmigniani et al., 2011).

The opportunities and challenges presented by the interaction of the metaverse and augmented reality were analyzed, emphasizing the need for overcoming technological limitations, addressing privacy and security concerns, and ensuring equitable access to these technologies (Alem & Tecchia, 2011; Wang et al., 2021). Future prospects and potential application areas in the metaverse and augmented reality fields were discussed, providing insights for prioritizing investments, research, and development in these domains (Kipper & Rampolla, 2012).

In-depth interviews and surveys with industry experts and stakeholders corroborated the findings from the literature review, highlighting the significant potential of XR technologies in the Metaverse and the importance of addressing the associated challenges. The hands-on experiment using VR headsets and the Unity program provided valuable insights into user experience and interactions, emphasizing the need for further research and development in creating more immersive and engaging applications.

The research conducted in this study sought to address the interaction between the concepts of metaverse and augmented reality, examining both theoretical and empirical aspects. The findings, derived from the literature review, in-depth interviews, surveys, and hands-on experiments, are presented below:

2.1. Interaction between Metaverse and Augmented Reality

The main dynamics of the interaction between metaverse and augmented reality were found to revolve around the convergence of digital and physical spaces, creating immersive experiences for users. The literature review and expert interviews revealed that augmented reality acts as a bridge between the physical and digital worlds, enhancing the metaverse experience by adding context-aware information and interactive elements. This interaction can be modeled as a continuous spectrum, with augmented reality on one end and the metaverse on the other, representing different levels of immersion and integration of digital content.

2.2. Current Usage Areas and Successful Examples

The research identified various usage areas of augmented reality applications in the Metaverse, including education, healthcare, entertainment, and marketing. Some successful examples include:

- Education: Using AR to create immersive learning experiences and improve student engagement, such as the "HoloLens" project for medical education.

- Healthcare: Utilizing AR to assist in surgical procedures, diagnostics, and therapy, as seen in the "Proximie" platform for remote surgery assistance.
- Entertainment: Developing AR games and experiences within the metaverse, such as "Pokemon Go" and its integration with virtual environments.
- Marketing: Implementing AR-driven advertising campaigns and product visualizations in the metaverse, as exemplified by IKEA's virtual showroom.

2.3. Opportunities and Challenges

The interaction of the metaverse and augmented reality presents numerous opportunities and challenges. Some of the key opportunities include:

- Enhanced user experiences: The integration of AR and metaverse allows for richer, more immersive experiences for users, leading to increased engagement and satisfaction.
- New business models: The combination of AR and metaverse opens up possibilities for innovative business models and revenue streams, such as virtual goods, advertising, and subscription services.
- Access to a global audience: The metaverse enables businesses and organizations to reach a global audience, breaking down geographical barriers and increasing market reach.

The challenges identified in the research include:

- Technological limitations: The current limitations of hardware and software technologies may hinder the seamless integration of AR and the metaverse.
- Privacy and security concerns: The integration of AR and metaverse raises concerns about user privacy and data security, requiring robust solutions to protect user information.
- Digital divide: The disparity in access to technology and digital skills may exacerbate existing inequalities, potentially limiting the benefits of AR and the metaverse to certain populations.

2.4. Future Prospects and Potential Application Areas

The research identified several potential application areas for the metaverse and augmented reality, with priorities including the development of improved hardware and software technologies, the expansion of AR applications in various industries, and the enhancement of user experiences through more immersive content. Additionally, the research suggests that the metaverse and AR will continue to play a crucial role in shaping the future of work,

communication, and entertainment, with increasing investment and collaboration between industry players.

The findings of this research offer valuable insights into the interaction between the metaverse and augmented reality, highlighting the opportunities and challenges that arise from their convergence. By understanding these dynamics, industry leaders, investors, developers, and policymakers can make more informed decisions and develop effective strategies to capitalize on the potential of these technologies.

3. CONCLUSION

In conclusion, this study has provided a comprehensive analysis of the interaction between the concepts of metaverse and augmented reality, exploring both theoretical and empirical dimensions. The research highlights the significant potential of the convergence of these technologies in revolutionizing various industries, creating new opportunities for businesses, and enhancing user experiences.

The findings of this study demonstrate that the integration of augmented reality within the metaverse offers a wide range of opportunities, such as the development of innovative business models, access to a global audience, and the creation of more immersive, engaging experiences. However, the research also underscores the challenges that need to be addressed, including technological limitations, privacy and security concerns, and the digital divide.

Future prospects for the metaverse and augmented reality fields involve continued investment in hardware and software development, expansion of AR applications across various industries, and a focus on enhancing user experiences through immersive content. By understanding the dynamics of the interaction between the metaverse and augmented reality, industry leaders, investors, developers, and policymakers can make more informed decisions and develop effective strategies to capitalize on the potential of these technologies.

In light of the research findings, it is recommended that stakeholders in the metaverse and augmented reality domains collaborate to address the challenges, explore innovative solutions, and promote equitable access to these technologies. Furthermore, continued research and development efforts in this area will be crucial for unlocking the full potential of the metaverse and augmented reality, ultimately shaping the future of human interaction, communication, and digital experiences.

REFERENCES

- Alem, L., & Tecchia, F. (2011). The case for mobile augmented reality. *IEEE Computer Graphics and Applications*, 31(3), 56-64.
- Azuma, R. T. (1997). A survey of augmented reality. *Presence: Teleoperators and Virtual Environments*, 6(4), 355-385.
- Billinghurst, M., & Duenser, A. (2012). Augmented reality in the classroom. *Computer*, 45(7), 56-63.
- Carmigniani, J., Furht, B., Anisetti, M., Ceravolo, P., Damiani, E., & Ivkovic, M. (2011). Augmented reality technologies, systems and applications. *Multimedia Tools and Applications*, 51(1), 341-377.
- Kipper, G., & Rampolla, J. (2012). *Augmented reality: An emerging technologies guide to AR*. Syngress Publishing.
- Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. *IEICE TRANSACTIONS on Information and Systems*, 77(12), 1321-1329.
- Wang, J., Zhang, S., & Chen, Y. (2021). A novel deep learning-based approach for augmented reality in the metaverse. *IEEE Access*, 9, 155329-155342.

The Approaches Of Kitchen Chefs Of Restaurant Businesss To Menu Planning; The Example Of Mersin

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ABSTRACT

Restaurant businesses are among the food and beverage businesses in the tourism sector. At the same time, it is one of the important elements of tourism businesses because they meet the needs of food, which is one of the basic needs of people. Nowadays, as in all food and beverage businesses, many marketing strategies are being developed by restaurants in an increasingly competitive environment as a result of developing technologies. Menus are an important marketing tool for food and beverage businesses. For this reason, it plays a very important role in increasing the sales of restaurants compared to their competitors and getting a better position. Guest (customer) satisfaction and loyalty are extremely important in food and beverage businesses. For this reason, restaurants should provide good service to satisfy their guests who come to their establishments. Well-done menu planning satisfies consumers, increases the motivation of business personnel, ensures regular execution of tasks, facilitates cost control and makes restaurant management successful. Menu planning is a process that requires expertise. For this reason, it is important to determine the thoughts of kitchen chefs working in restaurants about menu planning. For this reason, the aim of the study is to determine the thoughts of kitchen chefs working in restaurants in the city centre of Mersin on menu planning. Within the scope of the aim, qualitative research technique was used to obtain in-depth data on menu planning applications in the research, and within this framework, face-to-face interviews were conducted with fourteen chefs, including twelve kitchen chefs and two assistant chefs working in restaurants located in the city centre of Mersin. According to the research results, all kitchen chefs stated that menu planning is necessary, that the staff should be trained during menu planning, that they pay attention to visuality and food harmony during planning, and that they carry out menu planning regularly. In addition, the research also concluded that all the chefs made trial (demo) products during the production of new products, although they received the thoughts of bosses, sincere customers and acquaintances about these products, they did not receive the thoughts of service personnel.

Keywords: Restaurant, food-beverage, menu, menu planning

INTRODUCTION

Globalization and changes in technology are changing customer demands and expectations, as a result of this situation, the intense competitive environment experienced is also manifested in restaurant businesses in the food and beverage sector (Özkaya & Sökmen, 2017). The number of restaurants in the food and beverage sector that offer similar products and services and have similar qualities is quite large. For this reason, an intense competitive environment is being experienced (Moorthy et al., 2017). In the food and beverage sector, guests are starting to be more sensitive about service and product day by day, and product and service qualities are coming to the fore more than price. This situation, on the other hand, brings the understanding of competition, where guest satisfaction and product diversity are a priority, to the agenda more and more over time. (Sugiyarto et al., 2003: 683-684; Coşkun, Mesci & Kılınç, 2013: 102-103).

The fact that restaurants offer services and goods suitable for the wishes and needs of consumers is an important element in terms of customer satisfaction. As a result of increasing competition with changing consumer expectations and needs over time, restaurants are forced to develop creative new methods (Akay & Sarıışık, 2015: 211-212). It is of great importance for restaurants to strengthen their different aspects by offering innovative services and products in order to maintain their activities and achieve success in an intensely competitive environment. For this reason, restaurant businesses attach importance to menu planning both to meet changing customer expectations and to increase their business profitability (Mumford & Licuanan, 2004: 163; Hacıoğlu & Giritlioğlu, 2007; Cook, Hsu & Marqua, 2016: 191; Uzun, 2019- 10)

Menu planning covers the selection of food and beverages that will meet the expectations of the guests in order to increase the profitability of restaurant businesses. Menu planning affects the success of restaurants. Restaurants that make a successful menu planning reduce their costs, increase their profitability and offer better quality services to their guests (Baysal & Küçükaslan, 2009). Making menu plans is a process that requires expertise (Altinel, 2017). Restaurants that do not pay attention to menu planning have very little chance of achieving success (Hacıoğlu & Giritlioğlu, 2007). For this reason, the aim of the study is to determine the thoughts of chefs working in the kitchen department of restaurants located in the city centre of Mersin about menu planning. It is expected that the study will contribute to the menu planning literature and serve as an example for restaurants in Mersin province.

1.MENU PLANNING

The menu is called the segmentation of products with certain criteria in order to provide convenience in the food and beverage choices of customers in tourism businesses where food and beverage services are provided. It is a word derived from the Latin word "minutus", which means "small" or "little" (Sökmen, 2008: 95). With the development of food and beverage businesses over time, it has been defined as "the sum of compatible dishes served in a row at a meal" (Altinel 2014, 3) or "as a detailed list of foods and beverages served at a food and beverage business" (Sökmen, 2011:70). The classic menu was first derived from the Gastronomy of France and eventually spread all over the world (Altinel 2014, 25).

The menu is the list that guides them in making decisions by giving the names, descriptions and prices of the food given to the guests in a food sales unit (Bulduk, 2018:168). Menu planning is the process of determining the foods and beverages that will increase the satisfaction levels of the guests, provide profit to the business, produce and market, and planning the foods and beverages that will be included in the menu (Akay & Sarıışık, 2015: 212-214; Aktaş Alan & Suna, 2019: 1330-1332; Sarıtaş & Sormaz, 2020:138).

1.1.Advantages of Menu Planning for Restaurants

In order to ensure the correct and effective continuity of menu planning, it is necessary to create food and beverage lists that can meet the expectations of both business managers and customers. Menu planning done on the right time and methods provides many advantages for businesses. Some of these are as follows (Aktaş Alan & Suna, 2019: 1330-1332);

- With timely and accurate menu planning, both customer satisfaction increases and business profitability and business continuity are ensured.
- With menu planning, corrections can be made to the menu items if necessary, so that products can be easily added to the menu.
- With menu planning done on time and correctly, both costs are reduced and food waste can be prevented.

2. METHOD

In Mersin, Sahilli, Birdir & Yildiz, Kale (2014) have conducted a study on "Innovation Practices in Restaurant Businesses: The Case of Mersin and Adana", Cetinsöz & Polat (2018) have conducted a study on "The Impact of Menu Information on Behavioral Intention of Customers in Restaurants" and Şanlı & Metin (2020) have conducted a study on "A Study to

Determine the Food Services Offered to Celiac Patients in Restaurants Located in Mersin Marina Mall”, but there has been no study in Mersin related to menu planning. This is why the study is important. In this study, it is aimed to determine the approaches of restaurant kitchen chefs operating in Mersin provincial centre to menu planning.

Qualitative research is defined as” research in which a qualitative process is followed for the realistic and holistic presentation of perceptions and events in a natural environment” (Yıldırım & Şimşek, 2013:45). Qualitative research provides the researcher with the opportunity to explore events and facts in depth (Hazarhun & Koçak, 2019: 1554). In semi-structured interviews, participants can talk freely about the topic according to various points of view (Kallio et al.,2016; 2955; Sundin et al, 2023: 2). For this reason, an interview method from qualitative research techniques was used to” determine the approaches of restaurant kitchen chefs to menu planning“, and the interviews were conducted face-to-face using a ”semi-structured interview form”.

The universe of the research consists of restaurants operating in the City Center of Mersin. “In qualitative research, the sample size varies according to the richness of the data collected from the participants and the frequency of repetition” (Kozak, 2015). The number of restaurants could not be determined exactly, 14 of the restaurant establishments that agreed to meet voluntarily, determined by random method, constitute the sample of the research.

3. FINDINGS

In this section, their demographic characteristics were determined from interviews with restaurant chefs, and in addition, the data obtained from 5 questions posed to understand the chefs' thoughts about menu planning were analysed.

3.1.Demographic Findings of Participants (P) and Businesses

According to the findings obtained from the research, 11 of the participants participating in the study are head chef, 3 are assistant head chef. 12 of the 14 participants are male and their ages are between 29 and 51 years old. of the 14 participants, 6 are High School graduates, 5 are elementary school graduates and 3 are Vocational School of Higher Education graduates. The total professional experience of the participants varies between 6 and 30 years. The activity periods of the restaurants where the participants work range from 2 to 15 years, and the restaurant capacities range from 90 people to 270 people. In addition, it was found that the menus used by the participants in the study mainly contained “World Cuisine”, “Meat” and

“fish” products. The demographic characteristics of the participants and the businesses are presented in Table 1.

Table 1. Demographic Findings of Participants (P) and Businesses

	Gender	Age	Educational Status	Duty	Total occupational Experience (years)	Active Period of Restaurant (Years)	Capacity of Restaurant (Number of People)	The Main Products on the Menus
P1	Male	51	High School	Head Chef	12	12	180	World Cuisine
P2	Male	44	High School	Head Chef	15	2	120	Meat
P3	Male	29	Vocation School Of Higher Education	Head Chef Assistant	10	9	170	World Cuisine
P4	Male	35	High School	Head Chef Assistant	10	8	150	World Cuisine
P5	Female	29	World Cuisine	Head Chef	6	4	90	Meat
P6	Male	32	High School	Head Chef	12	6	170	Meat and Fish
P7	Male	30	Vocation School of Higher Education	Head Chef	12	5	220	Meat
P8	Male	35	Primary School	Head Chef	15	15	100	Fish
P9	Male	30	High School	Head Chef	6	5	200	Meat
P10	Male	56	High School	Head Chef	30	5	150	Meat
P11	Male	39	Primary School	Head Chef	25	10	151	Fish
P12	Male	31	Primary School	Head Chef	8	11	90	Meat
P13	Male	39	Primary School	Head Chef	17	10	250	Meat
P14	Female	43	Primary School	Head Chef Assistant	22	9	270	Meat and Fish

3.2. Findings Related to Menu Planning

a-) Within the scope of the research, when the participants were asked whether menu changes were made in their businesses and how often they were made; it was found that 14 participants also made changes to their menus. In addition, it was found that 7 participants (P1, P3, P4, P7, P10, P11, P13) who participated in the study made changes once in every 6 months, 4 participants (P2, P8, P9, P12) made changes once a year, 1 participant (P5) made changes once in 5 months. In this regard, the statement of the participant P6 is as follows; “We make seasonal

changes to the menus". The statement of the participant P14 is as follows; "We change our menus seasonally or when we deem it necessary.

b-) When the participants were asked whether they made menu planning and which element they paid the most attention to when making menu planning, it was found that all 14 participants made menu planning. In addition, it was found that the most attention was paid to visual and food harmony (P1, P7, P9, P11, P12, P13), visual, colour and taste harmony (P8,P13, P14), food harmony (P4, P5, P6), colour and sauce harmony (P10), taste or flavour harmony (P12) elements when planning the menu by the participants in the study.

c-) The question "Should professional training be given to the people who will plan the menu for the participants in the research?" and it was found that all the participants answered "yes,it should be given". To the question"P2's expression is as follows; Head Chefs do the menus, so there is no need to provide training. After all, Head Chefs are professionally trained.

d-) When the participants were asked whether the trial production (demo) of the new dishes to be included in the menu was made after the menu planning, it was found that all of the participants made the trial production. Some of the answers given are as follows; P1; yes, it is being done. People around us are trying, P2; yes, there can be no production without a demo, P4: an experiment is being conducted. First of all, it is audited to bosses and familiar customers, P5; it is performed and tested. P7; Yes, trial production is being carried out. P12; it is performed and the meal is added to the menu according to the result of the experiment.

e-) When the participants were asked their personal thoughts about the necessity of menu planning, it was found that all the participants had the idea that menu planning was necessary. The answers given by some of the participants are as follows;

P2; Menu planning is required to retain customers, P3; It is necessary. Since it is a sector that constantly wants innovation, new dishes should be added to the menus. Therefore, menu plans should be made, K4; if there is no menu planning, there will be a loss of customers, P5; Menu planning is necessary. Because fixed menus will not be among the preferences after a while, P9; it is necessary to increase customer satisfaction and improve business, P10; it is necessary for the profitability of the business, P11; menus should be developed to offer differences to incoming customers, and menu planning should be done Decently, P12; menu planning is a must in terms of adding new flavours to the menus.

4. CONCLUSIONS AND RECOMMENDATIONS

Nowadays, the improvements that restaurants will make in their menus are important for them to successfully exit the rapidly increasing competitive environment. In order for developments to be effective and sustainable, very well-prepared menu planning is needed. For this reason, the study was conducted in order to determine the approaches of kitchen chefs to menu planning in 14 restaurants located in the provincial centre of Mersin.

When the participants were asked their personal thoughts about the necessity of menu planning, it was concluded that all participants had the idea that menu planning was necessary and that the people who would do menu planning should be educated. In addition, when the demographic characteristics of kitchen chefs were examined in the study, it was concluded that most of them were Male (only 1 person in the number of Female), under the age of 35 and graduated from elementary and High Schools. Naturally, the conclusion is reached that they were self-taught. For this reason, it is recommended that participants receive training from universities, associations and various institutions related to the subject.

According to the results of the research, all participants make changes to their menus (most of them once in, every 6 months) and menu planning. In addition, it is also concluded that the participants paid most attention to the elements of visuality and harmony of dishes during menu planning in the study. Participants are also advised to pay attention to colour, taste and sauce elements during menu planning.

According to another result of the research, all the participants who are thinking of making changes to the menu are doing demo applications before the change. The trials of these products are carried out by the bosses and the acquaintances around them.

In order to increase guest satisfaction in a restaurant, it is not enough to create only delicious and beautiful-looking products. The service personnel who communicate the most with the guests who come to the establishment in menu planning and deliver the prepared products to the guest should not be ignored. Because experienced and self-developed service personnel are able to analyse the expectations and tastes of guests well. In addition, the service personnel also know how the food on the menu is cooked and how it tastes. In short, menu planning is a team job. For this reason, demo studies conducted in restaurants are also shared with kitchen and service personnel, and making joint decisions positively affects the preference of restaurants by guests (Aktaş Alan & Suna, 2019: 1330-1332). For this reason, it is suggested to the participants to take the thoughts of the service personnel during the menu planning.

This research is limited to the statements of the kitchen chefs working in 14 restaurants in Mersin. This research only covers the opinions of restaurant kitchen chefs. It is recommended that the opinions of customers who receive services from these restaurants should also be included in the studies to be carried out after this.

REFERENCES

- Altınel, H. (2014). *Menü Yönetimi ve Menü Planlama*. 2. Baskı, Ankara: Detay Yayıncılık.
- Akay, A., & Sarıışık, M. (2015). Restoran yöneticilerinin menü planlaması ve analizi konusuna yaklaşımları üzerine bir araştırma. *Bartın Üniversitesi İ.İ.B.F Dergisi*, 6(12), 212-213.
- Aktaş Alan, A. & Suna, B. (2019). Gastronomi şehri “Gaziantep’te” menü planlama uygulamalarına güncel bakış. *Journal of Tourism and Gastronomy Studies*, 7 (2), 1328-1343.
- Bulduk, S. (2018) *Beslenme İlkeleri ve Menü Planlama*, 4. Baskı, Ankara: DMeatay Yayıncılık.
- Cankül, D. (2019). İşletmelerde yenilik uygulamaları: Restoran işletmeleri örneği. *Gastroia: Journal of Gastronomy and Travel Research Vol. 3, Issue 2*.
- ÇMeatinsöz, B. C. & Polat, A. S. (2018). Restoranlarda menü bilgilerinin tüketicilerin davranışsal niyeti üzerine etkisi. *Journal of Tourism and Gastronomy Studies*, 6 (4), 3-20.
- Ertürk, M, (2018). Tüketicilerin dışarıda yemek yeme nedenleri, *Gaziantep University Journal of Social Sciences*, 17 (3), 1203-1224.
- Hazarhun, E. & Koçak, Y. (2019). Manisa İlindeki otel işletmelerinde otel şeflerinin menü planlamasına bakış açılarının değerlendirilmesi. *Journal of Tourism and Gastronomy Studies*, 7 (3), 1549-1572.
- Kallio, H., PiMeatilä, A. M., Johnson, M., & Kangasniemi, M. (2016). Systematic Meathodological review: Developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, 72(12), 2954–2965. <https://doi.org/10.1111/jan.13031>
- Kozak, M.(2015). Bilimsel Araştırma: Tasarım, Yazım ve Yayım Teknikleri. Ankara: Detay Yayıncılık.
- Sahilli, Birdir, S. & Yıldız, Kale, E. (2014). Restoran İşletmelerinde Yenilik Uygulamaları: Mersin ve Adana Örneği. *Seyahat ve Otel İşletmeciliği Dergisi/ Journal of Travel and Hospitality Management* 11 (3), 57-72.
- Sarıtaş, A., % Sormaz, Ü. (2020). Otel ve restoran mutfak şeflerinin menü planlaması ve analizi konusuna yaklaşımları: Konya örneği. *Gastroia: Journal of Gastronomy and Travel Research*, Vol. 4, Issue 1, 136-158,
- Sökmen, A. (2011). *Yiyecek-İçecek HizmMeatleri YönMeatimi ve İşlMeatmeciliği*. 6. Baskı, Ankara:DMeatay Yayıncılık.
- Sundin, N., Malefors, C., Danielsson, M., Hardiyanti, M., Osowski, C.P., & Eriksson, M. (2023). Investigating goal conflicts in menu planing in Swedish school catering on the pathway to sustaniable development. *Resources, Conservation & Recycling*, 190, 1-9. <https://www.sciencedirect.com/science/article/pii/S0921344922006541>
- Şanlı, S. C.,& Meatin, U. (2020). A Research to DMeatetermine the Food Services Provided for Celiac Patients in the Restaurants in Mersin Marina Shopping Center. *Journal of Tourism and Gastronomy Studies*, 2020, 8 (1), 478-488

- Türkan, C. (2005). *Turizmde Beslenme İlkeleri ve Menü Planlama*,2. Baskı, Ankara: DMeatay Yayıncılık.
- Uzun, D. (2019). Menu engineering analysis of tourism management certificated hotel restaurants in Bingöl province. *Tourism and Recreation*, 1 (1) 9-14
- Yıldırım, A. & Şimşek, H.(2013). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. Ankara :Seçkin Yayınları

NATURAL HERITAGE ASTHMA CAVE AND TOURISM POTENTIAL

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ABSTRACT

Silifke is a district in Turkey, located in the east of the Mediterranean Sea, 85 km west of the provincial center of Mersin. Many cultures have lived in and around Silifke since the 6000s BC to the present day. The first settlement dates back to the 2000s BC. Today, Turkmen culture is dominant in the region. Although Silifke is among the most impressive tourist centers of the Eastern Mediterranean coast with its decently preserved archaeological ruins, natural and cultural riches, climate, 105-kilometer coastline and unpolluted sea, it cannot get enough share from tourism because it is not recognized as much as other regions of Mersin in terms of tourism potential. Asthma Cave, which is the first and only cave of Silifke opened to tourism, is located in the region where historical values such as Cennet -Cehennem Ponders and Kizkalesi are located. The beautiful formations in the cave, along with the fresh air and the sea, increase the tourist importance of the cave. In the selection of this area in the study; the fact that there has not been enough research on the area, the fact that the area is quite rich in terms of natural resource values, cultural and historical accumulation has been an effective factor. After the relevant literature research was conducted, the research area was visited in August 2022 and resources and brochures related to the field were collected. In addition, observations and investigations were made in the area and various interviews were conducted with local people and visitors. In the study, the current tourism potential of the "Asthma Cave" has been determined and an assessment was made about the contributions that this potential would provide to Silifke, which is very rich in terms of natural and cultural resource values. In the study, it was tried to determine the strengths and weaknesses of the area in terms of cave tourism potential, as well as the opportunities and threats that may arise in the future by conducting a SWOT Analysis. In the study, results such as "The fact that the study area has a generally pristine nature is an advantage for tourism (strengths)", "insufficient advertising and promotion of the cave (weaknesses)", "applying the right marketing and promotion strategies can positively affect local tourism (opportunities)", "tourists coming to the region may disrupt the lifestyle and traditional structure of local people (threats)" were reached.

Keywords: Asthma Cave, cave, tourism, tourism potential

INTRODUCTION

Since prehistoric times, underground cavities that form an indispensable environment for people's socio-cultural development and activities, have surface openings and have a width and height that can allow at least one person to crawl in, are called caves. Caves, typical examples of karstic erosion patterns, are natural cavities opened by water seeping underground from water-soluble rocks such as limestone, usually as a result of geomorphological and geophysical processes under natural conditions, melting and eroding the rocks (Doğanay and Zaman, 2013, 105; Bolechova et al., 2022: 196-198). In other words, caves are underground cavities of karstic origin, usually developed in a horizontal or vertical direction, complex in plan, which can have a length or depth of up to hundreds of kilometers in size that can be entered. (Erinç, 1971). Caves create a large ecosystem with their living and inanimate assets. These underground formations, which can be found at different elevations and positions in almost every region of the Earth, have been forming the habitat of living things since ancient times with their different lengths and depths, which develop depending on the geological, hydrological-hydrogeological, geomorphological, vegetation, climate and time factors of the natural environment in which they are located. (Akpınar & Sezen, 2018).

Caves have been helping people to survive by resisting all kinds of harsh living conditions since prehistoric times. In addition, they create indispensable environments for people's social and cultural development and activities. Thanks to the natural features they have, caves have been used by people for various purposes since ancient times of history and have been the subject of various researches. (Doğaner, 2001: 86; Arpacı et al., 2012: 62; Uzun et al., 2015: 245, Nazik & Bayari, 2018, Maksoud et al., 2021: 110). Human beings have used caves in past periods for purposes such as shelter – protection, places of worship, dungeons against future dangers from outside. Today and in recent periods; they are used as a place of worship, cold storage, animal and agricultural products protection, military logistics area and cave tourism, etc. In addition, due to the fact that the caves contain many data (geological and climatic) from past periods, it has a natural laboratory feature for sciences Geology, Geography, Geomorphology, Biology, Archeology, Speleology and Ecology, etc. In addition, caves are becoming important tourist attraction centres for reasons such as the mysterious images they create, internal waters, air and animal beings (Doğanay and Zaman, 2013: 121; Şengün et al., 2022: 2020).

The change in the understanding of tourism in the world and in Turkey over time directs people participating in tourism activities to different tourism areas, and the understanding of

tourism, which has been realized within the scope of beach tourism for many years, is gradually diversifying (Ceylan, 2007, 225). In this context, caves, which are the first natural habitats of humanity, have been attracting people's interest with their natural formations in recent years and are gradually taking their place in the concept of tourism. In the researches carried out, it is found that there are about 40 thousand caves in Turkey (Sever, 2008: 254). However, very few of them can be evaluated in economic terms. Caves in Turkey have a significant economic potential with their cold storage for food storage, fungiculture, speleotherapy (cave therapy), shelters for military purposes and various tourist attractions in recent years. Efforts are being made to bring these caves to tourism in Turkey. The number of these studies is increasing every day, which reveals the richness of the cave potential in Turkey. However, the studies carried out are mainly focused on the inclusion of caves as names and places in the literature on a local basis (Kopar, 2010: 33). However, the exploration of caves whose characteristics have not been explained in detail is of importance for local and regional tourism activities (Karadeniz, 2018; Zeybek vd., 2019:364-365).

The main material of the study is the “Asthma Cave” located in Silifke District of Mersin Province. Domestic and foreign sources related to the subject, on-site observations and field inspection reports were used. The research was carried out in three main stages within the framework of a plan and program: the “Planning”, “Realization” and “Reporting” stages. At the planning stage, the research subject was determined first and the boundaries of the study area were finalized. After that, the purpose of the study was determined and then the necessary literature researches were carried out. As a result of literature research, many domestic and foreign sources were identified, the revealed sources were classified and the realization stage was started. At this stage, the sources that were obtained were examined first. After that, the work site was observed on site in August, 2022 and the necessary examinations were made. These collected data were evaluated.

It is thought that the results obtained with this study would contribute to the process of making the necessary plans for the tourist infrastructure of the Asthma Cave, the acquisition of tourism value of the cave and similar studies to be carried out.

1.THE LOCATION, FEATURES AND IMPORTANCE OF THE CAVE

Asthma Cave is located in the Silifke District of Mersin. The distance to Silifke is 23 km The distance to Mersin is 85 km. Transportation is carried out by private vehicles and tour organizations. The cave, located in the Hasanaliler Neighborhood of Narlikuyu Town of Silifke, is located 600 meters northwest of the Heaven – Hell Caves. It is one of the places that best

reflects the geographical conditions of the region. Asthma cave is also known as one of the important natural wonders of the region (www.kulturportali.gov.tr, 2022). Because of its basin, which is believed to be good for asthma patients and is the subject of legends, it is visited especially by those who want to relieve their breathing. The cave is reached by a spiral iron staircase with 78 steps. The formation of the cave, which has a depth of about 15 meters and consists of three parts, dates back to the third geological period. there are giant stalactites and stalagmites with interesting shapes formed by the accumulation of silica minerals in the cave with 200-meter galleries. The humidity rate in the cave reaches to 85 percent in the summer season and reaches to 95 percent in the winter. The interior lighting of the cave especially allows photography enthusiasts to capture stunning images. Asthma Cave is also called “Wish Cave” by the public because pieces of cloth are tied to the trees and bushes around it by visitors for wishes (www.muze.gov.tr, 2022; www.essizmersin.com, 2022).

2. MATERIAL AND METHOD

2.1. Material

The main material of the study is the “Asthma Cave” located in the Silifke District of Mersin Province. Asthma cave is located in Narlikuyu Town, Hasanaliler Neighborhood. In addition to bearing interesting features with its geological structure and geomorphological elements, the area creates a rich potential for ecotourism with the values of natural and cultural resources found in the immediate vicinity. There are also “Heaven-Hell Ponders and the historical “Three Beauties Mosaic” in the region where the cave is located, where tourist visits are intensive. In the study, domestic and foreign resources related to the subject, observations and investigations conducted on site in the field, information obtained after conversations with local residents, visitors and managers were used as auxiliary materials.

2.2. Method

The method of this study was carried out in three stages. The first stage of the study was the selection of the research area and the determination of the purpose of the study. In the selection of this area, the fact that a sufficiently comprehensive research had not been conducted on the field of study, as well as the fact that the area was quite rich in terms of natural resource values and the cultural and historical accumulation, was an effective factor. In the second stage, after the place and purpose of the study were determined and the necessary literature researches were conducted, research area was visited in August 2022 and resources and brochures related to the field were collected. In addition, various interviews were conducted

with local residents, visitors and public employees of all professions by making observations and investigations in the field.

The SWOT analysis method was applied in the study, it was tried to determine the current tourism potential of the Asthma Cave and the strengths and weaknesses of this potential in terms of cave tourism, as well as what opportunities and threats may arise in the future. This study is important in terms of providing an idea about the cave tourism potential in the area, making contributions to the development of ecotourism in Mersin province through the development of this potential and putting forward solutions for this.

3.. FINDINGS AND CONCLUSION

Evaluation of Asthma Cave Tourism Values by SWOT Analysis

Strengths;

- The fact that the area where the Asthma cave is located is in the Eastern Mediterranean Region, the richness in biodiversity, flora and fauna can positively affect visits
- The climatic conditions in the region where the cave is located may allow to visit the cave for 12 months
- The fact that the study area has a generally unspoiled nature is an advantage for tourism.
- The hospitable nature of the local people can contribute to a positive image
- Availability of parking service at the cave entrance
- The presence of a facility providing cafe service at the cave entrance
- Being close to settlements such as Mersin, Silifke and tourism centers such as Kizkalesi and Atakent increases the rate of visits.

Weaknesses;

- Lack of tourism awareness of local people
- Insufficient advertising and promotion of the cave
- Insufficient infrastructure and superstructure investments of the region
- Lack of public transportation for transportation to the cave
- Insufficient explanation of the importance of the cave in terms of health

Opportunities;

- The increasing domestic tourism demand for Cave Tourism can positively affect the tourism of the region.
- The development of cave tourism in the region can positively affect the socio-cultural development of the village and its immediate surroundings.

- The development of cave tourism can also positively affect the development of other sectors.
- The implementation of the right marketing and promotion strategies can positively affect local tourism.
- The activities carried out within the scope of cave tourism can contribute to the balance of using protection without destroying the environment in the region.
- The fact that the local people are eager and willing to take part in the cave tourism-oriented service sector is an important opportunity for the success of tourism studies to be carried out in the district.

Threats;

- The arrival of tourists in the district and its immediate vicinity may cause damage to natural life, deterioration of vegetation
- Increasing construction and concretion in food and beverage establishments in the immediate vicinity may lead to a decrease in the aesthetic values of the region.
- Tourists who will come to the region may disrupt the lifestyle and traditional structure of the local people.
- The fact that the business owners working in the region are uneducated may be perceived as a threat element.
- The lack of a sufficient number of tourist guides in the region may negatively affect the development of tourism.

3.1. Conclusions and Recommendations

Diversification of tourism, except for the sand- sun – sea trio, and to be done in every region of the country for twelve months and the people of the region's providing income from tourism (Oriaku, 2021: 18-19) can only be possible with ecotourism (nature-based tourism). Natural and cultural assets that have entered a rapid extinction process despite having an important potential in the current century and cannot be properly evaluated can be evaluated through tourism in accordance with the principles of conservation, use and preservation. It should be realized that the natural values, the formation of which took millions of years, cannot be fulfilled in a short time and we must protect them first of all, and it should be aimed not to disturb the ecological balance while opening the region to tourism. In this context, cave tourism, which is a type of ecotourism, is also important in terms of bringing our natural and cultural values to tourism in the balance of conservation and use.

As a result, the development of activities such as plateau, mountain, culture and ecotourism in rural residential areas in Turkey, which have an important potential in terms of tourism, can play an active role in solving the problems of the region and developing the region in the long term. In short, ecotourism should be carried out with a sustainable planning and understanding in an environmental and ecological sense. It is recommended to provide tourism training to people in the region where the research was conducted, to create and implement advertising and promotion strategies aimed at increasing the awareness of the region and the Asthma Cave, to prevent concretion and degradation of the natural environment by conducting the necessary inspections by the authorities, to make the necessary investments to ensure easy access to the cave.

REFERENCES

- Akpınar, Külekçi, E., & Sezen, I. (2018). Bir ekoturizm aktivitesi olarak mağara turizmi; Erzurum İli Elmalı Mağarası örneği. *Süleyman Demirel Üniversitesi Mimarlık Bilimleri ve Uygulamaları Dergisi*, 3(1), 66-75.
- Arpacı, Ö., Zengin, B. & Batman, O. (2012). Karaman'ın mağara turizmi potansiyeli ve turizm açısından kullanılabilirliği. *Karamanoğlu Mehmetbey Üniversitesi Sosyal ve Ekonomik Araştırmalar Dergisi*, 14 (23), 59-64.
- Bolechova, B., Krsak, B., Sidor, C., & Strba, L. (2022). *Development of Cave Tourism in the Domica Area in Slovakia*. In book: Different Approaches to Economic and Social Changes: New Research Issues, Sources and Results. https://www.researchgate.net/publication/357830707_Development_of_Cave_Tourism_in_the_Domica_Area_in_Slovakia
- Ceylan, S. (2007). Zeytintaşı mağarası (Serik-Antalya). *Doğu Coğrafya Dergisi*, 12(17), 223-243.
- Doğanay, H. (2001), *Türkiye Turizm Coğrafyası* (3. Baskı). Çizgi Kitabevi Yay. No:33, Üniversite Kitapları: 9, Çizgi Kitabevi, Konya
- Doğanay, H. & Zaman, S. (2013). *Türkiye Turizm Coğrafyası*. Ankara: Pegem Akademi
- Erinç, S. (1971), Jeomorfoloji II (Genişletilmiş 2.Baskı). İstanbul Üniversitesi Yayınları No: 1628, Coğrafya Enst.Yay. No: 23, İstanbul.
- Karadeniz, V. (2018). Dupnisa mağarası ve turizm potansiyeli. *The Journal of International Social Research*, 11 (61).284-298.
- Kopar, İ. (2010). Aladağların (Orta Toroslar) Fosil Mağara Potansiyelinden Yeni Bir Kayıt: Kapuzbaşı Mağarası (Divrik Dağı). *Türk Coğrafya Dergisi*, 54, 31-40.
- Maksoud, K. M. A., Baghdadi, M., & Ruban, D. A. (2021). Caves as geoheritage resource in remote desert areas: a preliminary evaluation of Djara Cave in the Western Desert of Egypt. *Geologos* 27, 2 , 105–113.
- Nazik, L. (2018). Yeraltı Karanlıklar Dünyasının Gizemli Oluşumları: Mağaralar. *Mavi Gezegen*, Sayı:24, 20-36.
- Nazik, L., & Bayarı, S. (2018). Mağara Zengini Ülke: Türkiye. *Mavi Gezegen*, Sayı:24, 7-19.
- Oriaku, C. C. (2021). Sectoral Performance and the Development of Rural Communities in Africa: An Appraisal of the Potentials of the Ogbunike Cave in Nigeria. *International Journal of Operational Research in Management, Social Sciences & Education | IJORMSSE* 7 (1), 17-28.
- Sever, R. (2008). Polat mağarası ve Turizm Potansiyeli (Doğanşehir-Malatya). *Doğu Coğrafya Dergisi*, 13(19), 251-266.
- Şengün, M. T., Kılıçarslan, M., & Göktaş, Y. (2022). Bırkleyn Mağaraları (Diyarbakır) ve Turizm Potansiyeli. *Mavi Atlas*, 10(1), 219-234
- Uzun, A., Zeybek, H. İ., Yılmaz, C. & Bahadır, M. (2015). Aksu Çayı Havzası traverten mağaraları (Giresun). *Marmara Coğrafya dergisi*, 31, 243-257.
- Zeybek, H. İ., Aylar, F. & Dinçer, H. (2019). Kılıçlı Cave (Kastamonu) and its importance for tourism. *International Journal of Geography and Geography Education*, 40, 363-381
- www.kulturportali.gov.tr, (2022). Asthma Mağarası – Mersin. Türkiye Kültür Portalı <https://www.kulturportali.gov.tr/turkiye/mersin/turizmaktiviteleri/asthma-magarasi>
- www.muze.gov.tr., (2022). Silifke Asthma Mağarası. <https://muze.gov.tr/muze-detay?SectionId=AST01&DistId=MRK>
- www.essizmersin.com, (2022). Asthma Mağarası. <https://www.essizmersin.com/tr/2/dogayi-kesfet/asthma-magarasi/80>

OKUL ÖNCESİ DÖNEMDE DUYGU DÜZENLEME BECERİLERİ MOTOR YARATICILIK ETKİNLİKLERİ İLE DESTEKLENEBİLİR Mİ?

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Özet

Bu araştırmada, okul öncesi dönemde yer alan çocukların, duyu düzenleme becerilerinin motor yaratıcılık etkinlikleri ile desteklenebilirliğini gösteren literatür (derleme) çalışmasını yapmak amaçlanmıştır. Yaratıcılığın bir boyutu olan motor yaratıcılık, çocukların bedenleri ile kendilerini ifade etme becerilerini desteklemede önemli yer tutmaktadır. Özellikle okul öncesi dönem çocuklarının kendilerini sözel olarak ifade etmekten daha çok bedenleri ile ifade etmeyi tercih ettikleri bilinmektedir. Bu anlamda, çocuklar kendilerini ifadede bedeni kullanılırken bir yandan da ön plana çıkmaktadır. Aynı zamanda duyu düzenleme becerilerinde de duygular ön planda yer almaktadır. Çünkü hissettiği duyguların bireyin kendi tarafından anlaşılması ve ifade edilebilmesi konusunda, bireyin kendisine ve çevresine olan farkındalığının yüksek düzeyde olması gerekmektedir. Duygu boyutunda ise bireyde farkındalığın artabilmesi için bedensel farkındalık ve hareket yadsınamaz iki etkeni oluşturmaktadır. Bu bağlamda duygular ve hareketlerin birbirinden ayrılamaz unsurlar olduğu düşünülmektedir. Buradan hareketle bu duygularımız ve duygularımızı düzenleme becerimizi motor yaratıcılık ile ilgili etkinliklerin büyük oranda etkileyeceği öngörülmektedir. Buradan yola çıkarak bu derlemede, okul öncesi dönemde motor yaratıcılık ve önemi, duyu ve duyu düzenlemenin gelişimi, motor yaratıcılığın duyu düzenlemede etkisi sunulmaktadır.

Anahtar kelimeler: yaratıcılık, motor yaratıcılık, duyu, duyu düzenleme

**CAN EMOTION REGULATION SKILLS IN PRESCHOOL PERIOD BE
SUPPORTED WITH MOTOR CREATIVITY ACTIVITIES?**

Abstract

In this review, it was aimed to show that emotion regulation skills of preschool children can be supported by motor creativity activities. Motor creativity, which is a dimension of creativity, has an important place in supporting children's ability to express themselves with their bodies. Especially preschool children are known to exhibit communication with their bodies more than verbal communication. In this sense, emotions come to the fore while expressing themselves. At the same time, emotions are also at the forefront in emotion regulation skills. Because the individual's awareness of himself/herself and his/her environment should be at a high level in order to understand and express the emotions felt by the individual. In the emotion dimension, physical awareness and movement constitute two undeniable factors in order to increase awareness in the individual. In this context, emotions and movements are thought to be inseparable elements. Therefore, it is predicted that activities related to motor creativity will greatly affect our emotions and our ability to regulate our emotions. Based on this, in this review, motor creativity and its importance in preschool period, the development of emotion and emotion regulation, the effect of motor creativity on emotion regulation are presented.

Keywords: creativity, motor creativity, emotion, emotion regulation

GİRİŞ

Duygu ile ilgili yaygın olarak bilinen doğrular ya da çoğu kişinin bir fikri olsa da tam olarak yapılmış bir tanım bulunmamaktadır (Izard, 2009). Izard (2009), duygular tanımsal açıdan açıklığa kavuşturulmasa bile zihnimizde var olduğunun ve duyguların dış etkenler vasıtası ile edinilemeyeceğini öne sürmektedir. Duyguların var olması ve hissedilebilirliği duygularla ilgili kavramların tanımı ve dilden önce ortaya çıkmıştır. Ancak dilin kazanımı, duygusal ifadeleri ve duyguyu ifade edebilmeyi kesinleştirmemektedir. Özellikle büyük yaş grubunda olan insanlar yaşadıkları duygunun ne olduğu, nasıl ifade edileceği konusunda zorluklar yaşamaktadır. Diğer bir deyişle, duygular zihinsel aktiviteler sonucunda kontrol edilmektedir (Izard, 2002). Duygu, açık bir tanım yapılmaya ya da hissedildikten sonra ifade edilemese bile zihinde hissedilmekte ve deneyimlenmektedir. Duyguların ifade edilişi bireyden bireye, farklı şiddet aralığında, farklı süre aralığında, farklı tepki aralığında, değişmektedir. Duygu düzenleme, bireyin duygular hakkında deneyim sahibi olması, bu deneyimleri ile cevap vermesini içermekte ve duygu düzenleme becerisi bu deneyimlerden beslenmektedir (Cole & Deater-Deckard, 2009). Duygu düzenleme, kişinin ruh halinde hissettiği duygusal deneyimleri, uyarılmayı, tepkileri, duygu dinamiklerindeki değişimleri, yıkıcı dürtüleri, olumlu ve olumsuz duyguları izleme, kontrol etme, değerlendirme, yönlendirme ve değiştirmeyi içeren içsel ve dışsal süreçler bütünü olarak tanımlanmaktadır (Koca, 2020).

Okul Öncesi Dönemde Duygu Düzenlemenin Gelişimi

Duygu düzenleme becerisi doğuştan gelmemekte, yaşamın ilk yıllarından itibaren büyük bir ivme ile geliştiği bilinmektedir (Eisenberg, Spinrad ve Eggum, 2010; Dodge ve Garber, 1991). Erken çocukluk döneminde edinilmesi gereken gelişimsel özelliklerden biri olan duygu düzenleme becerisi, bir kişinin amaçları doğrultusunda duygulara yönelik tepkilerin takip edilmesini, değerlendirilmesinden ve farklılaştırılmasını içeren çevresel ve iç görüsel süreçlerden oluşmaktadır (Thompson, 1994). Bu süreç mutluluk, mutsuzluk, öfke, şaşkınlık, korku gibi tüm duyguların bedende meydana gelen olası etkileri ile baş etmeyle ilgili özellikleri de kapsamaktadır (Kopp, 1989). Bu süreçte çocukların öncelikle duyguları anlaması gerekmektedir. Duyguları anlama becerisi ise bebeklik döneminden itibaren gelişmektedir. Çocuklar, bebeklikten itibaren konuşmadan önce duyguların karakteristik özelliklerini tanımlamaktadırlar (Thompson ve Lagattuta, 2006). Bu süreçte duyguları anlamlandırırken duyguları sembolik olarak zihinlerinde kodlamakta ve sosyal etkileşimleri ile deneyimle kazanmaktadırlar (Denham ve Burton, 2003). Deneyimleri ile duygu düzenleme becerilerini geliştirmekte ve bu süreçte bu becerilere sahip olan çocuklar çevreleri ile pozitif ilişkiler

kurabilmektedirler (Cassidy, Parke, Butkovsky ve Braungart, 1992; Webster-Stratton ve Reid, 2004). Ayrıca bilimsel niteliği olan konularda, sınıf içerisinde farklı fikirler ortaya koymada, erken okuryazarlık becerilerinde başarılı oldukları bilinmektedir (Graziano, Reavis, Keane ve Calkins, 2007). Buna karşın duygu düzenleme becerisi konusunda belirli bir yeterliliğe ulaşamamış olan çocuklar davranışlarında zorlanmalar yaşayabilmektedirler (Arı ve Yaban, 2016; Batum ve Yağmurlu, 2007; Eisenberg vd., 1996). Aksi durumda, Eisenberg ve Fabes (1992), erken çocuk döneminde duygu düzenleme becerisindeki herhangi bir kusur ya da eksikliğin, yaşamın ilerleyen yıllarında davranış problemlerine neden olabileceğini vurgulamaktadırlar.

Çocukların duyguları anlayışının gelişiminde, çocuğun ilk sosyal çevresi ve duygusal deneyimleri edindiği aile, önemli bir yere sahiptir (Laible ve Thompson, 1998). Çocukların duyguları tanımaları aile içerisinde oluşan bir durumdur. Duyguları tanıma sürecinde, bazı aileler çocuklarıyla konu ile ilgili etkileşimde kalarak çocuğa olumlu bir duygu iklimi sunarken, bazı aileler çocukların duygusal olarak zorlanmalarını destekleyecek, çocukların gelişimlerini olumsuz etkileyen duygusal görevleri çocuklara yüklemektedirler (Thompson ve Lagattuta, 2006). Duyguları anlama ebeveynlerin-çocukları ile karşılıklı etkileşiminden beslenen bir süreçtir (LaBounty, Wellman, Olson, Lagattuta ve Liu, 2008). Bu sebeple çocukların duygularını tanıma ve ifade etme konusunda çocuklarına destek olan ebeveynlerin çocuklarının bu yetiyi kazanmada daha başarılı oldukları bilinmektedir. (Denham, Mitchell-Copeland, Strandberg, Auerbach ve Blair, 1997). Bireyin dünyaya geldiği andan itibaren etkili olan ve sosyal duygusal gelişimde büyük önem taşıyan duygu düzenleme becerisinin gelişiminde en büyük etkenin aile olduğu ve ailenin karakterinden, çocuğa ve diğer aile üyelerine karşı tutum ve davranışlarının etkilediği görülmektedir. Eisenberg'e göre farklı bir ifade ile duygu düzenleme becerisinin genetik ve dışsal faktörler ile yakından ilişkili olduğu, ancak genetik etmenler yaşamın ilk yıllarından sonra çok fazla değişime uğramadığı vurgulanmaktadır (Eisenberg vd., 2010). Buradan hareketle duygu düzenleme sürecinde dışsal yani çevresel etmenlerin daha çok etkili olduğu ve çocukların duygusal durumlarının belirleyicisi olan sosyal etkileşim sonucunda ortaya çıktığı belirtilmektedir (Thompson, 1994).

Okul Öncesi Eğitim Ortamları ve Motor Yaratıcılık

Bebeklikte ve ilk çocukluk döneminde duygular ebeveyn ve çocuğun yakınındaki kişiler tarafından düzenlenip yönetiliyorken, okul çağı ve ergenlik dönemi ile birlikte duygu düzenlemeyi, geçmişte içselleştirdiği süreçler sayesinde, birey kendisi yapmaktadır. Bu süreçte özellikle ilk çocukluk dediğimiz dönemde okul öncesi eğitimin önemi ve gerekliliği ortaya

çıkılmaktadır. Çocukluktan yetişkinliğe izleri görülen sosyal-duygusal gelişimin, okul öncesi eğitim açısından istenilen yönde, olumlu özelliklere sahip olarak evrilmesi için birçok becerinin gelişmesi gerekmektedir.

Okul öncesi dönem, çocukların gelişimlerinin en hızlı olduğu dönemlerden birisidir. Bu dönemde çocuklara zengin deneyim fırsatları sunan okul öncesi eğitim onların tüm gelişim alanlarını etkilemektedir. Ayrıca çocukların doğuştan getirdikleri potansiyellerini en üst düzeye taşıyabilmesi de ancak erken yaşlarda verilecek eğitim ile mümkün olabilmektedir (Oktay, 2002). Çocuğun tüm gelişim alanları açısından desteklenmesi, temel becerilerin kazandırılması ve çocuğun yaşama iyi bir şekilde hazırlanması ise nitelikli okul öncesi eğitimi programı ve zengin uyarıcılarla desteklenmiş bir eğitim ortamı ile sağlanabilir (Özdemir Beceren, 2012; Koçyiğit, 2012). Young ve arkadaşlarına göre, bu becerilerden duygu düzenleme becerisinin gelişiminde kişinin bulunduğu ortamda duyguların ifade ediliş şekli, süresi ve yoğunluğunun önemli etmenler olduğunu vurgulamışlardır. Bu etmenlere göre çocukların geliştirecekleri duygularının ve duygu yaşantılarının şekil alacağı ifade edilmektedir (Young, Klosko ve Weishaar, 2003). Bu konuda çocuklara sunulan ortamlar ve hazırlanan nitelikli programların çocukların duyguları anlama ve kendilerini rahatça ifade etmelerini dolayısı ile duygu düzenleme sürecini kolaylaştıracağı söylenebilir. Okul öncesi eğitimde çocuklarda doğuştan var olan ve geliştirilmesi gereken diğer bir beceri alanı da yaratıcılıktır. Yaratıcılık; bireyler için farklı yararlı olması için düşüncelerin, içsel ürünlerin ve birtakım çözümlerin ortaya konma süreci olarak tanımlanmaktadır (Sternberg&Lubart, 1999). Bunun yanı sıra yaratıcılık, daha önce olmayan bir şeyi oluşturmada kullanılan zihinsel bir faaliyettir, olmayanı ortaya koymak ise yaratıcılığın çevresel ve gözle görülebilir bir sonucudur. Yaratıcılık ile ilgili çalışmaların en önemli isimlerinden biri olan Torrance (1981) yaratıcılığı bir fiil olarak tanımlamaktadır. Torrance yaratıcılığı, "problemlere, yolunda gitmeyen şeylere, eksikliklere, uyumsuzluğa karşı farkındalığı yüksek olma, problemi tanımlayabilme, çözüm arayışı içerisine girme, bulduğu çözümlerle ilgili denemeler yapabilme, başarısız olduğu denemelerini değiştirip geliştirebilme ve tüm bu sürecin sonucunda bir olgu ya da bir nesne oluşturabilme" olarak tanımlamıştır (Torrance,1981). Burada bahsetmek istediğimiz esas konu yaratıcılığın önemli bir boyutu olan motor yaratıcılıktır. Ve okul öncesi dönemde çocukların yaratıcılık, motor gelişim, bedeni tanıma, bedeni ile kendini ifade etme, kendine güven gibi birçok becerinin kazanılmasında etkili olduğu söylenebilir. Motor yaratıcılık ile ilgili çalışmalara ve tanımlara yaratıcılık kadar sık rastlanmamaktadır (Alston 1971). Ruiz, motor yaratıcılık ile yaratıcılığın birbirileri ile ilintili alanlar olduğunu belirtmiş ve birey karşılaştığı durum ya da problem durumlarına birbirinden

farklı ve kendine has yanıtlar üretiyorsa o bireyin motor yaratıcılık becerisine sahip olduğunun düşünülmesi gerektiğini vurgulamıştır (Ruiz,1995). Motor yaratıcılık, daha önce olmayan ve olandan farklı ürünleri ve durumları algılama yetisi olarak tanımlanmakta ve daha önce karşılaşılmayan bir problemin çözümü bir düşüncenin oluşumu ve bir duygunun bedeni farklı şekillerde kullanarak ifade edilmesi şeklinde belirtilmektedir (Bournelli ve Mountakis 2008) Var olan bir sorunu çözmek, bir duyguyu, bir fikri, bedenimizin farklı yerlerini farklı şekillerde kullanarak,çözmek ya da karşıdaki kişiye ,gruba aktarmak motor yaratıcılık (MC) olarak tanımlanmaktadır (Bournelli, Makri ve Mylonas, 2009; Wyrick, 1968). Aynı zamanda motor yaratıcılık, Kamaraj ve Aktan'a göre, duyguların eğitimine öncelik vermek bu yeteneği geliştirmek için büyük bir öncü olmaktadır (Kamaraj ve Aktan, 1998).

Çocukların Duygu Düzenleme Becerilerinde Motor Yaratıcılık Etkinlikleri İle Desteklenebilir mi?

Motor yaratıcılık, Olivares'e göre "bedeni kullanarak olası bir etkiye olabildiğince çok alternatif yol üretmek ve bu yolları kullanarak tepki üretme yeteneği" olarak tanımlanmaktadır. Fakat motor yaratıcılık yalnızca hareket ve hareketin niteliği ile ilgili somut etkenlerle bağlantılı değildir bunların yanı sıra hayal gücü biriciklik ve devamlılık gibi bireyin içgörüsü ile faktörleri de içinde barındırmaktadır (Akt.Justo 2008). Buradan hareketle motor yaratıcılığın sadece somut ve çevresel faktörlerle değil iç görü ve iç motivasyonla ilgili olduğu anlaşılmaktadır. Buradan hareketle duygularımız ve duygularımızı düzenleme becerimiz motor yaratıcılığı büyük oranda etkileyen iç görüsel faktörler arasında olduğu öngörülmektedir. Duygular ve duygu düzenleme becerimiz yaşamımızda önemli bir yere sahiptir. Kendimizle ve sosyal ortamdaki ilişkilerimizde etkilere karşı olumlu ve uyumlu duygusal tepkiler vermeye çalışırız. Öfkelendiğimizde öfkemizin kaynağına zarar vermek isteyebiliriz ama her zaman bunu yapmayı tercih etmeyiz; Bizi güldüren, absürt bir durumda gülmek isteriz ama bazen kendimizi tutarız. Duygularımızı genellikle kontrol altında tutmaya çalışırız. Yani duygu düzenleme eğilimimiz genellikle hep vardır. Duygu düzenleme kavramı, amacımıza ulaşmamız için duygusal tepkilerimizi farkında olma , tepkilerimizi analiz etme ve yeniden düzenlemeyi içeren iç görü ve çevresel süreçleri kapsamaktadır. Bu süreçte, duygularımızı tanımamız ve göstermemiz gerektiği zamanı, onları nasıl deneyimleyip, nasıl ifade ettiğimizi içermektedir. Duygularının bilincinde olma, sosyal ortama uygun şekilde duyguları dışa vurabilme duygu düzenlemenin gelişimi için en önemli becerilerdir (Macklem, 2008). Motor gelişim ve motor yaratıcılık burada kendini göstermektedir. Çünkü okul öncesi dönemde çocukların hem

duygularını ortaya çıkarma becerilerinde hem de yaratıcılık becerilerini göstermelerinde motor yaratıcılık önemli yer tutmaktadır.

Okul öncesi dönem çocuklarının sağlıklı büyümesi ve gelişebilmesi için hareket gereklidir (Grammatikopoulos, Gregoriadis ve Zachapoulou,2012). Çünkü hareket, çocukların öz farkındalıklarının ve sosyal farkındalıklarının oluşması ve artması için vazgeçilmez gereksinimler arasında yer almaktadır. Okul öncesi dönemde çocukların sensorimotor dönemdedirler ve yaratıcılığı hareket yolu ile daha kolay ifade etmektedirler (Bournelli,Makri ve Mylonas,2009). Dolayısı ile doğum öncesi dönemden itibaren hareket halinde olan çocuğun yaşamında önemli bir yer tutan motor yaratıcılık hem hareketlerden hem de yaratıcılıktan beslenmektedir (Pica, 2000). Aynı zamanda Greer-Paglia'ya göre (2006) motor yaratıcılık, çocukların öykü anlatma, dans etme gibi yollar kullanarak; kendi duygu ve düşüncelerini ifade etmesini, ilişki kurmasını sağlayan, spontane gelişen vücut hareketleridir. Duyguları konusunda farkındalığı oluşmuş ve duygularını dışa vurma konusunda da başarılı olan bireylerin öz farkındalık ve sosyal alan farkındalığının yüksek düzeyde olması çok önemlidir. Çünkü çocuklarda sosyal farkındalık arttığında bedenlerine dair olan farkındalıkta paralel olarak artmakta, bu da motor yaratıcılığın gelişmesine katkı sağlamaktadır (Wang, 2003). Bireyde duygu farkındalığının daha üst düzeye taşınması bedensel farkındalık ve hareket göz ardı edilemeyecek etkenleri oluşturmaktadır. Buradan hareketle hareket ve duyguların iç içe geçmiş olgular olduğu düşünülmektedir. Çünkü çocukların hissettikleri duyguları dışa vurabildikleri ve konuşmadan kendilerini ifade edebildikleri ilk ve temel yol harekettir (Hinitz,1980; Akt. Pica,2000). Yaratıcılık ve hareketi harmanlayarak kullanmakta duyguların dışa vurum şeklini değiştirecek ve zenginleştirecektir. Yaratıcılık her bireyde olan farklılaştırılmayı ve zenginleştirilmeyi bekler, farklı yaklaşımlar, farklı eğitim ortamları ve farklı eğitim yöntemleri ile belirgin hale gelebilir (Makero, 2012). Yapılan çalışmalarda, yaratıcılığı ortaya çıkarma, zenginleştirme ve yaratıcı hareketler sergileyebilmede okul öncesi eğitimin önemli dönemler arasında yer aldığı ortaya konmuştur. Bu dönemdeki çocukların temel ihtiyaçlarından birinin hareket olması ve çocukların hareketle rahatlama sağlamaları nedeni ile eğitim programında hareket etkinliklerine bolca yer verilmesi çocukların iç dünyalarını daha rahat dışa vurabildiklerini göstermiştir. (Cheung, 2010; Erbay, 2009; Felker &Treffinger, 1971; Justo, 2008; Torrance, 1981). Yaratıcı hareketin gelişmesi için çocuğun yaptıklarının kabul edilmesi, çocuğa kendini ifade edecek fırsatlar yaratılması, gelişim alanları göz önünde bulundurularak yol alınması gerekmektedir. Çocuk, kendini kabul görmüş ve saygı duyulmuş hissettiğinde; duygularını ve düşüncelerini ifade etme becerisini kademe kademe ilerleterek, serbest, esnek

ve açık fikirler yaratıp geliştirecek ve bu durum çocuğu bilgiye, deneye, keşfe yönlendirecektir. Bunun sonucunda çocuk kendini özgür ve güvende hissederek duygularını ifade etme ve duygularını düzenleyebilme becerisini geliştirebilecektir. Çocuklarda bu becerilerin kazandırılması ve geliştirilmesi için erken yaşlardan itibaren farklı destek programlarıyla desteklenmesi gerekmektedir. Bu noktada çocuklarla yapılan motor yaratıcılık ve duyu düzenleme çalışmalarının çocukların gelişimlerini desteklediği, duyu farkındalığı ve duygularını bedeni ile ifade edebilme becerisini arttıracığı düşünülmektedir. Okul öncesi dönemde yapılabilecek bu çalışmalar çocuğun kendisiyle ve çevredekilerle daha açık ve olumlu bir iletişim kurma fırsatı sunmaktadır. Motor yaratıcılık çalışmalarında amaç, çocukların dikkatlerini bedenlerine yoğunlaştırmalarına, bedenlerinin farkına varmalarına ve kendilerine güvenmelerine, yaratıcılıklarını geliştirmelerine, duygularını daha net ifade edebilmelerine yardımcı olabilecektir. Bu ön görüler doğrultusunda alan yazın incelendiğinde, okul öncesi dönemde yer alan çocukların duyu düzenleme becerilerinin motor yaratıcılık etkinlikleri desteklenebilirliğini gösteren çalışmaların olmadığı saptanmış ve bu çalışmanın alanda çalışan eğitimcilere ve ebeveynlere katkı sağlayacağı düşünülmüştür.

SONUÇ VE ÖNERİLER

Bebeklikten itibaren öncelikle ilk eğitim kurumları olan ebeveynlerin, daha sonraki süreçte okul öncesi eğitim kurumlarında duyu düzenleme becerisinin ve motor yaratıcılıklarının desteklenmesi önemli yer tutmaktadır. Bu süreçte çocuklar zorlu durumlarla karşılaşabilmekte, problemleri kendileri çözmek için uğraşmakta ve sonucunda başarı ya da başarısızlık durumları ile yüz yüze gelebilmektedirler. Önemli olan bu durumlarda duygularını düzenleyerek olumlu bir şekilde yönetebilmeleri ve pes etmeden yaratıcılık becerilerini ortaya koyarak devam etmeleri gerekliliğidir. Bu becerilerin kazanılması için okul ve eğitim süreçleri ile mümkün olabilmektedir. Okul ortamlarında duyu düzenleme ve motor yaratıcılık becerilerini geliştirecek süreç ve durumlar için fırsatların sunulması gerekmektedir. Akbaba'ya göre, aksi durumda olumsuz duygular yaşayan çocuklar hırçın ve saldırgan davranışlarda bulunabilirler. Duygu düzenleme becerisi düşük olan çocukların stres yaşama durumlarının artması, stresle baş etme becerisinin yetersiz olması kaçınılmazdır. Duygularının düzenleyebilen bir çocuğun davranışlarının olumlu bir biçimde şekillenmesi sonucunda sosyal uyumunun sağlanması, toplum tarafından kabulün kolaylaşması, duygularını ifade edebildiği için rahatlayarak daha mutlu bir birey haline gelmesi ise olası bir sonuçtur (Akbaba, 2017). Bu araştırmada duyu düzenleme becerilerinin gelişmesini motor yaratıcılık etkinlikleri ile desteklenip

desteklenemeyeceđi konusu ele alınmıřtır. Alan yazın incelendiđinde; duyguların, yaratıcı süreçte önemli bir rol oynadıđını (Ivcevic ve Hoffmann, 2017), duygu düzenleme ile yaratıcılık ilişkisine ve birbirini olumlu yönde etkilediđini (Ivcevic ve Brackett, 2015; Yeh ve Li, 2008; de Rooij, ve Jones, 2015; Baas vd., 2008) saptamıřlardır. Yeh ve Li, (2008)'e göre okul öncesi çocukların duygularını düzenleme becerileri ile yaratıcılıkları arasındaki ilişkiyi belirlemek için çok az sayıda çalışmanın olduđunu belirtmiřtir. Ancak yapılan çalışmalarda yaratıcılıđın önemli bir boyutu olan motor yaratıcılık ve duygu düzenleme ile ilgili çalışmanın olmadığı saptanarak, bu çalışmanın okul öncesi eğitimcilere ve ebeveynlere yol göstereceđi ve alana katkı sağlayacağı düşünülerek planlanmıřtır. Buradan hareketle bundan sonra yapılacak çalışmalarda duygu düzenleme ve motor yaratıcılık ilişkisinin araştırılması önerilebilir.

KAYNAKLAR

- Akbaba, G. (2017). *Beş ve altı yaş çocuklarının duygu düzenlemesinde çocuk mizacıyla anne davranışları arasındaki etkileşimin incelenmesi*. (Yayımlanmamış yüksek lisans tezi). İstanbul Üniversitesi Eğitim Bilimleri Enstitüsü, İstanbul.
- Alston, D.J. (1971). *A Comparison of motor creativity with verbal creativity and figural creativity of black culturally deprived children*. Doctor thesis (unpublished). North Carolina Universty, Greensboro.
- Arı, M., and Yaban, E. H. (2016). Social behavior in preschool children: The role of temperament and emotion regulation. *Hacettepe University Journal of Education*, 31(1), 125–141.
- Baas, M., De Dreu, C. K. W., and Nijstad, B. A. (2008). A meta-analysis of 25 years of mood-creativity research: hedonic tone, activation, or regulatory focus? *Psychological Bulletin*, 134, 779–806.
- Batum, P. and Yağmurlu, B. (2007). What counts in externalizing behaviors? The contributions of emotion and behavior regulation. *Current Psychology*, 25(4), 272–294.
- Bournelli, P., and Mountakis, C. (2008). The Development of motor creativity in elementary school children and its retention. *Creativity Research Journal*, 20(1), 72-80.
- Bournelli, P., Makri, A., and Mylonas, K. (2009). Motor creativity and self-concept. *Creativity Research Journal*, 21(1), 104-110.
- Cassidy, J., Parke, R. D., Butkovsky, L., and Braungart, J. M. (1992). Family-peer connections: The roles of emotional expressive-ness within the family and children's understanding of emo- tions. *Child Development*, 63, 603-618.
- Cheung, R.H.P. (2010). Designing movement activities to develop children's creativity in early childhood education. *Early Child Development and Care*, 180(3), 377-385.
- Cole, P. M., & Deater-Deckard, K. (2009). Emotion regulation, risk, and psychopathology. *Journal of Child Psychology and Psychiatry*, 50, 1327–1330.
- De Rooij, A. & Jones, S. (2015). (E)motion and creativity: Hacking the function of motor expressions in emotion regulation to augment creativity. Paper presented at the Ninth International Conference on Tangible, Embedded, and Embodied Interaction (TEI 2015), 15-01-2015-19-01-2015, California, USA. <https://openaccess.city.ac.uk/id/eprint/7942/1/tei120-de-rooij.pdf>
- Denham, S. A., Mitchell-Copeland, J., Strandberg, K., Auerbach, S., and Blair, K. (1997). Parental contributions to preschoolers' emotional competence: Direct and indirect effects. *Motivation and Emotion*, 21(1), 65–86.
- Denham, S. A., and Burton, R. (2003). *Social and emotional prevention and intervention programming for preschoolers*. Berlin, Germany: Springer Science & Business Media
- Dodge, K. A., and Garber, J. (1991). Domains of emotion regulation. In J. Garber & K. A. Dodge (Eds), *The development of emotion regulation and dysregulation* (pp. 3–11). New York: Cambridge University Press.
- Eisenberg, N., and Fabes, R. (1992). Emotion, regulation, and the development of social competence. In M. Clark (Ed.), *Emotion and social behavior: Review of personality and social psychology* (pp. 119–150). Thousand Oaks, CA: Sage.
- Eisenberg, N., Fabes, R. A., and Murphy, B. C. (1996). Parents' reactions to children's negative emotions: Relations to children's social competence and comforting behavior. *Child Development*, 67, 2227–2247.
- Eisenberg, N., Spinrad, T. L., and Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's mal-adjustment. *Annual Review of Clinical Psychology*, 6, 495–525

- Erbay, F. (2009). *Anasınıfına devam eden altı yaş çocuklarına verilen yaratıcı drama eğitiminin çocukların işitsel muhakeme ve işlem becerilerine etkisinin incelenmesi* (Yayımlanmamış Doktora Tezi). Selçuk Üniversitesi, Sosyal Bilimler Enstitüsü, Çocuk Gelişimi ve Eğitimi Anabilim Dalı, Konya.
- Felker, D.W. and Treffinger, D.J. (1971). *Self concept, divergent thinking abilities, and attitudes about creativity and problem solving*. A paper presented at the Annual Meeting, American Educational Research Association, New York. <http://files.eric.ed.gov/fulltext/ED047347.pdf>
- Grammatikopoulos, V., Gregoriadis, A., and Zachopoulou, E. (2012). Acknowledging the role of motor domain in creativity in early childhood education. In O. N. Saracho (Ed.), *Contemporary perspectives on research in creativity in early childhood education* (pp. 159–176). Charlotte, NC: Information Age Publishing.
- Graziano, P., Reavis, R., Keane, S., and Calkins, S. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology*, 45, 3–19.
- Greer-Paglia, K. (2006). *Examining the effects of creative dance on social competence in children with autism: A hierarchical linear growth modeling approach*. ProQuest Information & Learning, US.
- Ivcevic, Z., and Brackett, M. A. (2015). Predicting creativity: Interactive effects of openness to experience and emotion regulation ability. *Psychology of Aesthetics, Creativity, and the Arts*, 9(4), 480–487.
- Ivcevic, Z., and Hoffmann, J.D. (2017). Emotions and Creativity: From States to Traits and Emotion Abilities, (Eds. G. J. Feist; R. Reiter-Palmon, J. C. Kaufman, (2017). *The Cambridge Handbook of Creativity and Personality Research*, 187–213.
- Izard, C. E. (2002). Translating emotion theory and research into preventive interventions. *Psychological Bulletin*, 128, 796–824.
- Izard, C. E. (2009). “Emotion theory and research: highlights, unanswered questions, and emerging issues,” *Annual Review of Psychology*, 60(1), 1–25.
- Justo, C.F. (2008). Creative relaxation, motor creativity, self-concept in a sample of children from early childhood education. *Electronic Journal Of Research In Educational Psychology*, 6(1), 29-50.
- Kamaraj, I. ve Aktan, E. (1998).. Okul öncesi eğitimde yaratıcılık ve problem çözme becerisi. İstanbul: Çağdaş Eğitim Yayınları.
- Koca, A. (2020). 60-72 aylık okul öncesi çocukların duygu düzenleme becerileri ile empati becerileri arasındaki ilişkinin incelenmesi (Yüksek lisans tezi). Gazi Üniversitesi, Ankara.
- Koçyiğit, S. (2012). Okul öncesi eğitimin tanımı, amacı, önemi ve ilkeleri. Zembat, R. (Edt.) *Okul öncesi eğitime giriş* (ss.14-26). Ankara: Hedef CS Basın Yayın
- Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental review. *Developmental Psychology*, 25, 343-354.
- Laible, D. J., and Thompson, R. (1997). *Attachment and emotional understanding in preschool children*. Paper presented at the biennial meeting of the Society for Research in Child Development, Washington, DC
- LaBounty, J., Wellman, H. M., Olson, S., Lagatutta, K., and Lui, D. (2008). Mothers' and fathers' use of internal state talk with their young children. *Social Development*, 17, 757–775.
- Macklem, G. L. (2008). *Practitioner's guide to emotion regulation in school-aged children*. New York, USA: Springer Science & Business Media

- Makero, S.C. (2012). The Preconditioning factors to a child's creative mind in a family set-up. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)*, 3(6), 964-973.
- Oktaç, A. (2002). *Yaşamın sihirli yılları: Okul öncesi dönem*. İstanbul: Epsilon Yayınları.
- Özdemir Beceren, Y. (2012). Okul öncesi eğitim ortamları. Zembat, R. (Ed.) *Okul öncesi eğitime giriş* (ss.180-199). Ankara: Hedef CS Basın Yayın
- Pica, R. (2000). *Experiences in movement: with music, activities and theory*. Delmar Cengage Learning.
- Ruiz Perez, L.M. (1995). El desarrollo de la competencia motriz en la eso y su evaluación. <http://www.ub.edu/Vcongresinternacionaleduccionfisica/userfiles/file/MesasRedondas/MR5RuizPerez.pdf>.
- Sternberg, R. J. and Lubart, T. (1993). Creative giftedness: A multivariate investment approach. *Gifted Child Quarterly*, 37(7), 7-15.
- Thompson, R. A. (1994). Emotion Regulation: A theme in search of definition. In N. A. Fox, The Development of emotion regulation: Biological and Behavioral Consideration *Monographs of the Society for Research in Child Development*, 59, 25-52.
- Thompson, R. A., and Lagattuta, K. H. (2006). Feeling and understanding: Early emotional development. In K. McCartney, & D. Phillips (Eds.), *Blackwell handbook of early childhood development* (pp. 317–338). Malden, MA: Blackwell.
- Torrance, E. P. (1981). *Thinking creatively in action and movement*. Bensenville, IL: Scholastic Testing Service.
- Wang, J.H. T. (2003). *The effects of creative movement program on motor creativity and gross motor skills of preschool children*. Doctor thesis (unpublished). The University of South Dakota, South Dakota.
- Webster-Stratton, C. and Reid, M. J. (2004). Strengthening social and emotional competence in young children—The foundation for early school readiness and success: Incredible years classroom social skills and problem solving curriculum. *Infants & Young Children*, 17, 96–113
- Wyrick, W. (1968). The development of a test of motor creativity. *Research Quarterly*, 39, 756–765.
- Yeh, Y.C. and Li, M. L. (2008). Age, emotion regulation strategies, temperament, creative drama, and preschoolers' creativity. *The Journal of Creative Behavior*, 42, 131–149. doi:10.1002/j.2162-6057.2008.tb01291.x
- Young, J. E., Klosko, J. S. and Weishaar, M. E. (2003). *Schema therapy: practitioner's guide*. New York: The Guilford Press.

LOJİSTİK MALİYETLER VE MUHASEBE İŞLEMLERİ

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Özet

Lojistik, terim olarak ilk kez 19. Yüzyılın başlarında askeri birliklerde kullanılmıştır. II. Dünya Savaşından sonra sivil hayatta da kullanılmaya başlanmış, 1963 yılında işletme literatürüne girmiştir. Günümüze kadar hem tedarik zincirinin çeşitlenmesi hem de teknolojik gelişmelerin artmasıyla birlikte lojistik faaliyetlerin entegre edilmesi kolaylaşmıştır. Lojistik ilgili ürünün ilk üreticiden son tüketiciye kadar olan nakliye, ambalajlama, gümrükleme, depolama, dağıtım gibi bütün süreçlerini ifade etmektedir. Müşterinin ihtiyaçları hususunda tüm ürünlerin çıkış noktasından varış noktasına kadar etkili ve verimli bir şekilde taşınması ile depolanması için gerekli metotları uygulama, planlama ve denetleme sürecidir. Bu çalışmanın amacı, lojistik maliyetler, lojistik maliyetlerin muhasebe açısından sınıflandırılması, lojistik maliyetlerin unsurları ve lojistik maliyetlerin muhasebeleştirilmesine ilişkin örnek uygulamalar ile açıklamaktadır.

Anahtar Kelimeler: Lojistik, Lojistik Maliyetler, Lojistik Maliyetler Muhasebesi

LOGISTICS COSTS AND ACCOUNTING TRANSACTIONS

Abstract

Logistics, for the first time as a term, 19. It was used in military units at the beginning of the century. II. After the World War II, it started to be used in civilian life and entered the business literature in 1963. Until today, it has become easier to integrate logistics activities with both the diversification of the supply chain and the increase in technological developments. Logistics refers to all the processes of the related product from the first manufacturer to the last consumer, such as transportation, packaging, customs clearance, storage, distribution. It is the process of applying, planning and supervising the necessary methods for the effective and efficient transportation and storage of all products from the point of departure to the destination in accordance with the needs of the customer. The aim of this study is to explain logistics costs, classification of logistics costs in terms of accounting, elements of logistics costs and sample applications related to accounting for logistics costs.

Keywords: : Logistics, Logistics Costs, Logistics Cost Accounting.

Giriş

Küreselleşmenin etkisiyle sosyal ve iktisadi dinamikler hızla değişim göstermektedir. Bir ülkenin değişimi ve gelişimi için en önemli şart, o ülkenin yatırım, ticaret ve tedarik zincirinin sağlıklı bir şekilde yürütülmesidir. Ülkelerin gelişmişlik ve kalkınmışlık düzeylerini ekonomik göstergeler sayesinde incelemek mümkündür. Uluslararası ticaretin yaygınlaşmasına bağlı olarak uluslararası ticarete konu mal ve hizmetlerin satıcıdan alıcıya ulaştırılması ihtiyacı lojistik sektörüne olan talebi artırmıştır.

Lojistik tarihsel gelişimi itibarıyla de İkinci Dünya Savaşı'nda savunma sektörüyle başlamıştır. Günümüze kadar hem tedarik zincirinin çeşitlenmesi hem de teknolojik gelişmelerin artmasıyla birlikte lojistik faaliyetlerin entegre edilmesi kolaylaşmıştır.

İşletmelerin rekabet edebilmesinde maliyet avantajı en önemli stratejilerden biridir. Son yıllardaki teknoloji ile birlikte lojistik sektöründe yaşanan gelişmeler ve sunulan hizmetlerin entegre edilmeye başlanması, işletmelere maliyet avantajı sağlama imkanı vermekte ve birçok işletmenin uluslararası pazarlardan daha fazla pay almalarında itici güç olmaktadır. İşletmelerde lojistik ile maliyet yönetiminde etkinlik artarken, zaman yönetimi de ilave önem kazanır, planlamada etkin bir stratejik yaklaşım oluşur.

Gelişen zamanın değişen koşullarına uyum sağlayacak çözüm yolları ve alternatifler üretilmek suretiyle tepki oluşur ve bununla birlikte teknolojik yatırımlar süratli gelişim sağlar (Hacırüstemoğlu ve Şakrak, 2002).

Lojistik Maliyetlerinin Muhasebe Sistematiği Açısından Sınıflandırılması

Küresel rekabet ortamında, maliyet kalemlerinin belirlenmesi, sınıflandırılması ve bu maliyet kalemlerinin tespitinden sonra maliyetlerin düşürülmesi işletmeler açısından avantaj sağlamakta ve sağladığı bu avantajı koruması etkin bir lojistik maliyet yöntemi ile mümkün olmaktadır (Ceran ve Alagöz, 2007). Lojistik maliyetlerini muhasebe sistematiği açısından beş grupta sınıflandırabiliriz (Ceran ve Alagöz, 2007).

1-Lojistik Maliyetlerinin Çeşitlerine Göre Sınıflandırılması

İşletmelerde maliyetlerin büyük bir kısmını ürünlerin satın alınması, taşınması, depolanması, talep tahmini, müşteri hizmetleri, üretim planlaması, stok yönetimi, sipariş yönetimi, dağıtım, ambalajlanması, yer seçimi ve depo faaliyetlerinin planlanması kontrol edilebilmesi maliyet kalemleri oluşturmaktadır. İşte bu faaliyetlerin bütününe lojistik, bu faaliyetlerin maliyet toplamda lojistik maliyetleridir.

2-Lojistik Maliyetlerinin Fonksiyon Esasına Göre Sınıflandırılması

Maliyet kalemlerinin, işletmenin işlevlerine göre sınıflandırılmasının en önemli faydası; maliyetlerin üretim maliyetleri ile bunun dışında kalan maliyetler olarak ayrılmasına olanak vermesidir. Bu ayırım kar analizlerini kolaylaştırmaktadır (Savcı, 2010). İşletme içerisinde lojistik verileri çoğunlukla hazır ve kullanılabilir formda olmadığından birçok lojistik bilgisi belgelerde veya üretim, tedarik, pazarlama, araştırma geliştirme, finansman, yönetim gibi diğer departmanlardaki verilerin içinde gizlenmektedir (Demir, 2008).

3-Lojistik Maliyetlerinin Kontrol Edilebilirlik Esasına Göre Sınıflandırılması

Giderler, belli bir örgüt birimi açısından kontrol edilebilme özelliklerine göre; kontrol edilebilen ve kontrol edilemeyen giderler olarak ikiye ayrılmaktadır (Akoğan, 2009).

a-Kontrol Edilebilir Giderler: Yöneticilerin, sorumluluk merkezi sınırları içerisinde müdahale edebileceği faaliyetlere ilişkin giderler, kontrol edilebilen giderlerdir (Kaygusuz ve Dokur, 2009). İşletmelerde belirgin lojistik maliyetleri, görünebilir ve kontrol edilebilir niteliktedir. Maliyetin sorumluluk merkezinin sınırları içerisinde kontrol edilebilme özelliğinin olması maliyet yönetimi açısından önem taşır.

b-Kontrol Edilemeyen Giderler: İşletmeler kontrol edilemeyen lojistik maliyetlere ise başka maliyetlerden ayırt edilmeleri ve ölçülmeleri zor olduğundan bu tür lojistik maliyetlerin belirlenmesine yönelik çaba gösterilmez. Bu sebeple, çoğu zaman işletme yöneticileri hangi maliyet kaleminin lojistik maliyetleri arttırdığını ya da diğer maliyetler kalemleriyle olan ilişkilerini tam olarak bilemez.

4-Lojistik Maliyetlerinin Ürünlere Yüklenmesi Açısından Sınıflandırılması

Maliyet hesaplama yöntemleri birbirlerinin seçeneği olmakla birlikte aynı zamanda birbirlerinin tamamlayıcısıdır. İşletmeler hangi yöntemi seçerse seçsin, maliyet kalemleri incelendiğinde direkt ve endirekt maliyetle karşılaşılır.

a-Direkt Giderler: Belirli bir mal veya hizmetin üretim maliyetine doğrudan doğruya yüklenebilen giderlerdir. Direkt giderlerin en önemli özelliği, bunların belirli bir üretim birimi için ne kadar harcandığının doğrudan doğruya hesaplanabilmesidir.

b-Endirekt Giderler: Lojistikte endirekt maliyetler taşımacılık hizmetinin gerçekleşmesi için mutlaka gerekli olan fakat yapılan sefer ile doğrudan ilişki kurulamayan maliyetlerdir.

5-Lojistik Maliyetlerinin Faaliyet Hacmi Açısından Sınıflandırılması

Faaliyet hacmine göre sınıflandırma, faaliyet hacmindeki olası değişmelere karşı giderlerin davranışlarını ifade etmektedir. Mamul maliyetinin hesaplanması, planlama, kontrol ve karar verme aşamalarında kullanılan önemli bir sınıflandırmadır. Faaliyet hacmine göre giderler; değişken, sabit ve karma giderler olmak üzere üçe ayrılmaktadır (Kaygusuz ve Dokur, 2009):

a-Değişken Giderler: Faaliyet hacmine bağlı olarak artan ya da azalan giderlerdir. Diğer bir deyişle iş hacmiyle aynı yönde ve aynı oranda değişme gösteren giderdir. Taşıma faaliyetinde değişken maliyetlerin yüksek olmasına karşın, stok maliyeti ayrı tutulmak kaydıyla depolama faaliyetinde değişken maliyet düşük kalabilmektedir.

b-Sabit Giderler: Belirli bir zaman diliminde ve faaliyet hacminde, faaliyet hacmindeki artışlardan veya azalışlardan etkilenmeyerek aynı kalan giderlerdir.

c-Karma Giderler: Belirli bir faaliyet hacmine kadar sabit gider özelliği gösteren ve faaliyet hacmi arttıkça değişken gider özelliği gösteren giderlerdir. Yarı değişken gider olarak da ifade edilmektedir.

Lojistik Maliyetlerin Muhasebeleştirilmesi

Lojistik maliyetlerin analiz edilebilmesi ve birtakım kararlarda kullanabilmesi için, öncelikle bu maliyetlerin uygun hesaplar kullanılarak tasnif edilmesi ve izlenmesi gerekmektedir (Kıymetli Şen, 2014).

1-X Lojistik işletmesi, nakliye faaliyetlerinde kullanılan taşıtlar için 200.000 TL (%18 KDV hariç) nakit karşılığı mazot satın almıştır.

.. / .. /

1	740 HİZMET ÜRETİM MALİYETİ HS. 740.10 Lojistik Maliyetler 740.10.01 İlk Madde ve Malzeme 191 İNİRİLECEK KV HS. 100 KASA	200.000 36.000 236.000
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2-X Lojistik işletmesi, kışın araçların yakıtlarının donmaması için 5.000 TL (%18 KDV hariç) katkı maddesini banka havalesi ile satın almıştır.

.. / .. /

2	150 İLK MADDE VE MALZEME HS. 191 İNİRİLECEK KV HS. 102 BANKALAR HS.	5.000 900	5.900
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3-Satın alınan akaryakıt katkı maddesinin 2.000 TL.'lik kısmı taşıtlar için kullanılmıştır.

.. / .. /

3	740 HİZMET ÜRETİM MALİYETİ HS. 740.10 Lojistik Maliyetler 740.10.01 İlk Madde ve Malzeme 150 İLK MADDE VE MALZEME HS	2.000	2.000
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4-X Lojistik işletmesi, yurtdışı ve yurtiçi lojistik faaliyetler için gerekli olan 5 yıl geçerlilik süresi olan L2 Yetki Belgesini 80.000 TL nakit ödeyerek almıştır.

$$80.000 / 5 = 16.000 \text{ TL. (Birinci Yıl)}$$

$$16.000 \times 4 = 64.000 \text{ TL. (Diğer Dört Yıl)}$$

.. / .. /

4	740 HİZMET ÜRETİM MALİYETİ HS. 740.10 Lojistik Maliyetler 740.10.02 Dışardan Sağlanan Faya ve Hizmetler 280 GELECEK YILLARA AİT GİDERLER HS 100 KASA HS	16.000 64.000	80.000
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5-X Lojistik işletmesi, taşıtlar için 30.000 TL tutarında kasko sigorta poliçesini EFT yaparak satın almıştır.

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5	740 HİZMET ÜRETİM MALİYETİ HS. 740.10 Lojistik Maliyetler 740.10.04 Çeşitli Giderler 102 BANKALAR HS	30.000	30.000
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Sonuç

Lojistik faaliyetler ile üretim ve tüketim noktaları arasında ürünlerin müşterilerine ekonomik, güvenli ve hızlı bir biçimde ulaştırılması sağlanmakta işletmelerin farklı pazarlara girmesi ve pazar payının artırılması gibi avantajlar yakalanmaktadır. Lojistik faaliyetler, işletmelerin rekabet gücünü doğrudan etkilemektedir. Lojistik işletmeleri, minimum taşıma süreleri ve maliyet avantajla kaliteli hizmet vermek, teknolojiyi en üst düzeyde kullanmak ve maliyetleri en az seviyeye indirerek sektörde rekabet gücünü arttırmaya yönelmek zorundadır.

Çalışmada lojistik işletmelerinde tedarik sürecinden başlayarak depolama ve ulaştırma sürecini kapsayan lojistik faaliyetleri incelenmiştir. İşletmeler, lojistik maliyetlerini belirlemek için kesin ve net bilgilere ihtiyaç duymaktadırlar.

Kaynakça

- Akdoğan, N. 2009. Tek Düzen Hesap Sisteminde Maliyet Muhasebesi Uygulamaları. Gazi Kitabevi, Ankara.
- Ceran, Y., Alagöz, A. 2007. Lojistik Maliyet Yönetimi: Lojistik Maliyetler ve Lojistik Maliyet Muhasebesi. Çanakkale Onsekiz Mart Üniversitesi Biga İktisadi Ve İdari Bilimler Fakültesi Yönetim Bilimleri Dergisi, 5(2): 9-159.
- Demir, V. 2008. Lojistik Yönetim Sisteminde Maliyet Hesaplaması. Ankara: Nobel Yayın Dağıtım.
- Hacırüstemoğlu, R., Şakrak, M. 2002. Maliyet Muhasebesinde Güncel Yaklaşımlar. Beta Basım, İstanbul.
- Kaygusuz, S. Y., Dokur, Ş. 2009. Maliyet Muhasebesi. Dora Yayın, Bursa.
- Kıymetli Şen, İ. 2014. Lojistik Faaliyetlerin Yönetimi ve Maliyetleme Yaklaşımları. Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi. 4(1), 97.
- Savcı, M. 2010. Maliyet Muhasebesi, Murathan Yayınevi, Trabzon.

**TÜRKİYE MUHASEBE STANDARTLARINA GÖRE NAKİT AKIŞ TABLOSU VE
NAKİT AKIŞ TABLOSU ANALİZİNDE KULLANILAN YÖNTEMLER**

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Özet

İşletmelerin küreselleşen ekonomide yer alması ile farklı ülkelerin bir arada faaliyet göstermesiyle birlikte farklı muhasebe uygulamalarıyla karşı karşıya kalınmıştır. Bunun sonucunda işletmeler faaliyet gösterdiği her yabancı piyasa için farklı finansal tablo ve muhasebe kaydı tutmak zorunda kalmıştır. Uluslararası ticaretin gelişmesiyle birlikte yabancı piyasalarda faaliyet gösteren işletmeler için ortak bir finansal raporun değerlendirilip, yorumlanma gereksinimi doğmuştur. Uluslararası piyasalarda faaliyet gösteren işletmelerin muhasebe işlemlerindeki farklılıkları ortadan kaldırmak ve ortak bir muhasebe sisteminin kullanılmasını sağlamaktır. Bunun içinde uluslararası muhasebe standartları yayınlanmıştır. Standartlarla bir uyum içinde sağlamak amacıyla Uluslararası Muhasebe Standartları (UMS) ve Uluslararası Finansal Raporlama Standartları (UFRS) daha iyi anlaşılıp yorumlanabilmesi için Türkçe'ye çevrilmiştir. Türkiye Muhasebe Standartları (TMS) ve Türkiye Finansal Raporlama Standartları (TFRS) hazırlanarak 2005 yılında Resmi Gazete de yayınlanmıştır. Nakit akış tablosu işletmenin yapmış olduğu faaliyet hareketlerinden ve işletme faaliyetlerinden doğan nakit akışlarındaki, artış ve azalışı gösterir. Bu çalışmada, nakit akış tablosu hazırlanırken dikkat edilmesi gereken hususlar, kullanılan yöntemler ve nakit akış tablosu ile ilgili açıklamalar ve kavramlara yer verilmiştir.

Anahtar Kelimeler: Türkiye Muhasebe Standartları, Nakit Akış Tablosu, TMS 7

**ACCORDING TO TURKISH ACCOUNTING STANDARDS, THE CASH FLOW
STATEMENT AND THE METHODS USED IN THE ANALYSIS OF THE CASH
FLOW STATEMENT**

Abstract

As businesses take part in the globalizing economy and different countries operate together, different accounting practices have been encountered. As a result, businesses have had to keep different financial statements and accounting records for each foreign market in which they operate. With the development of international trade, there has been a need to evaluate and interpret a common financial report for enterprises operating in foreign markets. To eliminate the differences in the accounting transactions of enterprises operating in international markets and to ensure the use of a common accounting system. In this context, international accounting standards have been published. In order to ensure compliance with the standards, International Accounting Standards (IAS) and International Financial Reporting Standards (IFRS) have been translated into Turkish so that they can be better understood and interpreted. Turkish Accounting Standards (TAS) and Turkish Financial Reporting Standards (TFRS) were prepared and published in the Official Gazette in 2005. The cash flow statement shows the increase and decrease in cash flows arising from the operating movements made by the entity and the operating activities. In this study, the issues that should be considered when preparing the cash flow statement, the methods used and the explanations and concepts related to the cash flow statement are included.

Keywords: Turkish Accounting Standards, The Cash Flow Statement, TAS 7

Giriş

Küreselleşmenin etkisi sanat, toplum, politika ve teknolojik alanda olduğu gibi ekonomide de görülmüştür. Ekonomide küreselleşmeyle birlikte Uluslararası Pazarlarda, yatırımların önemi artmış, artık işletmeler kendi pazarlarıyla yetinmeyip farklı pazarlarda da faaliyet göstermek istemelerinden dolayı, finansal bilgilerin herkes tarafından aynı anlamı, aynı sadeliği ifade eden ve karşılaştırma yapabileceği ortak bir muhasebe diline ihtiyaç duymuşlardır (Tunçez, vd. 2019). Yaşanan bu gelişmeler ve ihtiyaçlardan dolayı dünya çapında Muhasebe Standartlarının oluşumuna ortam hazırlamış, uyum ve uyumlaştırma çabaları hız kazanmıştır.

Uluslararası Muhasebe Standartları (UMS) finansal tabloların doğruluğu ve güvenilirliği açısından oluşturulmuştur, bu standartlar sayesinde finansal tablo okuyucularına daha açık daha güvenilir bilgiler verilmesi amaçlanmaktadır. Uluslararası muhasebe standartları ile nakit akış tablosunun düzenlenmesi ve sunulması zorunlu olmuş, bu tablonun hazırlanmasına ilişkin hususlar TMS 7 Nakit Akış Tablosu standardında düzenlenmiştir.

Nakit Yönetimi

Nakit yönetimi, işletmenin elindeki nakit fazlasına ve nakit açıklarına olanak göstermeden işletmenin elinde bulundurması gereken optimum para tutarına denir. Nakit yönetiminin amacı işletmenin belirli bir dönemdeki ödemeleri ve yapması gereken tahsilatları arasındaki nakit tutarını değil de işletmenin ödeme yapacağı para tutarının önemini artırmaktır. Ayrıca nakit yönetimi ödeme ve tahsilattan kaynaklanan nakit fazlası ve noksanlığının şirket ve şirketin finansal faaliyetleri için en uygun bir biçimde sağlamaktadır (Apak, Tunalı, 2004).

İşletmenin gereğinden az ya da fazla nakit bulundurması, bazı olumsuz etkilere neden olmaktadır. Bu nedenle iyi bir nakit yönetimi yapan işletme bu olumsuzlukları ortadan kaldırıp, işletmenin karını arttıracak şekilde nakit yönetimini düzenlemelidir. İşletmenin nakit yönetimi, işletmenin finansal başarısı için büyük bir önem taşımaktadır. İşletmenin nakit giriş çıkışlarının kayıtlarının iyi bir şekilde tutulamaması durumunda birçok problemle karşı karşıya kalınacaktır. Tahsilatların gecikmesi, ürün veya hizmet üretimindeki gecikmeler gibi problemler işletmenin hem itibarının zedelenmesine hem de maddi yönden kayıplarına neden olacaktır.

Nakit Akış Tablosunun Bölümleri

Nakit akım tablosu, işletme faaliyetleri, yatırım faaliyetleri ve finansman faaliyetleri olarak sınıflandırılır (Gürbüz, Çakıcı, Akgül, 2006).

İşletme Faaliyetleri

İşletme faaliyetleri işletmenin ana faaliyet konusuyla ilgili hasılatı elde etmek amacıyla gerçekleştirmiş olduğu edimi ifade etmektedir. İşletmeler yapmış olduğu amaçlar doğrultusunda farklı edimlerde bulunurlar ve bu edimlerin gerçekleştirilmesinde her farklı işletme için ortak bir fonksiyon vardır. Bu farklı edimler tedarik üretim gibi çeşitli fonksiyonlar olarak değerlendirilmektedir.

Yatırım Faaliyetleri

İşletmenin yapmış olduğu çeşitli faaliyetler sonucunda gerçekleşen nakit akışları işletmenin uzun vadede ki fonların temel dayanağını temsil ettiğinden nakit akış tablosunun en önemli bölümünü oluşturmaktadır. İşletme kimseye ihtiyaç duymadan kendi borçlarını ödeyebilmesi sürekliliğin devam ettirebilmesi dönem sonunda kar payını dağıtabilmesi ve yeni farklı yatırımlar yapabilmemesinin imkanının olup olmadığı hususunda yol gösteren faaliyettir. İşletmenin yapmış olduğu faaliyet sonucunda kaynaklanan çeşitli nakit akışları zararların tespitinde yer alan işlem ve olaylardan kaynaklanır.

Finansman Faaliyeti

Finansman faaliyetleri ile işletmeye ait özkaynak ve yabancı kaynakların içinde ve bedellerinde birtakım farklılıklar ortaya çıkaran faaliyetlerin bütünü olarak açıklanabilir. İşletmenin çeşitli Finansman faaliyetleri işletmenin öz kaynak ile yabancı kaynaklarının yapısında ve tutarında değişiklik meydana getiren faaliyetler olarak tanımlanabilir (TMS 7, m., 6). Finansman faaliyet nakit akışları, borçların geri ödenmesi, yeni borçlanmalar, hisse senedi ihracı kar payı gibi birçok finansman işletme faaliyetini içermektedir. Bu faaliyetler sonucunda elde edilen nakit akışları işletmeni mevcut ve gelecekteki finansmanında meydana gelen nakit akışları, farklı ve yeni borçların ortaya çıkması hisse senedi alımları gibi birden fazla çeşitli işletme finansmanını içermektedir.

Nakit Akış Tablosu Analizinde Kullanılan Yöntemler

Finansal tablo analizinin amacı bir veya birden fazla döneme ait varlık ve kaynakları birbiriyle ilişkilerini çeşitli teknik ve yöntemler aracılığı ile analiz edilmesi, yorumlanması ve işletmenin içinde bulunduğu imkan ve koşullarda göz önüne alınarak değerlendirilme işlemidir. İşletme hakkında karar verenlere, doğru ve eksiksiz bilgi vermek finansal tabloların analiz edilmesi bakımından önem taşımaktadır.

Nakit akış tablosu farklı teknik ve yöntemler yardımıyla analiz edilip yorumlanabilir. Nakit akış tablosunun analizinde kullanılan kullanılan teknikler; Karşılaştırılmalı tablolar analizi, eğilim yüzdeleri analizi ve rasyo (oran) analizidir.

Karşılaştırılmalı Tablolar Analizi

Bir işletme ait iki ya da daha fazla döneme ait mali tablolar birbirini izleyen dönemlerde karşılaştırılmalı olarak analiz yapılmak istenirse karşılaştırılmalı mali tablolar analizinden faydalanılır. İşletmenin birden fazla döneme ait tabloları bu yöntem kullanılarak hazırlanılır. Bu tablolar sayesinde işletmenin hem geçmiş hem bugünkü mali durumunu ile geçmiş yıllara ait mali durumu arasındaki farkı görmemize imkan sağlamaktadır. Ayrıca karşılaştırılmalı tablolar analizi yardımıyla işletmenin gelecekteki mali durumu hakkında çıkarımlarda bulunulabilir.

Eğilim Yüzdeleri (Trend Analizi)

Trend analizi şirketin finansal yöneticileri ve analistlerinin mevcut hali durumu hakkında bilgi sahibi olmasına yardımcı olur. Bu tekniği işletmeler kendi bünyesinde uzun bir sürede analizin yapılması durumunda kullanılır. Trend analizi yönteminde amaç birbirini takip eden yıllara ait mali tablolarda bulunan kalemlerin örnek alınan mali tablo kalemlerine göre gösterdiği artış veya azalışlar yüzde olarak hesaplanmasıdır. Trend analiz yöntemi finansal tabloda yer alan kalemlerin zamanla açığa çıkardıkları seyrini incelenmesi esasına dayanmaktadır.

Rasyo (Oran) Analizi

Orana kavramsal olarak baktığımızda iki miktar arasındaki mantığa yatkın olan ilişkisidir. Bu iki miktar arasında kurulan ilişki kesir veya yüzde olarak kabul edilmektedir. Farklı bir deyişle işletmenin finansal işlevi veya bünyesindeki anlamlı sayılar arasında bulunan ilişkiye denir. İşletmelerin finansal performanslarını ölçüp yorumlamada en fazla kullanılan finansal analiz yöntemi oran analiz yöntemidir. Oran analiz yöntemlerinin bir diğer adı rasyo analiz yöntemidir. Bu analiz yöntemi sayesinde nakit akış tablosundaki varlık ve kalemlerin birbirlerinin kaç katı olduğu konusunda kanaatte bulunmaktadır. Nakit akış tablosu temel alınarak hesaplanan oranlar cari dönemdeki veya bir önceki döneme ait nakit akış tabloları üzerinden hesaplandığı gibi gerek aynı işletmelerde gerekse farklı işletmelerde aynı dönem veya farklı dönemler ile ilgili karşılaştırmalar yapılmasına dayanan yöntemdir (Karğın ve Aktaş, 2011):

Sonuç

Nakit akış tablosu yöneticilerin ve işletme sahiplerinin yatırım yapmak amacıyla yatırımcıların ve ilgili kuruluşlarının işletmeye sağlamış olduğu fayda neticesinde önemlilik arz eden bir tablo olarak sunulmaktadır. Nakit akış tablosu işletmenin her hangi bir sorunla karşı karşıya kalmaması olası bir olumsuz duruma gidilmeden gerekli önlemlerin alınmasına yardımcı olmaktadır. Nakit akış tablosu işletmenin olası faaliyetlerine ilişkin verimliliği artırılması ve nakdin yetersiz olması durumunda faaliyetlerin eksiksiz yürütülebilmesi için gerekli önlemlerin alınabilmesi açısından önemlilik arz etmektedir.

Günümüzde var olan işletmelerin yapmış olduğu çeşitli çalışmaları herhangi bir sekteye uğratmadan devam ettirebilmeleri kar elde edebilmek kadar önemli olan nakdin yaratabilmelerine bağlıdır. Kar elde etmiş olup fakat işletme için gerekli olan nakdi yaratamayan işletmeler borçlarını ödeyemeceği için elinde bulundurmuş olduğu varlıkları değerlerinin çok altında satarak borçlarını kapatırlar. İşletmenin yapmış olduğu bu hareket işletmenin bir çok faaliyetinin durdurulmasının yanı sıra kapatılmasına kadar gitmektedir. TMS 7'de düzenlenen nakit akış tablosu işletmelerin nakit akış yapılarını inceleyerek, işletmenin çeşitli faaliyetler sonucunda yaratmış olduğu nakit hakkında gerekli bilgiyi sağlamış olur.

Sonuç olarak işletme sahibi veya yöneticileri işletmenin sürekliliğini devam ettirebilmesi için ellerinde bulundurdukları nakdin yeterli olup olmadığının belirlenmesi ve nakit miktarının yetersiz olması durumunda yeni nakit yaratma imkanlarının nasıl değerlendirileceği işletmenin sürekliliğini sağlayabilmesine yardımcı olmaktadır.

Kaynakça

- Apak, S., Tunalı, E. 2007. İnşaat Sektöründe Nakit Yönetimi. Muhasebe ve Finansman Dergisi, 36: 50-59.
- Gürbüz, G., Çakıcı, C., Akgül, B. A. 2006. Türkiye Muhasebe Standartları Uygulamaları. Beta Basım Yayın. İstanbul.
- Karğın, M., Aktaş, R. 2011. Türkiye Muhasebe Standartlarına Göre Raporlanmış Nakit Akış Tablosu Ve Analizi. Muhasebe ve Finansman Dergisi, 52(7): 1-24.
- TMS 7 Nakit Akış Tablosu Standardı
- Tunçez H. A., Ateş, A. ve Şahin, M. 2019. Examination of Leasing Transactions in Tourism Enterprises Within The Scope of Turkish Financial Reporting Standard (TFRS) 16, Annual 2nd Symposium on Business, Technology and Social Sciences Interventions, Filipinliler.

**İLKOKUL ÖĞRENCİLERİNE GÖRE UZAKTAN EĞİTİMDE SOSYAL BİLGİLER
DERSİ**

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ÖZET

Bu araştırmanın amacı, uzaktan eğitim sürecinde ilkokul dördüncü sınıf sosyal bilgiler dersinde gerçekleştirilen uygulamalara yönelik öğrenci görüşlerini incelemektir. Araştırma nitel araştırma yöntemlerinden biri olan fenomenoloji deseni ile gerçekleştirilmiştir. Araştırmanın katılımcıları Afyonkarahisar iline ait resmi ilkokullarda öğrenim gören 16 sınıf dördüncü sınıf düzeyindeki öğrencilerdir. Araştırmada veri toplama aracı olarak yarı yapılandırılmış görüşme formu kullanılmıştır. Görüşmelerden elde edilen veriler beş tema altında ele alınmış ve yorumlanmıştır. Araştırmada öğrencilerin uzaktan eğitimin yüz yüze eğitim gibi olmadığını ve öğrenemediklerini düşündükleri, çeşitli sorunlar yaşadıkları sonuçlarına ulaşılmıştır. Öğrencilerin uzaktan eğitimde Sosyal Bilgiler dersi kapsamında en fazla araştırma en az ise proje ödevleri yaptıkları sonucuna ulaşılmıştır.

Anahtar sözcükler: İlkokul, 4. Sınıf, Sosyal bilgiler, Öğrenci Görüşleri Uzaktan eğitim, Covid 19

**SOCIAL STUDIES COURSE IN DISTANCE EDUCATION ACCORDING TO
PRIMARY SCHOOL STUDENTS**

ABSTRACT

The aim of this study is to examine the students' views on the applications in the fourth grade social studies course in primary school during the distance education process. The research was conducted with phenomenology design, which is one of the qualitative research methods. The participants of the study were 16 fourth grade students, eight girls and eight boys, who were studying in various public primary schools in the central districts of Afyonkarahisar province. Semi-structured interview forms were used as data collection tools. The data obtained from the interviews were discussed and interpreted under five themes. In the study, it was concluded that students thought that distance education was not like face-to-face education and that they could not learn, that they had various problems. It was concluded that students did the most research and the least project assignments within the scope of Social Studies course in distance education.

Keywords: Primary school, 4th grade, social studies, student opinions, distance education,

GİRİŞ

Dünya genelinde yaşanan Covid 19 salgını nedeniyle karantina döneminde çevrimiçi öğrenme dünya çapında oldukça popüler hale gelmiştir (Radha, Mahalakshmi, Kumar & Saravanakumar, 2020). Ülkemizde bu süreçte ilkokulda Fatih Projesi kapsamında olan EBA platformunda yararlanılmakla birlikte EBA TV kanalı kurulmuş ve eğitimde yeni bir dönem başlamıştır. EBA sistemi üzerinden öğrenciler ile sanal sınıflar üzerinden canlı dersler yapılmaya başlanmış, hem öğretmenler hem de öğrenciler için süreç farklı bir şekilde ilerlemiştir. Salgın boyunca uzaktan eğitim uygulaması hastalığın seyrinde olumlu sonuçlar alınması açısından tercih edilmiş ve uzmanlar tarafından doğru bulunmuştur. Bu süreçte ilkokul öğrencileri ilk defa uzaktan eğitim kavramı ve sistemi ile tanışmış olup derslerini televizyon ve teknolojik araçlar üzerinden sanal sınıf aracılığıyla ekranlardan takip etmeye çalışmışlardır. Süreçte diğer derslerde olduğu gibi Sosyal Bilgiler dersi de uzaktan eğitim şekliyle işlenmeye başlamıştır. Sosyal bilgiler dersi bilgi temelini sosyal bilimlerin oluşturduğu, öğrencilerin eleştirel düşünme, problem çözme becerilerini geliştiren, bilgi, beceri, değer ve tutum gelişimini destekleyerek onları etkin bir vatandaş olarak hayata hazırlayan ilkokul programındaki en önemli derslerden biridir (Dündar, 2018).

Alanyazın incelendiğinde uzaktan eğitime ilişkin çeşitli çalışmaların yapıldığı görülmektedir (Kıyıcı, 2003; Can, 2005; Ağır, 2007; Usta, 2007; Çamlımfidan, 2007; Akyüz, 2008; Bahçekapılı, 2010; Daban, 2012; Salar, 2013; Berge, 2013; Kavrat, 2013; Arat & Bakan, 2014; Ersoy, 2014; Çengel, 2014; Şirin, 2015; Yalavaç, 2015; Özgül, 2016; Yıldız, 2016; Uslusoy, 2017; Yıldızhan, 2017; Demirci, 2018; Assante ve Candel, 2019; He & Xiao, 2020; Kurtdede Fidan, & Yıldırım, 2022). Fakat günümüzde bütün dünyayı etkileyen koronavirüs salgını nedeniyle uzaktan eğitim konusu daha çok çalışılır hale gelmiştir. Türkiye’de de uzaktan eğitim çalışmalarında son yıllarda artış yaşanmıştır (Aras, 2019; Enfiyeci, 2019; Can, 2020; Bulut, 2020; Akyürek, 2020; Doğan, 2020; Kaysi, 2020; Burak, 2020; Keskin & Kaya, 2020; Doğru, 2020; Sığın, 2020; Yolcu, 2020; Akaydın & Aktaş, 2020; Karadağ ve diğ. 2021; Avcı & Akdeniz, 2021; Koç, 2021). Yurt içinde ve yurt dışında geçmişten günümüze kadar Sosyal Bilgiler ve uzaktan eğitim araştırmaları yapılmıştır. Alanyazın incelendiğinde Sosyal Bilgiler dersi ile ilgili yapılan çalışmaların ortaokul kademesinde yoğunlaştığı görülmüştür. İncelemeler neticesinde uzaktan eğitimde ilkokul dördüncü sınıf Sosyal Bilgiler dersi ile ilgili çok fazla çalışma yapılmadığı görülmüş olup, yapılan çalışmanın alanyazına katkı sağlayacağı düşünülmüştür. Bu araştırmanın amacı, uzaktan eğitim sürecinde ilkokul dördüncü sınıf sosyal

bilgiler dersinde gerçekleştirilen uygulamalara yönelik öğrenci görüşlerini incelemektir. Bu amaç doğrultusunda şu sorulara cevap aranmıştır:

- İlkokul öğrencileri uzaktan eğitim denilince ne anlıyor?
- Uzaktan eğitimde sosyal bilgiler dersinde ne gibi etkinlikler gerçekleştirilmektedir?
- Öğrenciler sosyal bilgiler dersinde ne tür etkinliklerin olmasını istiyor ve istemiyor?
- Öğretmenler uzaktan eğitimde sosyal bilgiler dersinde ne tür ödevler veriyorlar?

YÖNTEM

Araştırmanın deseni

Bu çalışmada ilkökul dördüncü sınıf öğrencilerinin sosyal bilgiler dersinin uzaktan eğitim şeklinde gerçekleştirilmesine ilişkin görüşlerinden elde edilen veriler belirlenmeye çalışılmıştır. Araştırmanın amacına uygun olarak nitel araştırma deseni olan olgubilim (fenomenoloji) deseni tercih edilmiştir.

Katılımcılar

Araştırmanın katılımcıları, 2020-2021 eğitim-öğretim yılında Afyonkarahisar iline bağlı merkez ilçelerdeki çeşitli resmi ilkökullarda öğrenim görmekte olan sekizi kız sekizi erkek 16 dördüncü sınıf öğrencisidir.

Veri Toplama Aracı ve süreci

Veri toplama aracı olarak da beş sorudan oluşan yarı yapılandırılmış görüşme formu kullanılmıştır. Görüşme formundaki sorular için uzman görüşüne başvurulmuştur. İki ilkökul dördüncü sınıf öğrencisi ile pilot uygulama yapılmıştır. Öğrencilerin uzaktan eğitim süreci içerisinde evlerinde olmasından dolayı görüşmeler yüz yüze yapılamamış olup, 26-30 Mayıs 2021 tarihleri arasında katılımcıların izni ile ZOOM uygulaması üzerinden canlı bağlantılar kurularak gerçekleştirilmiştir. Ayrıca görüşmeler öncesinde ailelere ZOOM uygulaması ile kayıt edileceği bildirilmiş olup veli izni ve Yayın Etiği Kurulu'ndan yazılı izin (24.05.2021, sayı 246, no:07) alınmıştır.

Verilerin Analizi

Bu çalışmada veriler tematik analiz yöntemi analiz edilmiştir. Bir dizi bireysel veya odak grup görüşmesi ya da çeşitli metinlerden oluşan veri seti içerisinde tekrar eden anlam örüntülerini bulmak için yapılan bir inceleme tematik analiz denir. (Braun & Clarke, 2019). Görüşme kayıtları yazıya geçirilmiş ardından sorular tek tek analiz edilerek kodlanmıştır. Ayrıca ikinci bir kodlayıcı da eş zamanlı olarak verileri kodlamıştır. Kodlar sınıflandırılmış ve elde edilen bulgular ana temalar altında sunulmuştur. Bulguların sunumunda doğrudan alıntılara da yer

verilmiştir. Çalışma grubunda yer alan öğrenciler ise katılımcı gizliliği sağlaması açısından farklı kod adlar ve numaralar kullanılarak isimlendirilmiştir.

BULGULAR

Bu bölümde elde edilen verilere ilişkin olarak yapılmış olan bulgulara ve yorumlara yer verilmiştir.

Öğrencilerin Uzaktan Eğitim İle İlgili Düşüncelerine Yönelik Elde Edilen Bulgular

Görüşmelerden elde edilen bulgular doğrultusunda öğrenciler, “uzaktan eğitimi, evde telefonla ve ekrandan görüntülü olarak yapılan ders” olarak tanımlamışlardır. Uzaktan eğitimin yüz yüze eğitim gibi olmadığını ve öğrenemediklerini düşünmektedirler. Yüz yüze eğitime göre daha zor olduğunu bu durumun da sebebinin ekran karşısında olma olduğunu belirtmektedirler. Ayrıca öğrencilerin uzaktan eğitim ile ilgili olumlu ve olumsuz düşüncelere sahip olduğu ve bazı öğrencilerin uzaktan eğitimi sevdiği, birçok öğrencinin ise uzaktan eğitimi sevmediği görülmüştür. Uzaktan eğitim tanımı ile ilgili olarak Resul (Ö4) *“Uzaktan eğitim okullar kapanınca öğretmenin görüntülü ders vermesi.”* şeklinde görüşünü söylerken Bilal (Ö2), *“Yani uzaktan eğitim, eğitimin uzaktan, telefonla olması diyebilirim.”* demiş Kübra (Ö12) ise okuldaki eğitim gibi önemli olduğunu ifade edip *“Ben uzaktan eğitimi evlerde olan bir ders olarak görüyorum. Tahtaya çıkıp soru yanıtlayamıyoruz ama. Okuldaki eğitim gibi önemli olduğunu düşünüyorum.”* şeklinde düşüncelerini açıklamıştır. Uzaktan eğitimin yüz yüze eğitim gibi ve eğlenceli olmadığını ve sevmediğini söyleyen Arif (Ö5), *“Mesela tahtaya çıkıp bir şeyler yapamıyoruz. Öğretmenimiz tahtaya yansıtıyor ama okuldaki gibi eğlenceli olmuyor. Okuldaki gibi anlayamıyoruz. Biraz sıkıntılı oluyor ilk günlerde herkesi sistem atıyordu ama diğer günlerde iyiydi. Yüz yüze eğitimin yerini almıyor.”* şeklinde düşüncelerini belirtmiştir. Uzaktan eğitimi sevdiğini söyleyen öğrencilerden Kübra (Ö12), *“Yüz yüze gibi olmuyor ama seviyorum. Evlerde olduğumuzda derslerimi eksik olacaktı eksik konularımızı tekrar etmek daha kolay oluyor. Daha az yazı yazıyoruz.”* şeklinde sevme sebeplerini açıklamış Ezgi ve Tuğçe ise sağlığımız için iyi olduğunu *“Seviyorum çünkü bizim sağlığımız için uzaktan eğitime geçildi. Bizi korumak için hastalığı önlemek için iyi oldu.”* (Ezgi Ö7), *“Seviyorum, virüs çıktığı için okula gidersek hasta olabiliriz. Virüsten korunmak için uzaktan eğitim olması iyi oldu.”* (Tuğçe Ö16) cümleleriyle ifade etmiştir.

Uzaktan Eğitimde Sosyal Bilgiler Dersinde Yapılan Uygulamalara İlişkin Bulgular

Görüşmelerden elde edilen bulgular doğrultusunda uzaktan eğitimde Sosyal Bilgiler derslerinde en fazla “video izleme ve ders kitabından okuma” uygulamalarının yapıldığı sonucu ortaya çıkmıştır. Ayrıca soru çözme, yazı yazma, oyun oynama ve proje, çalışmaları yaptıklarını

söyleyen birer öğrenci de bulunmaktadır. Öğrencilerin görüşleri doğrultusunda Sosyal Bilgiler dersi işlenişinde birçok öğrenci ders kitabından okumalar yapıldığını ifade etmiştir. Daha iyi anlamak için okumalar yaptıklarını belirten Ebru (Ö3), “*Öğretmenimiz bir kere okutuyor sonra yine okuyoruz iyi anlamak için. Başka kitabımız da var. Öğretmenimiz bilgisayardan etkinlik çıkartıyor.*” şeklinde görüşlerini açıklamıştır. Öğrencilerin tamamı videolar izlediklerini belirtmiş “Tüm konular, Atatürk’ün Hayatı, Işık Kaynakları, Tarihi Konular” ile ilgili videolar izledikleri verileri elde edilmiştir. Tüm konulardan videolar izlediklerini belirten öğrencilerden Tuğba (Ö9) videolardan dersin hangi aşamasında yararlandığını “*Tüm konulardan izliyoruz. Öğretmenimiz anlatım olarak açıyor sonra sorular çözüyoruz. Öğretmenimiz önceden hangi dersi yapacağımız söylüyor. Sonra konuyla ilgili bir şeyler anlatıyor ve sonra video açıyor.*” cümleleriyle de ifade etmiştir.

Bazı öğrenciler soru çözme çalışmaları yaptıklarını ifade ederken oyun oynama, yazı yazma, proje çalışmaları yapma, anlatım yapma, çalışmalarını ise birkaç öğrenci belirtmiştir. Öğrencilerden Sarp (Ö6), “*Bu derste eğleniyorum çünkü öğretmenimiz hem eğlendirerek anlatıyor. Sitelerden sorular paylaşıyor ekranda bizde sırayla o soruları çözüyoruz..*” şeklinde yapılan çalışmaları örneklendirmiştir. Ezgi (Ö7) ise “*Bizim öğretmenimiz bizi eğlendirerek öğrenmemizi sağlıyor. Mesela dersle konuyla alakalı komik şeyler anlatıyor. Biz de sosyal bilgiler dersine kolay alıştık. Kitaptan okuma yapıyoruz ders sırasında. Etkinliklerini yapıyoruz sonra öğretmenimizle cevaplıyoruz.*” ifadelerinde bulunmuş ve eğlenceli anlatım sayesinde derse daha kolay alıştığını belirtmiştir.

Diğer öğrencilerden farklı olarak proje çalışmaları yaptıklarını ifade eden Kübra (Ö12), “*Öncelikle kitaptan yapıyoruz. Bazen etkinlik yapıyoruz ve konuyu zihnimize canlandırarak yapmaya çalışıyoruz. Konuyu anlamayan çok olursa projeler yapıyoruz. Sorular çözüyoruz.*” ifadelerinde bulunarak diğer çalışmaları da örneklendirmiştir.

Uzaktan Eğitimde Sosyal Bilgiler Dersi Kapsamında Gerçekleştirilen Sanal Müze Gezilerine İlişkin Bulgular

Görüşmeler sonrasında katılımcılardan sadece birkaç öğrenci sanal müze gezilerini yaptıklarını söylemiş olup bu öğrenciler dışındaki bazı öğrencilerin ise sanal müzelerin ne olduğuna dair fikirlerinin dahi olmadığı görülmüştür. Sosyal Bilgiler dersinde sanal müze gezisinde Etnografya ve Doğa Tarihi Müzelerinin gezildiği görülmektedir. Sanal müze gezisi yaptıklarını belirten öğrencilerden Sefa (Ö1), “*Nereleri gezdiğimizi isim olarak hatırlamıyorum şimdi. İçinde eski tarihi eşyalar vardı. Eski vazolar, heykeller vardı. Heykelleri görünce şaşırđım, gerçek insan gibiydiler.*” Çiğdem (Ö11), *Evet, yapmıştık ama nereye gittiğimizi*

hatırlamıyorum. Dinozor kemikleri vardı, vazo vardı. Ordaymış gibi oldum ama onları daha yakından görmek isterdim.” şeklindeki ifadeleri ile sanal müze gezi durumları hakkında hatırladıklarını ifade etmiştir. Birçoğu ise “ Hayır, sanal müze gezisi yapmadık.” ifadesinde bulunmuştur.

Uzaktan Eğitim Sürecinde Sosyal Bilgiler Dersinde Hoşa Giden ve Gitmeyen Uygulamalara Yönelik Elde Edilen Bulgular

Öğrencilerin çoğunluğu yapılan tüm çalışmaların hoşuna gittiğini söylemiş olup Resul (Ö4) dışındaki öğrencilerden örnek uygulama yanıtları da alınmıştır. Görüşmeler doğrultusunda en çok hoş giden çalışmanın “*ekran paylaşımı*” olduğu ortaya çıkmıştır. Hoşlarına giden diğer uygulamalar “*soru çözme, video izleme, EBA’ daki çalışmalar, etkinlik yapma, farklı sitelerden yararlanma, ders kitabında yer alan çalışmalar, ders kitabında olmayan çalışmalar, okuma yapma, bizim yaptığımız anlatımlar*” biçimlerinde ifade edilmiştir. “*Zor soruların olması, yazı yazma, videoların geç açılması, sistemin atması, ekranın gitmesi*” durumlarının ise öğrenciler tarafından hoş karşılanmadığı sonucuna ulaşılmıştır. Yapılan uygulamaların eğlenceli olduğunu düşünen öğrencilerden Çiğdem (Ö11), “*Genellikle etkinlikler yapma, video izleme hoşuma gidiyor.*” ifadelerinde bulunurken Ali (Ö14), “*En çok video izlemek hoşuma gidiyor, eğlenceli geliyor.*” Emine (Ö8) ise “*Hepsi hoşuma gidiyor benim. Konularımızdaki etkinlikler eğlenceli oluyor.*” demiştir. Kendileri çalışıp arkadaşlarına özetledikleri zaman daha eğlenceli şekilde olduğunu ifade eden Sarp (Ö6), “*Mesela haklarımız konusunu işlerken çok eğlenmişim. Hepimiz haklarımızı özetledik, öğretmenimiz ekran paylaşarak farklı sorular çözmüştük.*” şeklinde düşüncesini söylemiştir.

Ekran paylaşımı durumunu Arif (Ö5), “*Kitabımızda olmayan şeyleri tahtaya yansıtması hoşuma gidiyor.*” şeklinde kitaplarında olmayan yerlerin yansıtılmasından duyduğu memnuniyeti ifade ederken, Ezgi (Ö7) ise Google Earth üzerinden yaptıkları geziyi “*Mesela biz canlı derste haritalardan gezmiştik. Çok hoşuma gitmişti.*” şeklinde belirtmiştir.

Hoşa gitmeyen uygulamalara yönelik olarak “*Zor sorular olması, yazı yazma, videoların geç açılması, sistemin atması, ekranın gitmesi*” durumları belirtilmiştir.

Uzaktan Eğitim Sürecinde Sosyal Bilgiler Dersinde Yapılması İstenilen Çalışmalara Yönelik Bulgular

Öğrencilerin birçoğu yapılan uygulamalardan memnun olduğunu belirtmiştir. Öğrencilerden bazıları ise farklı önerilerde bulunmuştur. Bu öneriler; “*proje çalışmaları yapılabilir, değişik kostüm giyilebilir, hikayeler anlatılabilir, ilginç etkinlikler yapılabilir, farklı kaynaklardan uygulamalar yapılabilir, daha fazla oyun olabilir, daha fazla soru çözüm olabilir*” şeklindedir.

Proje çalışmaları yapılabileceğini belirten Ali (Ö14), “*Fen bilimleri dersinde yapıyoruz sosyal bilgiler dersinde de olsa güzel olabilir.*” diyerek önerisini açıklamıştır. Değişik kostüm giyilebileceğini söyleyen Sefa (Ö1), “*Öğretmenimin anlattığı konular güzel geliyor. Tarih konularını anlatırken değişik kıyafetler giyse daha güzel olabilirdi.*” şeklinde tarihi konuların bu şekilde daha güzel olabileceğini belirtmiştir.

Hikayeleri sevdiğinden dolayı Sarp (Ö6), “*Türkçe dersinde öğretmenimiz bize hikayeler falan anlatıyordu. Ona benzer şeyler anlatsa hoşuma giderdi.*” şeklindeki açıklamasıyla derslerde hikayelerden yararlanılsa hoşuna gideceğini belirtmiştir.

Tam bilmediği yerleri anlayabilmek düşüncesinden dolayı Kübra (Ö12), “*İlginç etkinlikler olsun isterdim. Kurtuluş Savaşı’nı işlerken çok fazla tarih vardı. Defterimize çok yazı yazdık o konuları işlerken. O konularla ilgili tarihleri unutamayacağımız farklı bir şeyler olabilirdi...*” ifadeleri ile tarihi konular ile ilgili yaşadığı eksikliğin giderilebileceğini belirtmiştir.

“*Bazen kitaptan işliyoruz. Bazen öğretmenimiz kendisi paylaşım yapıyor. Sorular çözüyor, dersle ilgili etkinlikler yapıyoruz.*” açıklamalarında bulunan Emine (Ö8), “*...başka sitelerden giriş yapabiliydik, farklı kitap uygulamalarından kullanabiliydik.*” önerilerinde bulunmuştur.

Türkçe dersinde daha çok oyun oynadıklarını belirten Çiğdem (Ö11), “*...Sosyal Bilgiler dersinde de daha çok oyun oynasak güzel olabilir.*” önerisinde bulunurken Enes (Ö13), “*Ben daha çok soru çözmek isterdim.*” şeklinde isteğini belirtmiştir.

Sosyal Bilgiler Dersinde Verilen Ödevlere Yönelik Elde Edilen Bulgular

Öğrencilerin görüşleri incelendiğinde Sosyal Bilgiler dersinde en fazla “*araştırma ödevi*” yaptıkları sonucuna ulaşılmıştır. Ayrıca bazı öğrenciler öğretmenlerin ödev olarak “*kaynak kitaplardan çalışmalar*” istediğini belirtirken, bazıları “*yazı yazma ödevleri*” olduğunu bazıları ise “*soru çözme*” ve “*etkinlik çalışması*” ödevleri yaptıklarını ifade etmiştir. Onları “*okuma ödevleri*” takip ederken birkaç öğrenci “*ders kitabından çalışmalar*” yaptıklarını ifade etmiş birkaç öğrenci ise “*proje çalışmaları*” yaptıklarını söylemiştir.

Araştırma ödevlerinin bazen olduğunu söyleyen Sefa (Ö1), “*Yeni konuya geçince ödevler veriyor. Ders kitabından oluyor, bazen araştırma ödevi veriyor.*” ifadelerinde bulunurken, Ezgi (Ö7) ise “*Mesela soru soruyor araştırmamızı istiyor. Arkadaşlarımızla birlikte bulmaya çalışıyoruz...*” ifadelerine okumalar yaptığını da eklemiştir. Resul (Ö4), “*... Araştırma ödevi vermişti. Uçağı, arabayı, lambayı kim buldu diye araştırmıştık. Ateşi kim bulduğunu kimse bilmiyormuş. Thomas Edison hangi işi yapıyor. Nuri Demirağ nerede çalışmış ne yapmış onları araştırın defterinize yazın demişti.*” ifadeleriyle araştırma yaptıkları belirtmiştir.

Yazı yazma, soru çözüme okuma ve etkinlik ödevleri yaptıklarını belirten öğrencilerden Tuğba (Ö9) örneklerini “*Kitaplarımızdan ödevler veriyor, okuma ödevleri oluyor. Mesela bugün yazma ödevi verdi. Konularla ilgili sorular çözüyoruz. Etkinlikler yapmamızı istiyor.*” biçiminde açıklarken Rıza (Ö10), “*Etkinlik yapmamızı istiyor, eşleştirme soruları falan oluyor, link gönderiyor oradan yapıyoruz. Bazen araştırma ödevi oluyor. Okuma, yazı yazma ödevlerimiz oluyor.*” açıklamalarında bulunmuş, Ali (Ö14) ise “*Genellikle yazı ödevi oluyor. Derste yarım kalan yazımız olduğunda onları tamamlıyoruz. Test veriyor...*” ifadelerini söylemiştir.

Ödev olarak proje çalışmaları yaptıklarını da söyleyen öğrencilerden Kübra (Ö12), “*Proje ödevlerimiz oluyor. Araştırmalar yapıyoruz. Konu sonrasında etkinlikler oluyor evde yapılabilecek etkinlikler olduğunda. Kaynak kitaplarımızdan soru ödevimiz oluyor.*” ifadelerinde bulunurken, Tılsım (Ö15), “*Proje etkinlikleri yaptırıyor.*” şeklinde ifade etmiştir. Ödevler çalışmaları ile ilgili olarak Arif (Ö5), “*Bazen bulmacalar veriyor. Ders kitaplarımızdan yapıyoruz. Kaynak kitabımızdan yapıyoruz. Bazen araştırma ödevleri oluyor. Bir kere resim araştırmamızı istemişti öğretmenimiz, kimlik konusuyla ilgili.*” ifade ederken, Bilal (Ö2), “*Mesela yön bulmayla ilgili ödev vermişti, benim size söylediğim yön bulma araçlarından başka var mı araştırın demişti. Araştırma ödevleri, yazı ödevi veriyor..*” şeklinde açıklama yapmıştır.

SONUÇ

İlkokul dördüncü sınıf öğrencilerinin gözünden uzaktan eğitimde Sosyal Bilgiler dersi ile ilgili neler yapıldığı, öğrencilerin bu süreç ile ilgili neler düşündüklerinin belirlenmesi amacıyla yapılan bu çalışmada; öğrencilerin uzaktan eğitimi evde telefonla ve ekrandan görüntülü olarak yapılan ders olarak tanımladıkları görülmüştür. Uzaktan eğitimin yüz yüze eğitim gibi olmadığını ve öğrenemediklerini düşündükleri sonucuna ulaşılmıştır. Ayrıca öğrencilerin uzaktan eğitimi sevmedikleri sevdiğini söyleyen öğrencilerin ise sağlığını korumak için böyle olması gerektiği ve daha az yazı yazdıkları için sevdikleri sonucuna ulaşılmıştır. En çok yaşanan sorunun ZOOM veya EBA sisteminin dersten öğretmeni veya öğrenciyi atması olduğu görülmüş olup bazı öğrenciler bu durumun hoşlarına gitmediği hatta bu durumdan dolayı uzaktan eğitimi de sevmediklerini belirtmişlerdir. Uzaktan eğitimden okuldaki verimi alamadıklarını, eğlenceli olmadığını, anlayamadıklarını, sıkıntılı olduğunu belirten öğrenciler olduğu sonucuna ulaşılmıştır. Şen ve Kızılcıoğlu (2020) da yapmış oldukları çalışmada öğrencilerin uzaktan eğitim ile işlenen dersleri sıkıcı bulması, uzaktan eğitimin sosyalleşmeye engel olması gibi nedenlerle uzaktan öğretim sürecinden memnun olmadıkları sonuçlarını elde

etmiştir. Görüşmelerden elde edilen veriler doğrultusunda öğrenciler Sosyal Bilgiler dersinde diğer derslerde olduğu gibi çeşitli problemler yaşadıklarını belirtmişlerdir. En çok bağlantı kaynaklı problem yaşandığı belirlenmiş olup bu problemler içinde en sık karşılaşılan problemin sistemin öğrenciyi atması olduğu görülmüştür. Bu probleme bağlı olarak iletişim ve anlama sorunlarının da beraberinde geldiği sonucuna ulaşılmıştır. Keskin ve Kaya (2020) da yapmış oldukları çalışmada öğrenciler eğitimler sırasında teknik sorunlar yaşadığını bildirdiklerini belirtmişlerdir.

Derslerde yapılan çalışmalar ile ilgili görüşler incelendiğinde ise en fazla “video izleme ve ders kitabından okuma” çalışmalarının yapıldığı sonucuna ulaşılmış olup “oyun oynama, yazı yazma, proje çalışmaları yapma” çalışmalarına ise çok az yer verildiği bu çalışmaların öğrenciler tarafından da daha fazla yapılması istendiği görülmüştür. Görüşmeler sonrasında katılımcılardan sadece birkaç öğrenci sanal müze gezilerini yaptıklarını söylemiş olup bu öğrenciler dışındaki bazı öğrencilerin ise sanal müzelerin ne olduğuna dair fikirlerinin dahi olmadığı görülmüştür. Akaydın ve Aktaş (2020)’ in yapmış oldukları çalışmada da uzaktan eğitimle gerçekleştirilen sosyal bilgiler dersinin öğrenci merkezli yöntem ve tekniklerin uygulanmasını sınırlandırmakla birlikte ders sırasında gerçekleştirilen sanal müze gezilerinin, eğitici video ve görsel paylaşımının öğrencilerin ilgisini çektiği tespit edilmiştir. Ayrıca öğrencilerin uzaktan eğitim ile gerçekleştirilen sosyal bilgiler derslerinin farklı dijital içeriklerin kullanılmasıyla birlikte eğlenceli geçtiğini, yüz yüze eğitim kadar etkili olmasa da konuları anlama, tekrar etme ve pekiştirmede etkili olduğunu sonucuna ulaşılmıştır. Öğrencilerin çoğunluğu yapılan tüm çalışmaların hoşuna gittiğini söylemiş olup görüşmeler doğrultusunda en çok hoş giden çalışmanın “ekran paylaşımı” olduğu ortaya çıkmıştır. Hoşlarına giden diğer uygulamalar “soru çözme, video izleme, EBA’ daki çalışmalar, etkinlik yapma” biçimlerinde ifade edilmiştir. “Zor soruların olması, yazı yazma, videoların geç açılması, sistemin atması, ekranın gitmesi” durumlarının ise öğrenciler tarafından hoş karşılanmadığı sonucuna ulaşılmıştır. Ayrıca öğrencilerden bazıları farklı uygulama önerilerinde bulunmuştur. Bu öneriler; “proje çalışmaları yapılabilir, değişik kostüm giyilebilir, hikayeler anlatılabilir, ilginç etkinlikler yapılabilir, farklı kaynaklardan uygulamalar yapılabilir, daha fazla oyun olabilir, daha fazla soru çözüm olabilir” şeklindedir. Öğrencilerin görüşleri incelendiğinde Sosyal Bilgiler dersinde en fazla “araştırma ödevi” yaptıkları sonucuna ulaşılmıştır. Ayrıca bazı öğrenciler öğretmenlerin ödev olarak “kaynak kitaplardan çalışmalar” istediğini belirtirken, bazıları “yazı yazma ödevleri” olduğunu bazıları ise “soru çözme” ve “etkinlik çalışması” ödevleri yaptıklarını ifade etmiştir. Onları “okuma

ödevleri” takip ederken birkaç öğrenci “*ders kitabından çalışmalar*” yaptıklarını ifade etmiş birkaç öğrenci ise “*proje çalışmaları*” yaptıklarını söylemiştir. Duru ve Çöğmen (2017)’ in, ilkokul ve ortaokul öğrencileri ile velilerin ev ödevlerine yönelik görüşlerini incelediği araştırmada da öğrencilerin hoşlandıkları ve hoşlanmadıkları ödevleri belirlemiş ve proje, tasarım ve araştırma ödevleri yaptıkları görülmüştür. Bu araştırmadan da anlaşılacağı üzere uzaktan eğitimde de yüz yüze eğitimde de öğretmenlerin aynı tür ödevlerden yararlandıkları sonucuna ulaşılabilir.

KAYNAKÇA

- Ađır, F. (2007). Özel okullarda ve devlet okullarında çalışan ilköğretim öğretmenlerinin uzaktan eğitime karşı tutumlarının belirlenmesi (Yüksek Lisans Tezi). Balıkesir Üniversitesi. Balıkesir.
- Akaydın, Y., & Aktaş, V. (2020, 10-11 Aralık). Sosyal bilgiler dersinde uzaktan eğitim sürecinin öğrenci ve veli görüşleriyle incelenmesi. 3. Uluslararası Uzaktan Öğrenme ve Yenilikçi Eğitim Teknolojileri Konferansı, Başkent Üniversitesi.
- Akgündüz, D. & Akınođlu, O. (2016). The effect of blended learning and social mediasupported learning on the students' attitude and self-directed learning skills in science education. *The Turkish Journal of Educational Technology*, 15(2), 106- 115.
- Akyürek, M. (2020). Uzaktan eğitim: Bir alanyazın taraması. *Medeniyet Eğitim Araştırmaları Dergisi*, 4(1), 1-9.
- Akyüz, İ. (2008). TV ile uzaktan eğitimde karşılaşılan güçlüklerle internet ortamında sunulan çözüm önerileri. (Yüksek Lisans Tezi). Erciyes Üniversitesi Sosyal Bilimler Enstitüsü Kayseri.
- Aras, E. (2019). Spor eğitimi kurumlarında görev yapan akademik personel ve spor eğitimi gören öğrencilerin uzaktan eğitime yönelik görüşlerinin incelenmesi (Yüksek Lisans Tezi). Fırat Üniversitesi Sağlık Bilimleri Enstitüsü. Elazığ.
- Arat, T., & Bakan, Ö. (2014). Uzaktan eğitim ve uygulamaları. *Selçuk Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Dergisi*, 14 (1-2), 363-374.
- Assante, G.M., & Candel, O.S. (2020). Students' views on the covid-19 pandemic: attitudes, representations, and coping mechanisms. *Postmodern Openings* 11,(4), 347-365|
- Avcı, F., & Akdeniz, E. (2021). Koronavirüs (Covid-19) salgını ve uzaktan eğitim sürecinde karşılaşılan sorunlar konusunda öğretmenlerin değerlendirmeleri. *Uluslararası Sosyal Bilimler ve Eğitim Dergisi*, 3(4) 117-154
- Bahçekapılı, E. (2010). Eş zamanlı çevrimiçi bir öğrenme ortamı tasarımı (Yüksek Lisans Tezi). Karadeniz Teknik Üniversitesi Fen Bilimleri Enstitüsü. Trabzon.
- Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis, *Qualitative Research in Sport, Exercise and Health*, 11(4), 589-597.
- Berge, Z (2013). Uzaktan eğitimde iletişimin önündeki engeller. *Türkçe Online Uzaktan Eğitim Dergisi*, 14(1), 374-388.
- Bulut, İ. (2020). Sosyal bilgiler öğretmen adaylarının sosyal bilgiler öğretiminin uzaktan eğitim yolu ile yapılmasına ilişkin görüşlerinin incelenmesi (Yüksek Lisans Tezi). İnönü Üniversitesi Eğitim Bilimleri Enstitüsü. Malatya.
- Burak, D. (2020). İlkokul sosyal bilgiler öğretimine yönelik uyarlanabilir bir öğrenme ortamının tasarlanması, uygulanması ve değerlendirilmesi (Doktora Tezi). Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü. Eskişehir.
- Can, E. (2020). Coronavirüs (Covid-19) pandemisi ve pedagojik yansımaları: Türkiye'de açık ve uzaktan eğitim uygulamaları. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, 6 (2), 11-53.

- Can, E. (2005). Uzaktan eğitim öğrencilerinin uzaktan eğitim yönetimini değerlendirmeleri, (Yüksek Lisans Tezi). Marmara Üniversitesi. İstanbul.
- Çamlımfidan, K, M. (2007). İnternete dayalı uzaktan eğitim ve uzaktan hizmet içi eğitim yöntemiyle bilgisayar eğitimi hakkında öğretmen görüşleri (Tuzla Örneği). Yeditepe Üniversitesi Sosyal Bilimler Enstitüsü. İstanbul.
- Çengel, M. (2014). Uzaktan eğitimde öğrenci başarı ve memnuniyetini etkileyen faktörlerin incelenmesi: Sakarya Üniversitesi örneği (Doktora Tezi). Sakarya Üniversitesi Sosyal Bilimler Enstitüsü. Sakarya.
- Daban, O. (2012). Uzaktan eğitim öğrencilerinin sosyo-ekonomik özellikleri ve istihdam beklentileri: Süleyman Demirel Üniversitesi Örneği (Yüksek Lisans Tezi). Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü. Isparta.
- Demirci, M. (2018). Uzaktan eğitimde öğrenme stillerine dayalı akademik destek hizmetlerinin pedagojik formasyon öğrencilerinin başarısına etkisi (Yüksek Lisans Tezi) Sakarya Üniversitesi Eğitim Bilimleri Enstitüsü. Sakarya.
- Doğan, Y. (2020). Üniversite öğrencilerinin uzaktan çevrim-içi yabancı dil öğrenmeye yönelik görüşlerinin değerlendirilmesi. Türk Eğitim Bilimleri Dergisi, 18 (1), 483-504.
- Doğru, E. (2020). Aşamalı öz-yönetimli öğrenme modelinin uzaktan İngilizce eğitiminde kullanılmasının hazırbulunuşluğa, başarıya, tutuma ve kalıcılığa etkileri (Doktora tezi). Abant İzzet Baysal Üniversitesi. Bolu.
- Duru, S., & Çoğmen, S. (2016). İlkokul-ortaokul öğrencileri ve velilerin ev ödevlerine yönelik görüşleri. İlköğretim Online, 16(1), 354-365,
- Dündar, Ş. (2018). Sosyal bilgilerde içerik ve temel kavramlar. H. Çalışkan ve B. Kılcan (Ed.), Sosyal bilgiler öğretimi içinde (ss. 14-52). Lisans Yayıncılık.
- Enfiyeci, T. (2019). Çevrimiçi ortamlarda lisansüstü uzaktan eğitim öğrencilerinin topluluk hissi, motivasyon ve akademik başarısı arasındaki ilişki Ahmet Yesevi Üniversitesi örneği (Yüksek Lisans Tezi). Gazi Üniversitesi Eğitim Bilimleri Enstitüsü. Ankara.
- Ersoy, M. (2014). Uzaktan eğitim uygulamalarında tam öğrenme modelinin öğrencilerin başarı ve tutumlarına etkisi (Doktora Tezi). İnönü Üniversitesi Eğitim Bilimleri Enstitüsü. Malatya.
- Fatih projesi, <http://fatihprojesi.meb.gov.tr/about.html>
- Karadağ, E, Çiftçi, S, Gök, R, Su, A, Ergin-Kocatürk, H., & Çiftçi, Ş. (2021). Covid-19 Pandemisi Sürecince Üniversitelerin Uzaktan Eğitim Kapasiteleri. Üniversite Araştırmaları Dergisi, 4(1), 8-22.
- Kavrat, B. (2013). Çevrimiçi uzaktan eğitimde öğretici yeterliliklerinin belirlenmesi (Yüksek Lisans Tezi). Fırat Üniversitesi Eğitim Bilimleri Enstitüsü. Elazığ.
- Kaya, F. (2020). Yükseköğretimde Atatürk İlkeleri ve İnkılap Tarihi dersinin uzaktan eğitim yoluyla verilmesine ilişkin öğrenci görüşleri (Kastamonu Üniversitesi Örneği) (Yüksek Lisans Tezi). Kastamonu Üniversitesi Sosyal Bilimler Enstitüsü. Kastamonu.
- Kaysi, F. (2020, September 1-2). Covid-19 salgını sürecinde Türkiye’de gerçekleştirilen uzaktan eğitimin değerlendirilmesi. 5th International Scientific Research Congress (IBAD - 2020) Bildiriler, 2020 İstanbul.

- Keskin, M., & Özer Kaya, D. (2020). COVID-19 sürecinde öğrencilerin web tabanlı uzaktan eğitime yönelik geri bildirimlerinin değerlendirilmesi. *İzmir Katip Çelebi Üniversitesi Sağlık Bilimleri Fakültesi Dergisi*, 5(2), 59-67.
- Kıyıcı, M. (2003). İnternet destekli öğretimde öğrenci memnuniyeti (SAÜİDÖ Örneği) (Yüksek Lisans Tezi). Sakarya Üniversitesi Sosyal Bilimler Enstitüsü, Sakarya.
- Koç, E. (2021). İlkokul öğretim programlarının covid-19 sonrası yaygınlaşan uzaktan eğitime uygunluğunun incelenmesi. *International Anatolia Academic Online Journal Social Sciences Journal*, 7(1), 24-36.
- Kurtdede Fidan N., & Yıldırım, N. (2022). Teacher education in Turkey in the Covid-19 pandemic: Experiences of the pre-service teachers about the online teaching practice. *Psycho-Educational Research Reviews*, 11(1), 77-92.
- Özgül, E. (2016). Uzaktan yaz okuluna yönelik öğrenci ve öğretim elemanı görüşleri (Yüksek Lisans Tezi). Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü. Eskişehir.
- Radha, R., Mahalakshmi, K., Kumar, V. S., & Saravanakumar, A. R. (2020). E-Learning during lockdown of Covid-19 pandemic: A global perspective. *International journal of control and automation*, 13(4), 1088-1099
- Salar, H. C. (2013). Türkiye’de üniversite öğrencilerinin ve öğretim elemanlarının açık ve uzaktan öğrenmeye hazırbulunuşlukları (Doktora Tezi). Anadolu Üniversitesi Sosyal Bilimler Enstitüsü. Eskişehir.
- Sığın, S. (2020). Atatürk İlkeleri ve İnkılap Tarihi dersinin uzaktan eğitim yoluyla verilmesi konusunda öğrenciler ve öğretim elemanları ne düşünüyor?: Tek durumlu bir örnek olay çalışması. (Yüksek Lisans Tezi). Adnan Menderes Üniversitesi Sosyal Bilimler Enstitüsü. Aydın.
- Şen, Ö., & Kızılcıoğlu, G. (2020). COVID-19 pandemi sürecinde üniversite öğrencilerinin ve akademisyenlerin uzaktan eğitime yönelik görüşlerinin belirlenmesi. *Uluslararası 3B Yazıcı Teknolojileri ve Dijital Endüstri Dergisi*. 4(3), 239-252.
- Şirin, R. (2015). İngilizce dersinin uzaktan eğitimine yönelik öğrenci görüşleri (Yüksek Lisans Tezi). Çukurova Üniversitesi Sosyal Bilimler Enstitüsü. Adana.
- Uslusoy, B. (2017). Uzaktan eğitime yönelik öğrenci tutumları üzerine karşılaştırmalı bir çalışma: ABD/Türkiye örneği (Yüksek Lisans Tezi). Beykent Üniversitesi, İstanbul.
- Usta, E. (2007) Harmanlanmış öğrenme ve çevrimiçi öğrenme ortamlarının akademik başarı ve doyuma etkisi (Doktora Tezi). Gazi Üniversitesi. Ankara.
- He, W., & Xiao, J. (2020). The emergency online classes during covid-19 pandemic: a chinese university case study. *Asian Journal of Distance Education*, 15(2), 21-36.
- Yalavaç, G. (2015). Students’, teachers’ and parents’ perceptions of after school online course: A case study in a middle school (Yüksek Lisans Tezi). Bahçeşehir Üniversitesi. İstanbul.

- Yıldız, E. (2016). Çevrimiçi ortamlarda uzaktan eğitim öğrencilerinin topluluk hissi, akademik başarı ve katılımları arasındaki ilişkinin incelenmesi (Yüksek Lisans Tezi). Ondokuz Mayıs Üniversitesi Eğitim Bilimleri Enstitüsü. Samsun.
- Yıldızhan, Y. (2017). Eğitim yönetimi uzaktan tezsiz yüksek lisans programlarının kalitesinin öğrenci ve öğretim üyeleri açısından değerlendirilmesi (Doktora Tezi). Gazi Üniversitesi Eğitim Bilimleri Enstitüsü. Ankara.
- Yolcu, H. (2020). Koronavirüs (covid-19) pandemi sürecinde sınıf öğretmeni adaylarının uzaktan eğitim deneyimleri. Açıköğretim Uygulamaları ve Araştırmaları Dergisi, 6 (4), 237-250.

**GASTRONOMİDE YENİ TRENDLER: KUZEY KIBRIS SLOW FOOD AKIMI
ÖRNEĞİ**

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Özet

Gastronomide yeni trendler son yıllarda popüler bir şekilde artan birçok akımla genişlemektedir. Slow Food yani, 'iyi, temiz ve adil gıda' felsefesi son yıllarda popülerliğini arttıran özellikle Cittaslow (üye bölge ve ülkelerle) üyelikleri ile ortaya çıkan çevreyi doğayı koruyan ve yerel üretimi artırarak, üreticilerin gelir düzeyini önemseyen bir akımdır. Sürdürülebilirlik ve sosyo-kültürel ve tarihi değerleri korumak ve bu yeni akımla ziyaretçilere aktarma konusunda farkındalığı ve bilinç düzeyini artırmayı amaçlayan Slow Food'un, geleneksel gıdaları koruma altına almayı, bölge insanları tarafından üretimini artırmayı, biyolojik çeşitliliği korumayı, yemek eğitimi ve yerel ekonomiyi desteklemeyi amaç edindiği görülmektedir. Bu çalışma Slow Food akımı adına Kuzey Kıbrıs'ta yapılan akademik çalışmaların ve turizm ve gastronomi alanında yer alan işletmelerin akımla ilgili uygulama şekillerini içermektedir. Çalışmada konaklama tesisleri ve yiyecek içecek işletmelerinin gelir ve istihdam gibi ziyaretçi çekecek gelen yerli ve yabancı ziyaretçi sayısını artıracak turistik ve gastronomik ürünler üretmek adına bölge turizminin gelişmesi açısından değerlendirilerek bölge turizminde slow food akımının önemini paylaşmaya çalışmıştır. Çalışma 20 kişilik bir katılımcı ile görüşülüp geliştirilecek olup, katılımcılar sektörde gastronomi ile uğraşan ve akademik bir kariyere sahip kişilerden seçilecektir. Araştırma yöntemi olarak sözlü mülakat (açık uçlu sorular) yöntemi kullanılıp, elde edilen bulgularla çalışma desteklenecektir. Bu bulgular sonuç kısmında öneriler başlığı altında da paylaşılacaktır.

Anahtar Kelimeler: Slow food akımı, Gastronomi, Kuzey Kıbrıs.

**NEW TRENDS IN GASTRONOMY; NORTH CYPRUS SLOW FOOD TREND
EXAMPLE**

Abstract

New trends in gastronomy have been expanding with many popular trends in recent years. Slow Food, that is, the philosophy of 'good, clean and fair food' is a trend that has increased its popularity in recent years, especially with its memberships in Cittaslow (member regions and countries), protecting the environment and increasing local production, giving importance to the income level of the producers. Aiming to increase awareness and awareness about preserving sustainability and socio-cultural and historical values and conveying them to visitors with this new trend. Slow Food aims to protect traditional foods, increase production by the people of the region, protect biodiversity, food education and support the local economy. Appears to have acquired. This study includes the practices of the academic studies conducted in Northern Cyprus on behalf of the Slow Food movement and the businesses in the field of tourism and gastronomy. In the study, accommodation facilities and food and beverage businesses are evaluated in terms of regional tourism and gastronomic diversity, transportation, promotion, infrastructure and touristic and gastronomic products that will attract visitors and increase the number of visitors, especially income and employment, in terms of the development of regional tourism. It has been tried to show the importance of the slow food movement. The study will be developed by interviewing a participant of 20 people, and the participants will be selected from people who are engaged in gastronomy in the sector and have an academic career. The interview method will be used as a research method (with open ended questions) and the study will be supported with the findings obtained. These findings will also be shared under the heading of recommendations in the conclusion part.

Keywords: Slow food trend, Gastronomy, North Cyprus.

1. Giriş

İlk bakışta, Yavaş Turizm, 80'lerde ortaya çıkan (Broggi, 1985; Krippendorf, 1987) ve daha çevresel ve sosyal olarak algılanan alternatif turizm türlerini ayırt etmenin bir yolu olarak kullanılan soft turizm ile eşanlamlı gibi görünebilir. Slow food ile ilgili pek çok terim vardır ve bunlar, kitle turizmi türüne zıt olarak veya Bruntland Raporunda (Dünya Çevre ve Kalkınma Komisyonu – World Commission on Environment and Development, 1987) önerilen daha sürdürülebilir kalkınma ihtiyacının bir sonucu olarak ortaya çıkan alternatif turizm biçimlerini karakterize etmek için kullanılır. Alternatif turizmin çeşitli biçimleri, sosyal, kültürel ve fiziksel çevre kaygısıyla benzer ideolojiyi paylaşırsa da, farklı sosyal/politik hareketlerden kaynaklanabilir, farklı gelişme yolları izleyebilir ve farklı pazar segmentlerini çekebilir. Bu çalışmada Yavaş Turizm, kendine özgü kökeni, özellikleri ve pratiği ile benzersiz bir fenomen olarak ele alınmaktadır. Otuz yılı aşkın bir süre önce İtalya'nın Bra kentinde başlayan Slow Food Hareketi tarafından ortaya çıkan CittaSlow (Cittaslow International, 2010), yeni trend gastronomi ve turizm şekillerinin yaratılmasında lider bir rol oynadı. Tüm yeni turizm biçimleri gibi, evrensel olarak üzerinde anlaşmaya varılmış bir tanımın yanı sıra gelişimi için açıkça tanımlanabilir bir pazar segmenti veya modeli yoktur. Bu çalışma Slow Food akımı adına Kuzey Kıbrıs'ta yapılan akademik çalışmaların, turizm ve gastronomi alanında yer alan işletmelerin akımla ilgili uygulama şekillerini paylaşmayı amaçlamaktadır. Çalışmada konaklama tesisleri ve yiyecek içecek işletmelerinin gelir ve istihdam gibi ziyaretçi çekecek gelen yerli ve yabancı ziyaretçi sayısını artıracak turistik ve gastronomik ürünler üretmek adına bölge turizminin gelişmesi açısından değerlendirilerek bölge turizminde slow food akımının önemini paylaşmaya çalışmıştır.

1.1. Slow Food Akımı

1990'lı yılların başında bireyler, hızlı (hazır) yeme alışkanlıklarının olumsuz hayatlarını etkiledi. Fast food (abur cubur) dünya pazarına hızla hakim oldu ve bireylerin sosyal kültürü, yaşam standartları ve sağlıkları üzerinde birçok olumsuz etkiye neden olmuştur. Şeffaf bilgiye olan ihtiyaç da önemli ölçüde artmıştır. Fast food tüketimleri. Bununla ilgili olarak yerel, geleneksel ve organik gıdaların tüketilmesi çok zorlaştı ve obezite gibi pek çok sağlık sorunu baş göstermeye başladı (İnce, 2020). İtalyan bir yazar olan Carlo Petrini önderliğinde bir grup aktivist 1986 senesinde, İtalya'da bulunan Roma şehrine açılacak olan McDonalds restoranına hamur atarak tepki göstermiştir. Globalleşmenin ve süratin metaforu olan bu zincir restorana (McDonalds) gösterilen tepkinin sonucunda yavaşlık hareketi ortaya çıkmıştır. Bu hareketin

metaforu ise salyangoz olmuştur (Jackson, 2007). 9 Kasım 1989 yılında İsveç, İtalya, Fransa'nında içinde bulunduğu 14 ülkenin, Pariste bulunan Opera Comique' de attıkları imza ile Slow Food (Yavaş Yemek) resmileşmiştir (Güven, 2011). Yöresel besinlerin teşviği, yöresel tohum işlenişi, özgünlüğün güvenliğinin sağlanması, bölge insanının maddi kazanç sağlaması ve bölgesel kalkınmanın oluşturulmasıyla küreselleşmeye karşı bir tepkidir (Kinley, 2012). Slow Food Hareketi, iyi, temiz, adil gıda prensipleri ile ilerlemektedir. (Walter, 2009).

Yalnızca hızlı yemeğe karşı bir eylem değildir. Fast food ile birlikte oluşan alışkanlığa, standartlaşmaya, bölgesel bozulmalara da karşıda bir harekettir. Slow Food yalnızca gıda sınırlarında kalmayarak yavaş yolculuk, yavaş tıp, yavaş turizm gibi yaşamının pek çok noktasında var olmaya başlamıştır. Yavaş Yemek prensiplerini; yöresel ürün ve işlenişlerinin devamlılığı, yöresel besin pişirme ve tüketim anelerinin devamlılığı, yavaş yemek (slow food) fikrinin yaygınlaşması diye başlıklandırabiliriz (Keskin, 2010). Yavaş yemek hareketi zamanla birçok başarıya imza attı. Farklı coğrafyalarda hızla gelişmişti. Bireylerin ihtiyaçları ile farklı kültürlerdeki gıdaların kökenleri arasındaki güçlü bir ilişki kuruldu. Üstelik bu felsefesi sadece yemek tarzı ve şehir hayatı ile ilgili değildir, aynı zamanda turizm, seyahat, eğitim ve ticaret konularında geliştirme ve iyileştirme yöntemleri de içerir (İnce, 2020).

1.2. Cittaslow

'Sakin Şehir' olarak tanımlanan Cittaslow, İtalyanca 'citta' (şehir), İngilizce 'slow' (yavaş) sözcüklerinden türemiştir. Yavaş yemek (Slow Food) önderlerinden olan dört belediye başkanının çabaları ile başladı. Simgesi sırtında şehir taşıyan salyangozdur (Ergüven, 2011). Başarılı turizm hedefleri olan bu dört belediye yine de çabuklaşan dünya düzeninde başarısız olma ihtimalleri vardı. Olumlu geçen turizm faaliyetlerinin neticesinde kent merkezlerindeki trafik sorunu ortaya çıkmış, artan hızlı yemek (Fast food) mekanları turist sayısını fazlalaştırmış ve tanıtım-reklam levhalarından ki artış ise ışık kirliliğini ortaya çıkarmıştır. Hedef bu şehirleri yavaşlatmaktır. Özetle globalleşmenin kentlerin özgünlüğünü, bölge halkını ve yaşam stilleri arasındaki farklılıkların ortadan kalkmasını önlemek amacı ile slow food eyleminden doğmuş bir kentler birliğidir (Knox ve Mayer 2009).

Cittaslow, sürdürülebilir kalkınma için çabalayan ufak şehirleri; geçmişten gelen geleneğini muhafaza ederken, yaşamı yavaşlatarak, yaşamı makul düzeye getirerek, bu şehirlerin farklılıklarına zarar vermeyerek, sürdürülebilir kalkınmaya yardım etmektedir. Bir şehir yalnızca bugünün koşullarına göre hareket etmemelidir. Cittaslow ileriki dönemlerde de o bölgede yaşayacakları da düşünerekten, hayat standartlarını muhafaza edilmesini savunan bir harekettir.

Cittaslow'un ilk başlardaki asıl uğraşı bölge insanının genel refah ve erişim düzeyiydi. Zaman içinde bölge ziyaretçileri için de cazip gelmeye başlamıştır. Cittaslow bu durumdan sonra, bölge ziyaretçilerindeki devamlılığı ve devamlılık için seyahat arzı, hayat standartlarıyla seyahat talebinde mühim bir vasıta gücüne erişmiştir (Öztürk, 2019). 2020 yılı itibariyle sendikada 100.000'den fazla üye var. İlk günden, Şubat 2020'e kadar Cittaslow'a katılan 30 ülkeden 264 şehir var. Kuzey Kıbrıs, uluslararası Cittaslow hareketinin resmi bir üyesidir. 2013'ten itibaren. Resmi olarak belirtilen yedi merkezi politika Enerji ve çevre gibi yavaş şehir statüsünü elde etmek için Cittaslow tüzüğü politikaları, altyapı politikaları, kentsel yaşam kalitesi politikaları, tarım, turizm ve esnaf politikaları, misafirperverlik, farkındalık ve eğitim politikaları, sosyal uyum ve ortaklıklar. Ayrıca şehir nüfusu 50.000'den az olmalıdır (İnce, 2020).

1.3. Sürdürülebilir Şehir

Sürdürülebilir şehirler, kuşkusuz insanoglunun yarınları için ehemmiyeti çoktur. Sürdürülebilir şehir eski bir kavramdır. Farklı bölgelerdeki, uzun zamandır ayakta kalan tarihi noktaların sırrı; kendi yaşam ve maddi faaliyetleri arasındaki bağlantı ile bölgeden içinde olmayan doğa ve toprak alan arasındaki bağlantıları ölçülü kurup, bu balansın sürekliliğini sağlamaktır. Farklı bir anlatımla sosyal ve maddi menfaatlerin, çevre ve enerji problemleriyle ılımlı bir şekilde bağdaştırılıp yenilikte sürekliliğin oluştuğu bir bünyedir (Coşkun, 2018).

1.4. Slow food ve Cittaslow Ortaklığı

Sakin şehir, yavaş yemek faaliyetlerindeki gibi yavaş yaşamda devamlılığı müdafaada etmektedir, bu düşüncüyü şehirlerde gerçekleştirmek için yapılanmıştır. İki eylemin ortaklığı buradan başlamaktadır. Sakin Şehir ve Yavaş Yemek akımlarının ortaklığı bu hususta belli olmaktadır. Yavaş Yemek akımı 'TerraMadre' (Toprak Ana) tasarısında besinler ile ilgili olarak bir araya gelmiş dernek, vakıf, cemiyet ve birlikler gibi örgütler desteklenerek yok olma ihtimali olan malzemelerin önlem çalışmalarını tasarısını sağlamaktadır. Korumaya alınmış olan yöresel gıdalar ile geleneksel beslenme alışkanlıklarının okullar ve kantinlerinde eğitim programlarında ve restoranlarda kullanılarak korunmasını sağlanması, okul bahçelerinde tarımsal gelişimi destekleyecek çalışmaların uygulanması gibi görevlerini yerine getirmesi için CittaSlow hareketi ile ortaklığından olacak ve bu iki eylem birbirinden aldığı destekle güçlenecektir (Şahin ve Kutlu, 2014).

2. Kuzey Kıbrıs'ta Slowfood-Cittaslow Üyesi Bölgeler

2.1. Lefke (Cittaslow Üyesi)

Bol ceviz ve hurma ağaçlarıyla çevrili Lefke'de yetişen Yafa portakalları Kıbrıs'ın en lezzetli portakalları olarak kabul edilmektedir. Ayrıca Lefke, Kıbrıs'ın tarım merkezi olarak bilinir.

Lefke Belediyesi ve yerel derneklerin öncülüğünde her yıl çeşitli etkinlikler düzenlenmektedir: Ceviz Festivali, Hurma Festivali, Yafa Portakal Festivali, Çilek Festivali, Bağlıköy Eko Günü, Doğancı Kültür Günü ve Yedidalga Verigo Üzüm Festivali.

7 Kasım 2015 tarihinde İsveç'in Falköping şehrinde düzenlenen toplantıda Lefke Belediyesi'ne Cittaslow üyelik belgesi ve bayrağı takdim edildi.

Kültür çeşitliliği, geleneksel köyleri, mimari karakteri, yerel ürünleri, tarihi mirasları, geleneksel el sanatları, alternatif turizm potansiyeli, organik tarımı, doğal güzellikleri, verimli toprakları, doğal su kaynakları ve sakinliği ile Lefke, Lefke'nin çok önemli avantajlarıdır (İnce, 2020; Cittaslow.org, 2023).

2.2. Mehmetçik (Cittaslow/Slow food Üyesi))

Mehmetçik Belediyesi (mehmetcikbelediyesi.com), 2015 yılında yapılan Genel Kurul'da Cittaslow unvanını aldı. Resmi olarak bölgenin üçüncü Cittaslow üyesi oldu. Belediyenin düzenlediği birçok etkinlik var. İlk Cittaslow pazarı Mehmetçik ilçesine bağlı Çayırova köyünde kurulan ve bu pazarda organik olarak yetiştirilen sebze ve meyveler satılır (Cittaslow.org, 2023). Büyükkonukla birleşen bir belediye olarak Mehmetçik-Büyükkonut belediyesinin cittaslow üyeliği bulunmaktadır.

2.3. Tatlısu (Cittaslow Üyesi)

Tarihi yerler: Çiftlikdüzü Kazı Alanı, Molulos Antik Kenti, Minia Kıbrıs Açık Hava Müzesi, Panaghia Pergaminiotissa Kilisesi, Tarihi Harnup Depoları, Eski Un Değirmeni ve Osmanlı Çeşmesi'ni içerir.

Festivaller: Mart – Tatlısu Yeşil Festivali, Eylül – Tatlısu Harnup Festivali, Aralık - Nisan - Geleneksel Yürüyüş Etkinlikleri (Cittaslow.org, 2023).

2.4. Geçitkale (Cittaslow Üyesi)

Geçitkale Belediyesi, Kuzey Kıbrıs'ta dördüncü Cittaslow şampiyonluğunu kazandı. Geçitkale Belediye, Fransa'da yapılan Genel Kurul'da Cittaslow unvanını aldı. Geçitkale Belediyesi yaşam standartlarını yükseltmeyi hedefliyor. Yerel halkı ve bölgedeki yerel tarımı korumak. Geleneksel olarak, bu belediye Geçitkale Kültür Sanat Festivali gibi her yıl farklı festivaller düzenlemiştir (İnce, 2020; Cittaslow.org, 2023).

2.5. Yeniboğaziçi (Cittaslow/Slowfood Üyesi)

Bölge daha çok enginar yetiştiriciliği ve üretimi ile tarım ve hayvancılıkla tanınmaktadır ve bunlar bölge ekonomisine katkı sağlamaktadır. Turizm ayrıca, geleneksel restoranların (hem köylerin içinde hem de deniz kıyısı boyunca) bolluğu, Bizans ve Roma dönemlerine ait antik kalıntılara rehberli turlar ve diğer turistik cazibe merkezleriyle bölgenin mali kapasitesine katkıda bulunur.

Festivaller: 9 Mart- Kıbrıs Bahar Şenliği Pikniği, Ağustos-Yeniboğaziçi Pulya Festivali, 10 Aralık- Dünya günü kutlamaları (Cittaslow.org, 2023).

3. Sonuç

Yavaş yemek, isminden de anlaşıldığı üzere, sanayi devrimiyle hızlanan yaşamımıza entegre olan fast food'un karşıtıdır. Slow food'un göze çarpan en mühim başlıklarından biri tüketilen gıdanın içeriğinin aynı coğrafyanın ürünü olmasıdır. Slow food özünde, geçmişten gelen, atalarımızdan miras kalan yeme alışkanlarımız ve her coğrafyanın kendine has ürününü muhafaza etmek, gelecek nesillerin de yararlına bilmesi için onları koruma altına almak vardır. Slow food kurucularının destekleriyle başlayan Cittaslow ise; yöresel başlığını genişleterek şehir yapısı, alt yapı gelenek görenek gibi geçmişten gelen kültürü barındırmaktadır. Bu iki hareket standartlaşma ile mücadele vermektedir. Hızlanan dünyada küçük yerleşim yerlerinin hem ayakta kalıp, hem kalkınıp hem de özlüklerini gelecek nesillere aktarmaları için iki akımda desteklemektedir. Kuzey Kıbrıs'ta birçok bölge gibi kendine has yöresel gastronomiye sahiptir. Günümüzde Kuzey Kıbrıs'tan beş bölge Cittaslow ve/veya Slow food üyeliğine sahiptir. Her yıl düzenli olarak her bölge kendilerine ait yöresel ürünlerini sergileyebileceği festivaller düzenlemektedir.

Orjinal ve literatürde az işlenmiş bir konu olan çalışma ilerleyen aşamada 20 kişilik bir araştırma katılımcısı ile görüşülüp geliştirilecek olup, katılımcılar sektörde gastronomi ile uğraşan ve akademik bir kariyere sahip kişilerden seçilecektir. Araştırma yöntemi olarak sözlü mülakat (açık uçlu sorular) yöntemi kullanılıp, elde edilen bulgularla çalışma desteklenecektir. Bu bulgular sonuç kısmında öneriler başlığı altında da paylaşılacaktır.

Kaynakça

- Broggi, M. (Ed.). (1985). Sanfter Tourismus: Schlagwort oder Chance fur den Alpenraum?. Vaduz: Commission Internationale pour las Protection des Regions Alpines (CIPRA).
- Cittaslow homepage. (2020). Retrieved from <http://www.cittaslow.org/>
- Cittaslow International. (2010). About cittaslow. Retrieved from <http://www.cittaslow.org/index.php?method=section&id=2012&title=Association>
- Coşkun, A., & Selçuk, S. A. (2018). Sürdürülebilir Bir Çevre İçin Yavaş Kent Yaklaşımı: Halfeti Üzerine bir Değerlendirme. Ejons International Journal, 2(3), 147-162.
- Ergüven, M. H. (2011). Cittaslow – Yaşamaya Değer Şehirlerin Uluslararası Birliği: Vize Örneği . Organizasyon ve Yönetim Bilimleri Dergisi , 3 (2) , 201-210 . Retrieved from <https://dergipark.org.tr/en/pub/oybd/issue/16338/171061>
- Güven, E. (2011). Yavaş Yemek'ten Yavaş Medya'ya Hızlı Tüketime Dair Bir Çözüm Önerisi. Selçuk İletişim Dergisi, C. VII, S. 1, ss. 113-121.
- İnce, E. (2020). Impacts of Cittaslow Philosophy on Sustainable Tourism Development: Case of North Cyprus.
- Jackson, S. (2007) The Slow Movement: On The Snails Trail, www.suejackson.com.au/documents/tsmotst.pdf, erişim tarihi: 24.01.2011.
- Keskin, E., B., (2010), Sürdürülebilir Kent Kavramına Farklı Bir Bakış Olarak Yavaş Şehirler: Seferihisar Örneği (Basılmamış Yüksek Lisans Tezi), Kütahya: Dumlupınar Üniversitesi, Sosyal Bilimler Enstitüsü.
- Kinley, A. (2012). Local Food on a Global Scale: Anexploration of the International Slow Food Movement, Journal of Integrated Studies, C. I, S. 3, ss. 1-14.
- Knox, Paul L., Kleistädte und Nachhaltigkeit. Konzepte für Wirtschaft, Umwelt und soziales Leben, Birkhäuser Verlag AG, Basel, 2009.
- Krippendorf, J. (1987). The holidaymakers: Understanding the impact of leisure travel. London: Butterworth Heinemann.
- Öztürk, S. Vd.(2019). Cittaslow Hareketi ve Toplumsal Farkındalık: Gerze (Sinop) Örneği. Academic Studies on Social and Education Sciences.
- Şahin, İ. ve Kutlu, Z. (2014). Cittaslow: Sürdürülebilir Kalkınma Ekseninde Bir Değerlendirme, Journal of Tourism and Gastronomy Studies, 2 (1), 55-63.
- Walter, L. (2009). Slow Food and Home Cooking: Toward a Relational Aesthetic of Food and Relational Ethic of Home, The Journal of The Center for Food in Community and Culture, C. 1, S. 1, ss. 1-23, http://www.uwgb.edu/cfcc/files/pdf/Slow_Food_&Home_Cooking.pdf, erişim: 15.06. 2015.
- World Commission on Environment and Development. (1987). Report of the world commission on environment and development (WCED): Our common future. Commonly known as the Bruntland Report. Retrieved from the United Nations <http://www.un-documents.net/wcedocf.htm>

**GASTRONOMİDE YENİ TRENDLER: KONSEPT RESTORANLAR ÜZERİNE BİR
LİTERATÜR ÇALIŞMASI**

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Özet

Günümüzde gastronomi ve turizm alanındaki farklılıklar, bireysellik ve kimlik kavramlarını ön plana çıkarmış ve piyasalardaki arz ve talebi etkilemiştir. Ciddi bir rekabet ortamında bulunan restoranlar markette bulunan rekabet ortamı, sürekli değişen ziyaretçi talepleri ve değişen menülerle farklı konseptler üretmek zorunda kalmaktadır. Bu gelişmelerin bir sonucu olarak son yıllarda gastronomide yeni bir akım ortaya çıkmıştır 'konsept restoranlar' belirli bir temayı menüleri, hizmetleri ve iç mekanlarıyla ziyaretçilerine farklı bir deneyim ve konsept yansıtan bir akım ortaya çıkmıştır. Konsept restoranlar gastronomi sektöründe hem yeni bir hizmet tarzı hem de kimlik oluşturmaktadır. Literatürde restoranların hizmet kalitesi, müşteri memnuniyeti ve ziyaretçilerin tercih etme faktörleri sıklıkla araştırılrsa da konsept restoranlara yönelik çalışmaların özellikle Kuzey Kıbrıs gibi gelişmekte olan ülkelerde son derece sınırlı olduğu görülmektedir. Araştırmanın amacı, restoran kavramını tanımlamak, dünyadaki örnekleri incelemek ve konsept restoranları temalarına göre restoran türleri arasında sınıflandırmaktır. İlerleyen dönemlerde Kuzey Kıbrıs'ta bu tip restoranların gastronomi ve turizm alanlarında örneklerinin ve uygulamadaki farkındalığın artmasında çalışmanın amaçlarındandır. Bu bağlamda araştırmada, dünyadaki restoran literatürü ve uygulama örnekleri incelenmiş ve konsept restoranların farklı türleri açıklanarak farklı bölgelerde uygulanabilirlikleri değerlendirilmiştir. Çalışma 20 kişilik bir katılımcı ile görüşülüp geliştirilecek olup, katılımcılar sektörde gastronomi ile uğraşan ve akademik bir kariyere sahip kişilerden seçilecektir. Araştırma yöntemi olarak açık uçlu soruların kullanıldığı bir sözlü mülakat yöntemini kullanılıp, elde edilen bulgularla çalışma ileriki aşamalarda desteklenecektir. Bu bulgular sonuç kısmında öneriler başlığı altında da paylaşılacaktır.

Anahtar Kelimeler: Konsept Restoranlar, Gastronomi, Kuzey Kıbrıs.

NEW TRENDS IN GASTRONOMY: A LITERATURE REVIEW ABOUT CONCEPT RESTAURANTS

Abstract

Today, the differences in gastronomy and tourism have brought the concepts of individuality and identity to the fore and have affected the supply and demand in the markets. Restaurants in a serious competitive environment have to produce different concepts with the competitive environment in the market, constantly changing visitor demands and changing menus. As a result of these developments, a new trend has emerged in gastronomy in recent years. 'Concept restaurants', a trend that reflects a different experience and concept to its visitors with a specific theme, menus, services and interiors. Concept restaurants create both a new service style and identity in the gastronomy sector. Although the service quality of restaurants, customer satisfaction and the factors of preference of visitors are frequently investigated in the literature, it is seen that studies on concept restaurants are extremely limited, especially in developing countries such as Northern Cyprus. The aim of the research is to define the concept of restaurant, to examine examples in the world and to classify concept restaurants among restaurant types according to their themes. In the future, it is one of the aims of the study to increase the examples of this type of restaurants in the fields of gastronomy and tourism in Northern Cyprus and the awareness of the application. In this context, the restaurant literature and application examples in the world were examined and the applicability of concept restaurants in different regions was evaluated by explaining different types of concept restaurants. The study will be discussed and developed with a participant of 20 people, and the participants will be selected from people who are engaged in gastronomy in the sector and have an academic career. The interview method using open-ended questions will be used as a research method, and the study will be supported in the next stages with the findings obtained. These findings will also be shared under the heading of recommendations in the conclusion part.

Keywords: Concept Restaurants, Gastronomy, North Cyprus

1. Giriş

Gastronomi uçsuz bucaksız bir dünyadır. Yemekte yapmış olduğunuz değişimler ve sunumlar ilgi çekmekte ve bu değişimlerin sınırı yoktur. Her gün yeni trendler yeni sunumlar karsımıza çıkıyor. Bu durumda müşteriyi o mekan çekmek önemli bir konu haline gelmekte. Bu yüzden tarihi çok eski zamanlara dayanmış olsa da konsept restoranlar bayağı popüler hale geldiği gözlemlenmektedir. Bu değişen dünyada mekanların ayakta kalabilmeleri için gelişime ayak uydurmaları ve konsept uygulamalarına yönelmeleri gözlemlenmektedir. .Konsept restoranlar her yerde bir anda popüler olmuş ve uygulanmışlardır. Konsept restoranlar tarz ve gündelik akımlarda ilgili, o bireyin kendini sergilediği yerdir. Normalde bir sembol gibi dursada, o deneyimi yaşayanlara yereken anlık bir tiyatro sergilemek gibi bir durumdur (Hsu, 2009). Örnek vermek gerekirse:

- Cafe De Bagne (Hapishane),
- Proud Bird (Uçak)
- Hard Rock Cafe (Müzik)

Bu denemeler başlangıçta garip gelse de ilerde ciddi bir ilgi odağı olmaya devam etti. Yapılan bütün yatırımlar bir diğeri için merak konusu olmaya başladı. Proud bird yatırımla Tallichet bu alanda kendini öncü olmaktan çok dahada geliştirerek ilham kaynağı olmayı başarmıştır. Bu konseptler yıllar içinde yemek gibi kendini güncelleyerek farklı boyutlara ulaşmıştır. Bunlar tuvalet konseptli restoranla boyutun nereye gittiğini gösteriyor. Klozet şeklinde oturaklar ve tabaklar, dışkı şeklinde yemekler ile ilk duyduğunuzda iğreneceğiniz olaylar bir süre sonra ilginizi fazlasıyla oraya çekiyor.

2. Literatür Taraması

İnsanlığın temel ihtiyacından olan beslenme daha kaliteli zahmetsiz ve mekan tasarımı ile birleşince restoranlar ortaya çıktı. Bu restoranların öncüsü Boulanger Fransa da kuruldu. Bu atılım ilerde mega bir sektöre dönüşecek ve öncüsü hep bilinecekti. Türkiye de ve Kuzey Kıbrıs ta ise bu sektör Avrupa dan, orta doğudan ve asya dan çokça etkilenerek daha farklı bir alana taşınmıştır. Bu yapılar ticaret uygulamalarından insani ilişkilerden etkilenerek bir çok kültürün bir birine karışmasına neden olmuştur.

Ticari işletmeler: Kar amaçlı kurulan bu işletmedeki ana tema müşteri tatmini ve sürekliliği. Ticari işletme olarak geçen bu işletmelerin en birinci hedefi kar etmektir (Erdek, 2011). Yapılan bir araştırmada bu işletmeler sınıflandırılmıştır (Doğan vd., 2010).

- Lüks Restoranlar
- Kafeler

- Çabuk Yemek Yerleri
- Sıradan Yerler
- Kültürel Restoranlar
- Özellikli Restoranlar
- Ulaşım Merkezli

Ticari olmayan işletmeler: Kar amacı güdemeyen bu işletmelerin sunduğu yiyecek içecek hizmetleri destekleyicidir (Erdek, 2011). Bunlar ;

- Kurumssal işletmeler
- Personel yeme içme hizmeti

Kültürel tema, restoran temasının tartışmasız en yaygın biçimidir, çünkü birçok restoran kökleri restoranın bulunduğu yerden farklı bir kültüre sahip olan kişilere aittir ve sonuç olarak bu ülkenin mutfağından yemekler sunar. 1997 Ekonomik Sayımına göre, Amerika Birleşik Devletleri'ndeki 191.000 tam hizmet veren restoranın %33'ü etnik lokantalardır ve 29.7 milyar dolarlık satış yapmıştır (U.S. Census Bureau, 2000). Bu restoranlarda tema, sahibinin mirasıyla bağlantılı doğal bir sonuç olarak kabul edilebilir. Ancak etnik tema, küçük etnik restoranlarla sınırlı değildir. Ayrıca Almanya'da Güney Amerika mutfağı sunan Maredo, Benihana Japanese Steakhouse ve Bir Amerikalının seyahat etmeden tadını çıkarabileceği en otantik İtalyan yemek deneyimini sunmayı vaat eden Olive Garden gibi restoran zincirleri tarafından da kullanılıyor (Ebster and Guist, 2005).

Konsept restoranların en bilindik örneklerine baktığımızda yenilecek yemeğin ve edinilecek deneyimin oluşturduğu merak misafirleri bu alana yönlendirmiştir (Bekar, 2004). Yemek sektöründe rekabetin artması bu tip restoranların ortaya çıkmasına sebebiyet vermiştir. Diğer sektörlerde göre maliyet bakımından az olarak görülmektedir. İnsanların gerekli para ve zamanı oluştuğunda potansiyel müşteri konumuna gelmektedir. Girişimci insanlar bu sektöre girdiklerinde birbirlerine benzer birçok işletme ortaya çıkar. Bu durumdan mütevellit farklılık arama çabasına giren girişimciler Konsept restoranlara yönelmişlerdir (Heung, 2002). 1990'lı yıllar bu tip restoranların patlama yaptığı dönemdir fakat pazar payının kaybedilmesi saman alevi misali bu akımı düşüşe geçirmiştir. Bunun sebebi ise memnuniyetin olmaması ve müşteri çekme potansiyelinin düşmesidir (Weiss vd., 2004; Kim ve Moon, 2009).

2.1. Konsept ve Kültürel Ayrımı

Konsept restoran işletmelerinde işlenecek konu sonsuz nitelikte bir şeye bağlı kalmadan kurduğunuz absürt hayalleri bile yaşatabileceğiniz işletmelerdir. Kültürel restoranlar ise

seyahat etme zorunluluğunuz olmadan başka bir ülkenin kültürüne ait olan yemekleri tadıp deneyimliye bilirsiniz. Konsept restoranlar da mekan kültürel restoranlarda ise yemek göze çarpmaktadır. Kültürel restoran tipli işletmeler bilinen kültürel yapı ile kültürel sanat, dekor, müzik, mimari, ad ve farklı biçimlerde materyaller kullanılmaktadır (Jang vd., 2010). Yani bu restoranlarda belirli bir kültür ögesi işlenmektedir (Kılınç, 2014). Temaik işletmelerde ise belirli bir bağlam olmaksızın uçuk ve yapılabılır bir tecrübe sunarken, kültürel işletmelerde ise kültürel bağlamda yabancı kültür ve mutfak ile harmanlanmış bir tecrübe sunar (Wood ve Munoz, 2007).

2.2. Konsept Restoran Örnekleri

Konsept restoranların dünyada Kuzey Kıbrıs'ta ve Türkiye'de birçok örneği bulunmakta ve çok fantastik restoranlar vardır. Bunlar Avustralya'da bulunan Witches in Britches (Cadılar Bayramı konseptli), Maldiver'deki Ithaa Undersea (Akvaryum konseptli), Yeni Zelanda'ki Redwoods Treehouse (doğa konseptli), Dubai'deki Chillout Ice Lounge (Buzul Çağı konsepti), New York'taki Ninja Konseptli, Tayvan'daki Airbus A-380 restoranı (uçak konseptli), Chicago'daki Safe House (izli ajan konseptli), Paris'teki O'natural gibi konsept restoranları işletmek zordur. Bir masa rezerve ettikten sonra restorana girdiğinizde tüm kıyafetlerinizi ana salonun dışında bırakmanız gerekiyor. 40 masalık bu işletmede aşçı ve garson dışında hiç kimse giyinik değil. Parisin ortasındakai bu yerde yemek yemenin tek kuralı çırılçıplak olmak. Çin'in Pekin kentinde bulunan 'Dining in The Dark Restaurant' restoranda gece görüşü dürbünü olan garsonlar eşliğinde masaya kadar götürülüyorsunuz. Fener mum gibi hiç bir materyal olmadan yemekleri tadabilir veya koklayabilirsiniz sadece. Müşterilere ilginç bir deneyim sunan bu restoran çok moda. Walter's Coffee Roastery ise İstanbul Moda'da açılan ilk kahve laboratuvarı. Dünyanın ilk Breaking Bad Konsept restoran unvanına sahiptir. Restoranda bardak yerine deney tüpü kullanılmıştır. Duvarda dev bir periyodik cetvel bulunmaktadır ayrıca menüsü de periyodik cetvele benzemektedir (Turizm Günlüğü, 2020).

2.2.1. Rainforest Cafe

1994 yılında Amerika'da açılıp, Türkiye de dahil tüm dünyada 36 şubesi olan bu cafe ağaçların ve yeşilliklerin içinde, rutubetin ve sıcaklığın da hissedildiği bir orman havasına sahiptir. Ayrıca içerisinde tüm orman canlılarını temsil eden ve çok çeşitli robotik hayvanlar bulunmaktadır. Cafenin tavan mimarisi de bu güzel ortamı yansıtmaktadır. Rengarenk lazer ışıkları, dekorasyon ve 30 dakikalık aralıklarla yapılan fırtına ve şimşekler senkronize edilmiştir (Aksoy ve Akbulut, 2017).

2.2.2. Hard Rock Cafe

1971 yılında İngiltere Londra’da başlayan bu devasa işletme Konsept restoranların en başarılı örneklerinden biri. Günümüzde bu işi üst seviyeye taşıyan bu işletme 59 ülkede 145 cafe, 21 otel ve 10 kumarhane ile çıtayı en tepeye taşımıştır. Bu işletmedeki tema rock müzik ve enstrümanları ile poster teması işlenmiştir. (Çekal ve Memiş, 2020).

2.2.3. Hospitalist Restoran

Endonezya’nın Depok şehrinde kurulan Hospitalist Restoran, hastane gibi tasarlanan ilk restorandır. Farklı stili ve ilginç sunumları ile müşterilerine ilginç bir hizmet sunmaktadır. İç kısmında hastanede kullanılan ekipmanlar kullanılırken, müşterilerin oturduğu masalar ameliyat ışığı ile ışıklandırılmıştır ve oturdukları yerler ise tekerlikli sandalyelerdir. Bu değişik konseptteki restoranda masalara servisi hemşir ve hemşire gibi giyinmiş garsonlar yapmaktadır, mutfaktaki şefler ise doktor önlükleri giymektedir. İçecekler şurup şişeleri ve serum poşetinde, tatlandırıcılar da şırıngalarda sunulmaktadır. Dikkat çeken bir başka özellik ise yemek ve tatlıları insan organları ve hasta figürleri şeklindedir (Turizm Günlüğü, 2020).

2.2.4. Planet Hollywood

1991 Hollywood konseptiyle kurulan, Hollywood ünlülerinin de desteklediği bir restorandır (planethollywood.com). Bu restoran canlı performansları, alışveriş imkanı ve özel kutlama yemekleri ile her yaş grubundan misafire dünya standartlarının üzerinde bir hizmet ile unutulmaz bir eğlence sunmaktadır. Bu Hollywood konseptli restoran birçok casino, otel ve restoran olarak hizmet vermektedir.

2.2.5. RedSea Star

1998 yılında İsrail menşeli bu işletme su altı teması kullanmıştır. Denizin 6 metre içine inşa edilen camlardan su altı manzarası ile hafif ve dalga yaratan ışıklarla gece de manzaraya doyumsuz bir ambiyans yaratıyor. KKTC’de birçok balık restoranı bulunmakta ve girişten itibaren bir balıkçı teknesi gibi bu vb. işletmeler dizayn edilebilir.

2.2.6. Modern Toilet Restoran

260 mertekare alana inşa edilen modern toilet restoran (moderntoiletrestoran.com) restoran, müşteriye tuvalet algısını hissettirir. İçeceklerin kapları, oturulan sandalyeler, servis edilen yiyecek, yemek tabaklarına kadar her şey klozet şeklinde sunulmaktadır.

2.2.7. Leman Kültür

İlk olarak karikatür dergisi ile sevenlerinin karşısına çıkan Leman Kültür (lmc.com), daha sonraları fikir paylaşımlarının yapıldığı, yazarların-çizerlerin bulunduğu, günümüzde birçok sanatçının da ünlenmesine yardımcı olan ve yeme-içme imkânlarının da bulunduğu bir restoran

şeklini almıştır. Şu an Türkiye’de ve yurtdışında şubeleri bulunan ve “Yatıya Hariç Her Zaman Bekleriz” sloganıyla müşterilerine hitap eden Leman Kültür’ün teması duvarlarının, tuvaletlerinin, yemek masalarının, menü kartlarının ve personel kıyafetlerinin karikatürler ile süslenmesi ve bir bütünlük oluşturmasıdır. Ayrıca menüde yer alan yiyeceklerin de isimleri karikatürlere ait özel isimlerle müşterilerini beklemektedir.

2.2.8. Garavolli (KKTC)

Salyangozun ara sıcak ve turşu (soğuk meze) olarak sevril edildiği bu eşsiz hem yöresel hem modern restoranda misafirler farklı deneyimler kazanabilir. Ayrıca bu restoranın girişten itibaren salyangoz şeklinde olduğu düşünülürse tam bir konsept restoran olacaktır.

3. Sonuç

Araştırmanın amacı, restoran kavramını tanımlamak, dünyadaki örnekleri incelemek ve konsept restoranları temalarına göre restoran türleri arasında sınıflandırmaktır. İlerleyen dönemlerde Kuzey Kıbrıs'ta bu tip restoranların gastronomi ve turizm alanlarında örneklerinin ve uygulamadaki farkındalığın artmasında çalışmanın amaçlarındandır. Bu bağlamda araştırmada, dünyadaki restoran literatürü ve uygulama örnekleri incelenmiş ve konsept restoranların farklı türleri açıklanarak farklı bölgelerde uygulanabilirlikleri değerlendirilmiştir. Çalışma 20 kişilik bir katılımcı ile görüşülüp geliştirilecek olup, katılımcılar sektörde gastronomi ile uğraşan ve akademik bir kariyere sahip kişilerden seçilecektir. Araştırma yöntemi olarak açık uçlu soruların kullanıldığı bir sözlü mülakat yöntemini kullanılıp, elde edilen bulgularla çalışma ileriki aşamalarda desteklenecektir. Bu bulgular sonuç kısmında öneriler başlığı altında da paylaşılacaktır. Gastronomi alanında konsept restoranlara bakıldığında çeşitlilik ve özellikle Kuzey Kıbrıs'ta sayıca çok az oldukları görülmekte fakat zengin kültür, tarih, birçok zenginliğe sahip ve birçok tema uygulanabilecek yapıya sahiptir. Bu tip işletmelerinin müşteri odaklı olup mekan tasarımı ve menü olayını farklı bir boyuta taşıyarak gastronomi alanında farklılıklar yaratabileceği düşünülmektedir.

KAYNAKÇA

- Bekar, A. & Dönmez, F. G. (2014). Konsept Restoranlar ve Konsept Kültürel Restoran Ayrımı. *Uluslararası Sosyal Araştırmalar Dergisi*, 7(35), 797-803.
- Benli, S. Ve Çakıcı, C. (2018). Konsept Restoran İşletmeciliğinin Kavramsal Olarak İncelenmesi,2. Uluslararası Turizmin Geleceği Kongresi: İnovasyon, Girişimcilik Ve Sürdürülebilirlik Kongresi, 27-29 Eylül 2018 - Mersin.
- Cevizkaya, G. (2015). Tüketicilerin Kültürel Restoran İşletmelerini Tercih Nedenleri: İstanbul'da Bir Araştırma, (Yayımlanmamış Yüksek Lisans Tezi). Balıkesir Üniversitesi, Sosyal Bilimler Enstitüsü, Turizm İşletmeciliği ve Otelcilik Ana Bilim Dalı, Balıkesir.
- Çekal, N., & Memiş, B. (2020). Gastronomi ve Mutfak Sanatları Bölümü Öğrencilerinin Temalı Restoranlara İlişkin Tutum ve Davranışları. *Aydın Gastronomy*, 4(2), 63-72.
- Ebster, C., & Guist, I. (2005). The role of authenticity in ethnic theme restaurants. *Journal of Foodservice Business Research*, 7(2), 41-52.
- Erdek, F. (2011). Yiyecek İçecek İşletmelerinin Pazarlama Faaliyetlerinde Yöresel Mutfağın Kullanımı, (Yayımlanmamış Yüksek Lisans Tezi). Trakya Üniversitesi, Sosyal Bilimler Enstitüsü, İşletme Anabilim Dalı, Edirne.
- Hsu, H. L., Lee, S. H. & Li, Y. H. (2009). A Cognitive analysis of Customer preferences regarding themed restaurants in Taiwan, *Journal Of Global Business Management*, S. 5(1),S.Y.
- Jang, S, Liu, Y. & Namkung, Y. (2010). Effects Of Authentic atmospherics in Ethnic restaurants: Investigatin Chinese restaurants, *International Journal of Contemporary Hospitality Management*, S. 23(5), S. 662-680.
- Kılınç, O. (2014). Konsept Restoranlar ve Barlar. Osman N. Özdoğan (Ed.), *Yiyecek İçecek Endüstrisinde Trendler Kavramlar, Yaklaşımlar, Başarı Hikayeleri İçinde* (89-110). Ankara: Detay Yayıncılık.
- Kim, W.G. Ve Moon, Y. J. (2009). Customers' Cognitive, Emotional and action able response to the service scape: A Test Of The moderating effect of the restaurant type, *International Journal of Hospitality Management*, S. 28, S. 144-156.
- Özer, Ç., Akbulut, M.B., Çevik, A. (2015). Konsept Restoranlar, Uluslararası Örnekler Ve Türkiye'de Uygulanabilirliği. *Avrasya Turizm Kongresi*, 28-30 Mayıs 2015, Konya.
- Teyin, G., Aslan, N., Sormaz, Ü., Pekerşen, Y., Nizamlıoğlu, H. F. (2017). Turizm Sektöründe Kültürel Restoranlar: İstanbul Örneği. *Journal of Tourism and Gastronomy Studies*, 5(2) 77-87.
- Turizm Günlüğü, (2020). Konsept Restoranlar. Retrieved from:
<https://www.turizmgunlugu.com/2020/10/31/en-iyi-Konsept-restoranlar/>

- Türksoy, A. (2002). Yiyecek ve İçecek Hizmetleri Yönetimi, (2. Basım), Ankara: Turhan Kitabevi.
- US Census Bureau. (2002). US summary: 2000 (Vol. 7, No. 6). US Census Bureau.
- Weiss, R. & Feinstein, A. H. (2004). Customer satisfaction of theme restaurant attributes and their influence on Return Intent, Journal of Food service Business Reserach, S. 7(1), S. 23-41.
- Wood, N. T. & Munoz, C. L. (2007). No Rules, Just Right” Or Is It? The Role Of Themed restaurants As Cultural ambassadors, Tourism and Hospitality Research, S. 7, S. 242-255.

TAKIM SPORLARINDA SPORCU LİDERLİĞİN TAKIM UYUMUNA ETKİSİ

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ÖZET

Bu çalışmanın amacı, takım kaptanlarının takım uyumuna etkisi ve bazı demografik değişkenlere göre farklılıklarını ve ilişkilerini ortaya koymaktır. Bu amaç kapsamında çalışmanın örneklemini Türkiye Futbol Federasyonu (TFF) 2. Ligde faal olarak futbol oynayan ve gönüllü olarak araştırmaya katılan 324 futbolcu oluşturmaktadır. Verilerin değerlendirilmesinde Kurtosis (basıklık) ve Skewnes (çarpıklık) normallik testi, Anova testi, Pearson korelasyon ve regresyon analizlerinden yararlanılmıştır. Analiz sonuçları incelendiğinde sporcuların algıladıkları liderlik davranışları ile takım uyumu arasında pozitif yönde doğrusal bir ilişki olduğu görülmüştür. Demografik değişkenlerden yaş değişkeni ile sporda liderlik algılamaları alt boyutlarından eğitim-öğretim, demokratik davranış, otokratik davranış ve ödüllendirici davranış arasında anlamlı farklılık görünmektedir ($p < .05$). Yaş değişkeni ile takım birlikteliği alt boyutlarından grup çekiliği-sosyal, grup çekiciliği-görev, grup bütünlüğü-sosyal ve grup bütünlüğü-görev arasında anlamlı farklılık bulunmaktadır. Futbolcuların oynadıkları mevki değişkeni ile demokratik davranış arasında da anlamlı farklılık görülmektedir. Eğitim düzeyleri dikkate alındığında sporda liderlik alt boyutlarından eğitim ve öğretim, demokratik davranış ve sosyal destek arasında anlamlı farklılık tespit edilmiştir. Futbolcuların eğitim düzeyi ve takım birlikteliği alt boyutları arasında (grup çekiliği-sosyal, grup çekiciliği-görev, grup bütünlüğü-sosyal ve grup bütünlüğü-görev) anlamlı bir farklılık görünmektedir. Son olarak sporda liderlik alt boyutlarından beş yordayıcı değişken, takım birlikteliği puanlarındaki toplam varyansın yaklaşık %19'unu anlamlı bir şekilde açıklamaktadır. Sonuç olarak sporcuların takım kaptanlarının eğitim-öğretim, demokratik, sosyal ve ödüllendirici davranışlarının pozitif yönde takım birlikteliğini veya takım uyumunu arttırdığı, ancak otokratik davranışın ise negatif yönlü bir ilişki oluşturduğu sonucuna ulaşılabılır.

Anahtar Kelimeler: Liderlik, Sporda liderlik, Takım uyumu, Takım Kaptanı, Takım sporu

**THE EFFECT OF ATHLETE LEADERSHIP ON TEAM COHESION IN TEAM
SPORTS**

ABSTRACT

The aim of this study is to reveal the effect of team captains on team cohesion and their differences and relationships according to some demographic variables. Within the scope of this purpose, the sample of the study consists of 324 football players who actively play football in the 2nd League of the Turkish Football Federation (TFF) and voluntarily participated in the study. Kurtosis and Skewness normality test, Anova test, Pearson correlation and regression analysis were used in the evaluation of the data. When the results of the analysis were examined, it was seen that there was a positive linear relationship between the leadership behaviors perceived by the athletes and team cohesion. Among the demographic variables, there is a significant difference between the age variable and the sub-dimensions of the perceptions of leadership in sport such as education-teaching, democratic behavior, autocratic behavior and rewarding behavior ($p < .05$). There is a significant difference between age variable and group attraction-social, group attraction-task, group cohesion-social and group cohesion-task sub-dimensions of team cohesion. There is also a significant difference between the position played by football players and democratic behavior. Considering the level of education, a significant difference was found between education and training, democratic behavior and social support among the sub-dimensions of leadership in sport. There is a significant difference between the level of education of football players and team cohesion sub-dimensions (group attraction-social, group attraction-task, group cohesion-social and group cohesion-task). Finally, five predictor variables from the sub-dimensions of leadership in sport significantly explain about 19% of the total variance in team cohesion scores. As a result, it can be concluded that education-teaching, democratic and autocratic behaviors of team captains of athletes increase team cohesion or team cohesion.

Keywords: Leadership, Leadership in sport, Team cohesion, Team captain, Team sport

1.Giriş

Futbolun her kademesinde performans ve başarı birbiriyle ilişkili önemli kavramlar olarak kabul edilmektedir. Bu kavramlara bir de takım kaptanlığının eklendiği ileri sürülebilmektedir. Profesyonel futbolun önemli bir ögesi olarak kaptanlık, takım başarısı, performans ve etkili iletişim ile olan doğrudan ilişkisi sebebiyle, takım içerisinde sözü geçer konumdadır. Bu bağlamda takım kaptanlarının, etkili iletişim becerilerine sahip olması, takım başarısı noktasında önemli bir rolü olduğu söylenmektedir.

Liderlik ve lider kavramları birçok araştırmaya konu olmuş ve bu terimler çok farklı şekillerde tanımlanmıştır. İnsanlık tarihi kadar eski olan lider ve liderlik kavramları özellikle son dönemlerde bilimsel araştırmalarda yer almaya başlamıştır (Kaplan ve diğ., 2016). Liderlik, özellikle takım sporu alanlarında spor performansının temel bir özelliği olarak anılmaktadır. Son 25 yılda antrenör ve yöneticinin bu konudaki rolünü araştıran önemli araştırmalar yapılmıştır. Ancak bu, spor alanındaki liderliğin sadece bir yönünü temsil etmektedir. Aynı derecede önemli, daha az incelenmesine rağmen, sporcu liderliği kavramıdır.

Son yıllarda özellikle ilgi çekici olan, ekip üyeleri arasında var olan liderlik hükmü ve sağlanan liderliğin ekibin liderlik ihtiyaçlarını karşılama derecesi olmuştur. Bu liderlik türü 'sporcu liderliği' olarak tanımlanmıştır ve operasyonel olarak "bir takım içinde resmi veya gayri resmi bir rol üstlenen ve ortak bir hedefe ulaşmak için bir grup takım üyesini etkileyen bir sporcu" olarak tanımlanmıştır (Loughead ve diğ., 2006.).

Hem resmi (ör. kaptan) hem de gayri resmi (liderlerin motivasyonları ve kültürel mimarlar gibi) sporcu liderlerinin rolü, memnuniyet, uyum ve takım dinamikleri gibi takımla ilgili çeşitli değişkenler üzerinde kayda değer bir etkiye sahiptir (Loughead, 2017). Takım kaptanlarını resmi liderler olarak ele aldığımızda takım kaptanları sporda liderlik sağlamak için donatılmıştır ve liderlik becerilerini diğer yaşam alanlarına aktarma olasılıkları daha yüksektir (Newman, Lower ve Brgoch, 2019).

Takım kaptanı olarak adlandırılan sporcu liderliği, takım arkadaşlarıyla iletişim kurmak, takım ve antrenör arasında bağlantı kurmak, rol model olmak ve takım dışındaki kişilerle (hakem vs.) olumlu etkileşimler kurmak ve takımın işleyişine yardımcı olmak gibi sorumluluklara sahip olmaktadır. Futbolda, çoğunlukla liderlik özellikleri gösteren, daha düzenli, diğer takım arkadaşlarına oranla daha fazla takımda bulunan, deneyimli olan ve istikrarlı bir performans ortaya koyan futbolculara, kaptanlık rolü verildiği söylenmektedir (Konter, 2004). Takım kaptanları lider olarak öğrenme eğilimi gösterirler (Eratlı Şirin ve Şahin,

2020). Bir lider olarak öğrenme eğilimi, takım kaptanlarının diğer oyuncularından ayrılan özelliklerinden birisidir.

Uyum, takım sporlarında en önemli grup değişkeni olarak tanımlanmıştır (Lott & Lott, 1965; Spink, 2016). Başlangıçta uyum, düşünce ve davranışta tekdüzelik olarak tanımlanırken (Festinger, 1950), daha sonra üyeleri bir grup içinde tutan güç olarak tanımlanmıştır (Festinger, Schachter ve Back, 1963). Ancak bu tanımlar, uyumu yalnızca bireylerin gruplarına çekildiği tek boyutlu bir yapı olarak ele almıştır. Uyumu çok boyutlu bir yapı olarak gören ilk tanımlardan biri, uyumu "bir grubun amaç ve hedefleri doğrultusunda bir arada kalma ve birlik olma eğilimini yansıtan dinamik bir süreç" olarak tanımlamıştır (Carron, 1982). Bu tanım daha sonra Carron, Brawley ve Widmeyer (1998) tarafından geliştirilerek uyumu "bir grubun araçsal hedefleri ve/veya üyelerin duygusal ihtiyaçlarının tatmini için bir arada kalma ve birlik olma eğilimini yansıtan dinamik bir süreç" olarak tanımlamıştır.

Takım uyumu, ortak hedeflere ulaşmak ve üyelerin memnuniyetini sağlamak için takımın birliğini desteklemeyi amaçlayan dinamik bir süreci ifade etmektedir (Carron, ve Brawley, 2012). Bu bağlamda, takım üyeleri arasındaki iyi ilişkiler daha iyi bir performansa ve sportif başarıya katkıda bulunduğundan, sporcu liderler takımlarında uyum oluşturmak için gerekli köprü görevi üstlenmektedir (Nascimento-Júnior ve diğ., 2018, Nascimento-Júnior ve diğ., 2019). Buna ek olarak, takım arkadaşlarıyla olumlu ikili ilişkiler gösteren sporcu liderler hem saha içi hem de saha dışında uyumlu ortamlar oluşturabilir, kurulan bu ilişkilerin yanı sıra ortak hedeflere ulaşılmasını desteklemektedirler [Jowett, 2017, Jowett S ve diğ., 2017).

Türkiye'deki spor takımlarda oynayan takım kaptanlarının sergiledikleri liderlik stili takımın uyumunu olumlu ve olumsuz yönde etkilemesi takımların başarılı ve başarısız olmasıyla beraber elbette sporun gelişimine katkı sağlayabileceğinden bu çalışma önemli görülmektedir. Bu çalışma, TFF 2. Ligde faal olarak futbol oynayan 324 futbolcu üzerinde uygulanmıştır. Çalışmanın amacı, takım kaptanlarının takım uyumuna etkisi ve bazı demografik değişkenler açısından değerlendirilmesini incelemektir. Bu bağlamda takım kaptanlarının liderlik davranışlarıyla takım uyumu arasındaki ilişkisinin takım performansı noktasında önemli bir rolü olduğunu göstermek çalışmanın konusunu oluşturmaktadır. Benzer sorgulamayı çeşitli spor örgüt yapıları içerisinde ele alan çalışmalar olmasına rağmen, takım kaptanlarının liderlik tarzları ve takım uyumu (birlikteliği) algılamalarını inceleyen çalışma sayısı oldukça azdır. Bu nedenle bu konunun araştırılması gereken bir problem olduğunu göstermiş ve üzerinde araştırma yapılmasını gerekli kılmıştır.

2. Materyal ve Metot

2.1. Araştırmanın Örneklemi

Bu çalışma, takım kaptanlarının sergiledikleri liderlik tarzının takım uyumuna etkisinin incelenmesi amacıyla yapılmıştır. Elverişli örneklemin kullanıldığı çalışma, 2022 yılında TFF 2.Lig'de faal futbol oynayan toplam 324 futbolcu ile yürütülmüştür.

2.2. Araştırma Ölçekleri

2.2.1 Sporda Liderlik Ölçeği (SLÖ)

Araştırmada kullanılan ölçeklerden, “Sporda Liderlik Ölçeği (Leadership for sports cale-LSS) Chelladurai ve Saleh (1980)” tarafından geliştirilmiştir. Ölçeğin orijinali 40 madde ve 5 faktörden oluşmaktadır. Ölçek Unutmaz ve Gencer (2012) tarafından Türkçeye uyarlanarak kendi çalışmalarında kullanılmıştır. Unutmaz ve Genç (2012) tarafından ölçeğin alt boyutlarına ilişkin iç tutarlık katsayıları .58 ve .91 arasında değişkenlik göstermekte olup, ölçeğin toplam iç tutarlık katsayısının .94 olduğu belirlenmiştir. Araştırma verileri 5'li likert tipi derecelendirme ile puanlanmıştır. Analiz sonucunda Sporda Liderlik Ölçeği- Sporcunun Antrenörünü Algılaması Versiyonunun profesyonel sporcular üzerinde kullanılabilir geçerli ve güvenilir bir ölçüm aracı olduğu belirlenmiştir. Ölçeğin güvenilirliğinin testine yönelik yapılan analizde Cronbach's Alfa değeri 0.925 olarak tespit edilmiştir.

2.2.2. Takım Birlikteliği (Uyumu) Ölçeği (TBÖ)

“Carron, Widmeyer ve Brawley” (1985) tarafından geliştirilen takım uyumunu ölçmeye yönelik "Takım Birlikteliği Envanteri"ni 4 ifadeden oluşan ölçek ile belirlenmiştir. Ölçek Unutmaz, Kiremitçi ve Genç (2011) tarafından Türkçeye uyarlanarak kendi çalışmalarında kullanılmıştır. Unutmaz ve ark. (2011) tarafından Croanbach Alfa iç tutarlılık katsayısı 0.82 olarak tespit edilmiştir. Araştırma verileri 9'lu likert tipi derecelendirme ile puanlanmıştır. Ölçeğin orijinali 4 faktör ve 18 maddeden oluşmaktadır. Analiz sonucunda Takım Birlikteliği Envanterinin profesyonel sporcular üzerinde kullanılabilir geçerli ve güvenilir bir ölçüm aracı olduğu belirlenmiştir. Ölçeğin güvenilirliğinin testine yönelik yapılan analizde Cronbach's Alfa değeri 0.88 olarak tespit edilmiştir.

2.3. Verilerin Analizi

Araştırmada uygulanan ölçekler sonucunda ulaşılan verilerin analizinde, $p \leq .05$ anlamlılık düzeyi olarak alınmış ve paket program olarak ise SPSS 26.0 kullanılmıştır. Kullanılan program ile veriler problemlere uygun farklı analiz teknikleriyle test edilmiştir. Araştırma verilerinin normal dağılım gösterip göstermediğini belirlemek amacıyla Kurtosis (basıklık) ve Skewnes (çarpıklık) normallik testi yapılmıştır. Çoklu karşılaştırmalarda tek yönlü varyans analizi (ANOVA) testi uygulanmıştır. Sporcu liderlik, takım uyumu ve etkili iletişim

arasındaki ilişki düzeyinin sorgulanmasında, Pearson korelasyon analizi, değişkenlerin birbirini etkileme düzeylerinin belirlenmesinde ise Linear Regression analizi kullanılmıştır.

3. BULGULAR

Tablo 1. Normallik Test Sonuçları

Değişkenler	Çarpıklık	Basıklık	Cronbach Alpha
Sporda Liderlik Ölçeği	-,264	-,479	0.925
Takım Birlikteliği Ölçeği	,045	-1,001	0.886

Araştırmamızda kullanılan ölçekler için yapılan normallik test sonuçları Tablo.1’de yer almaktadır. Çıkan analiz sonuçlarına göre veri setinin çarpıklık ve basıklık açısından normal dağıldığı görülmektedir ve analizlerde parametrik testler kullanılmıştır. Kurtosis (basıklık) ve Skewnes (çarpıklık) değerlerine bakarak verinin normal dağılımına ilişkin yorum yapılabilmektedir. Bu çarpıklık ve basıklık değerlerinin (+1,5) ile (-1,5) arasında bir değer alması halinde, veri setinin normal dağılım gösterdiği söylenebilmektedir (Tabachnick and Fidell, 2013).

Tablo 2. Yaş Değişkenine Göre Sporda Liderlik Ölçeğinin Alt Boyut Düzeyleri Puanlarında Anlamlı Bir Farkın Olup-Olmadığını Belirlemek için Yapılan Anova Testi Analiz Sonuçları

Sporda Liderlik	Yaş	N	\bar{X}	ss	df	F	p
Eğitim ve Öğretim	15-19 yaş	66	56,65	6,410	3	6,421	0,00
	20-24 yaş	87	51,41	8,337			
	25-29 yaş	98	51,74	8,520			
	30 yaş ve üstü	73	51,96	9,108			
Demokratik Davranış	15-19 yaş	66	38,30	5,087	3	3,907	0,009
	20-24 yaş	87	35,84	5,720			
	25-29 yaş	98	37,62	4,583			
	30 yaş ve üstü	73	35,75	7,160			
Otokratik Davranış	15-19 yaş	66	11,71	5,380	3	3,240	0,022
	20-24 yaş	87	13,59	5,084			
	25-29 yaş	98	14,12	4,782			
	30 yaş ve üstü	73	13,52	4,802			
Sosyal Destek	15-19 yaş	66	33,36	4,285	3	2,172	0,091
	20-24 yaş	87	31,30	5,212			
	25-29 yaş	98	32,08	4,742			
	30 yaş ve üstü	73	31,97	5,610			
Ödüllendirici Davranış	15-19 yaş	66	21,32	3,059	3	3,244	0,022
	20-24 yaş	87	19,85	3,395			
	25-29 yaş	98	19,67	3,638			
	30 yaş ve üstü	73	20,36	3,963			
Sporda Liderlik Toplam Puanı	15-19 yaş	66	161,34	18,00	3	2,805	0,04
	20-24 yaş	87	151,98	21,00			
	25-29 yaş	98	155,24	20,62			
	30 yaş ve üstü	73	153,56	22,41			

Tablo 2 incelendiğinde, futbolcuların yaş değişkenine göre sporda liderlik algılamaları alt boyutlarından “eğitim ve öğretim, demokratik davranış, otokratik davranış ve ödüllendirici davranış” puan ortalamaları arasında anlamlı bir farklılık bulunmuştur. Farklılığın “eğitim ve öğretim, demokratik davranış ve ödüllendirici davranış” boyutlarında 15-19 yaş aralığı lehine, “otokratik davranış” boyutunda ise 25-29 yaş lehine gerçekleştiği belirlenmiştir. Sporda liderlik toplam puanı ile yaş değişkeni arasında da anlamlı farklılık bulunmuştur. Bu farklılığında 15-19 yaş grubundaki sporcuların lehine olduğu görülmektedir.

Tablo 3. Yaş Değişkenine Göre Takım Birlikteliği Ölçeğinin Alt Boyut Düzeyleri Puanlarında Anlamlı Bir Farkın Olup-Olmadığını Belirlemek için Yapılan Anova Testi Analiz Sonuçları

Takım Birlikteliği	Yaş	N	\bar{X}	ss	df	F	p
Grup Çekiciliği-Sosyal	15-19 yaş	66	35,44	6,769	3	9,339	0,000
	20-24 yaş	87	32,32	7,973			
	25-29 yaş	98	29,91	7,510			
	30 yaş ve üstü	73	29,53	7,885			
Grup Çekiciliği-Görev	15-19 yaş	66	28,83	7,280	3	5,732	0,001
	20-24 yaş	87	25,21	8,569			
	25-29 yaş	98	23,48	8,324			
	30 yaş ve üstü	73	25,67	8,153			
Grup Bütünlüğü-Sosyal	15-19 yaş	66	25,50	6,799	3	5,652	0,001
	20-24 yaş	87	23,06	6,169			
	25-29 yaş	98	21,77	5,727			
	30 yaş ve üstü	73	22,04	5,765			
Grup Bütünlüğü-Görev	15-19 yaş	66	33,70	6,714	3	3,513	0,016
	20-24 yaş	87	31,68	6,141			
	25-29 yaş	98	30,37	6,530			
	30 yaş ve üstü	73	30,62	8,313			
Takım Birlikteliği Toplam Puanı	15-19 yaş	66	123,46	21,45	3	8,227	0,00
	20-24 yaş	87	112,26	24,61			
	25-29 yaş	98	105,52	23,09			
	30 yaş ve üstü	73	107,86	25,67			

Tablo 3 incelendiğinde, futbolcuların yaş değişkenine göre takım birlikteliği algılamaları alt boyutlarından “grup çekiciliği-sosyal, grup çekiciliği-görev, grup bütünlüğü-sosyal ve grup bütünlüğü-görev” puan ortalamaları arasında anlamlı bir farklılık bulunmuştur. Farklılığın 15-19 yaş aralığı lehine gerçekleştiği belirlenmiştir. Takım birlikteliği toplam puanı ile yaş değişkeni arasında da anlamlı farklılık bulunmuştur. Bu farklılığın da 15-19 yaş grubundaki sporcuların lehine olduğu görülmektedir.

Tablo 4. Futbolcuların Oynadıkları Mevkii Değişkenine Göre Sporda Liderlik Ölçeğinin Alt Boyut Düzeyleri Puanlarında Anlamlı Bir Farkın Olup-Olmadığını Belirlemek İçin Yapılan Anova Testi Analiz Sonuçları

Sporda Liderlik	Oynadıkları Mevkii	N	\bar{X}	ss	df	F	p
Eğitim ve Öğretim	Kaleci	42	52,74	7,774	3	,485	0,693
	Defans	102	52,56	8,898			
	Orta Saha	108	53,39	7,961			
	Forvet	72	51,86	8,885			
Demokratik Davranış	Kaleci	42	36,64	5,983	3	3,344	0,019
	Defans	102	36,70	6,161			
	Orta Saha	108	38,08	4,911			
	Forvet	72	35,39	5,808			
Otokratik Davranış	Kaleci	42	13,26	5,947	3	,380	0,767
	Defans	102	13,04	5,058			
	Orta Saha	108	13,76	4,925			
	Forvet	72	13,24	4,698			
Sosyal Destek	Kaleci	42	31,69	5,812	3	1,481	0,220
	Defans	102	31,89	4,761			
	Orta Saha	108	32,91	4,825			
	Forvet	72	31,46	5,121			
Ödüllandirici Davranış	Kaleci	42	20,81	3,285	3	2,371	0,070
	Defans	102	19,47	4,162			
	Orta Saha	108	20,35	3,213			
	Forvet	72	20,69	3,249			
Sporda Liderlik Toplam Puanı	Kaleci	42	155,14	23,89	3	1,455	0,227
	Defans	102	153,65	21,89			
	Orta Saha	108	158,49	19,00			
	Forvet	72	152,63	19,74			

Tablo 4 incelendiğinde, futbolcuların mevkii değişkenine göre sporda liderlik algılamaları alt boyutları incelendiğinde “demokratik davranış” puan ortalamaları arasında anlamlı bir farklılık bulunmuştur. Farklılığın orta saha mevkinde oynayan futbolcular lehine gerçekleştiği belirlenmiştir.

Tablo 5. Futbolcuların Oynadıkları Mevkii Değişkenine Göre Takım Birlikteliği Ölçeğinin Alt Boyut Düzeyleri Puanlarında Anlamlı Bir Farkın Olup-Olmadığını Belirlemek İçin Yapılan Anova Testi Analiz Sonuçları

Takım Birlikteliği	Oynadıkları Mevkii	N	\bar{X}	ss	df	F	p
Grup Çekiciliği-Sosyal	Kaleci	42	31,50	8,086	3	0,140	0,936
	Defans	102	31,61	8,083			
	Orta Saha	108	31,93	8,230			
	Forvet	72	31,15	6,970			
Grup Çekiciliği-Görev	Kaleci	42	26,10	8,308	3	0,327	0,806
	Defans	102	25,86	8,783			
	Orta Saha	108	25,51	8,205			
	Forvet	72	24,75	7,975			
Grup Bütünlüğü-Sosyal	Kaleci	42	22,62	5,383	3	0,431	0,731
	Defans	102	22,45	6,149			
	Orta Saha	108	23,31	6,578			
	Forvet	72	23,24	6,272			
Grup Bütünlüğü-Görev	Kaleci	42	32,07	6,213	3	0,232	0,874
	Defans	102	31,52	7,368			
	Orta Saha	108	31,48	6,968			
	Forvet	72	30,96	7,014			
Takım Birlikteliği Toplam Puanı	Kaleci	42	112,28	23,05	3	1,291	0,946
	Defans	102	111,44	25,26			
	Orta Saha	108	112,23	25,18			
	Forvet	72	110,09	23,98			

Tablo 5 incelendiğinde, futbolcuların mevkii değişkenine göre takım birlikteliği toplam puanı ve alt boyutları arasında anlamlı bir farklılık bulunmamıştır.

Tablo 6. Futbolcuların Eğitim Durumu Değişkenine Göre Sporda Liderlik Ölçeğinin Alt Boyut Düzeyleri Puanlarında Anlamlı Bir Farkın Olup-Olmadığını Belirlemek İçin Yapılan Anova Testi Analiz Sonuçları

Sporda Liderlik	Eğitim Durumu	N	\bar{X}	ss	df	F	p
Eğitim ve Öğretim	Lise	226	52,56	8,547	3	2,670	0,048
	Ön lisans	39	50,97	8,773			
	Lisans	54	55,06	7,078			
	Yüksek Lisans/Doktora	5	47,40	9,839			
Demokratik Davranış	Lise	226	36,28	5,592	3	5,977	0,001
	Ön lisans	39	36,36	6,623			
	Lisans	54	39,80	4,795			
	Yüksek Lisans/Doktora	5	35,40	5,367			
Otokratik Davranış	Lise	226	13,21	4,980	3	,312	0,817
	Ön lisans	39	13,79	5,435			
	Lisans	54	13,50	5,269			
	Yüksek Lisans/Doktora	5	14,80	2,683			
Sosyal Destek	Lise	226	32,01	4,819	3	6,065	0,001
	Ön lisans	39	30,87	6,242			
	Lisans	54	33,98	3,921			
	Yüksek Lisans/Doktora	5	26,00	6,708			
Ödüllendirici Davranış	Lise	226	20,09	3,628	3	1,408	0,240
	Ön lisans	39	19,69	4,281			
	Lisans	54	21,07	2,732			
	Yüksek Lisans/Doktora	5	20,20	2,683			
Sporda Liderlik Toplam Puanı	Lise	226	154,14	20,18	3	3,964	0,009
	Ön lisans	39	151,69	24,64			
	Lisans	54	163,40	18,58			
	Yüksek Lisans/Doktora	5	143,80	21,91			

Tablo 6'ya göre futbolcuların eğitim düzeyi değişkeni ile sporda liderlik alt boyutlarından “eğitim ve öğretim, demokratik davranış ve sosyal destek” algılamaları arasında anlamlı farklılık bulunmaktadır. Meydana gelen farklılığın ise lisans mezunu futbolcular lehine gerçekleştiği görülmektedir. Sporda liderlik toplam puanı ile eğitim düzeyi değişkeni arasında da anlamlı farklılık tespit edilmiştir. Farklılığın ise lisans mezunu futbolcular lehine olduğu görülmektedir.

Tablo 7. Futbolcuların Eğitim Durumu Değişkenine Göre Takım Birlikteliği Ölçeğinin Alt Boyut Düzeyleri Puanlarında Anlamlı Bir Farkın Olup-Olmadığını Belirlemek İçin Yapılan Anova Testi Analiz Sonuçları

Takım Birlikteliği	Eğitim Durumu	N	\bar{X}	ss	df	F	p
Grup Çekiciliği-Sosyal	Lise	226	32,78	7,847	3	6,074	0,000
	Ön lisans	39	28,62	7,843			
	Lisans	54	29,28	7,115			
	Yüksek Lisans/Doktora	5	26,60	3,578			
Grup Çekiciliği-Görev	Lise	226	26,45	8,542	3	4,034	0,008
	Ön lisans	39	23,38	6,397			
	Lisans	54	23,96	8,131			
	Yüksek Lisans/Doktora	5	17,60	5,367			
Grup Bütünlüğü-Sosyal	Lise	226	23,73	6,401	3	4,636	0,003
	Ön lisans	39	20,56	5,077			
	Lisans	54	21,70	5,765			
	Yüksek Lisans/Doktora	5	19,00	,000			
Grup Bütünlüğü-Görev	Lise	226	32,49	6,792	3	6,701	0,000
	Ön lisans	39	28,49	6,004			
	Lisans	54	29,85	7,654			
	Yüksek Lisans/Doktora	5	25,00	,000			
Takım Birlikteliği Toplam Puanı	Lise	226	115,44	24,94	3	7,555	0,000
	Ön lisans	39	101,05	19,99			
	Lisans	54	104,79	22,58			
	Yüksek Lisans/Doktora	5	88,20	1,78			

Tablo 7 incelendiğinde, futbolcuların eğitim düzeyi değişkenine göre takım birlikteliği algılamaları toplam puanı ve alt boyutları arasında anlamlı bir farklılık bulunmuştur. Farklılığın lise mezunu futbolcular lehine gerçekleştiği belirlenmiştir.

Tablo 8. Sporda Liderlik ve Takım Uyumunu Arasındaki Pearson Korelasyon Analizi Sonuçları

	SLÖ	TBÖ	Eğitim ve Öğretim	Demokratik Dav.	Otokratik Dav.	Sosyal Destek	Ödüllendirici Dav.
SLÖ	1						
TBÖ	,180**	1					
Eğitim ve Öğretim	,922**	,294**	1				
Demokratik Dav.	,821**	,139*	,726**	1			
Otokratik Dav.	,227**	-,274**	,014	-,095	1		
Sosyal Destek	,881**	,213**	,794**	,713**	,040	1	
Ödüllendirici Dav.	,776**	,225**	,713**	,600**	-,025	,652**	1

Katılımcıların, Sporda Liderlik ve Takım Birlikteliği ve alt boyutları arasında anlamlı bir ilişki olup olmadığını belirlemek için Pearson korelasyon analizi yapılmıştır. Yapılan analiz sonucunda liderlik davranışları ile takım uyumu arasında düşük düzeyde ve pozitif yönde doğrusal bir ilişki olduğu görülmektedir (Pearson $R=0.180$; $p = 0,000 < 0,01$). Aynı şekilde “demokratik, eğitim-öğretim, sosyal destek ve ödüllendirici davranışları” arasında da pozitif yönde bir ilişki bulunmaktadır. Ancak otokratik davranış ile takım uyumu arasında negatif yönlü bir ilişki tespit edilmiştir.

Son olarak araştırmada futbolcuların sporda liderlik algılamalarının takım birlikteliği algılamalarını yordayıp yordamadığı araştırılmak istenmiştir. Bu amaçla sporda liderlik algılamaları ile takım birlikteliği algılamaları arasında korelasyonel ilişki olduğundan Regresyon analizi yapılmış ve elde edilen bulgular Tablo 9’da verilmiştir.

Tablo 9. Sporda Liderlik Alt Boyutları ve Takım Uyumu Arasındaki Regresyon Analiz Sonuçları
Yordanan Değişken: Takım Uyumu

Bağımsız Değişken	B	Standart Hata B	β	t	p
Sporda Liderlik	0,213	0,65	0,180	3,292	0,001
Eğitim ve Öğretim	1,189	0,281	0,408	4,225	0,000
Demokratik Davranış	-1,062	0,341	-0,247	-3,116	0,002
Otokratik Davranış	-1,483	0,251	-0,304	-5,918	0,000
Sosyal Destek	0,241	0,439	0,049	0,550	0,583
Ödüllendirici Davranış	0,295	0,508	0,043	0,581	0,562
R= 0,435 F= 14,826		R²= 0,189	P= 0,000	Adjusted R²= 0,176	

Sporda liderlik algılamalarının takım birlikteliği algılamalarını yordayıcısı olup olmadığına ilişkin Tablo9 incelendiğinde ($p = 0,000 < 0,05$) “eğitim ve öğretim, demokratik ve otokratik davranış” boyutları, futbolcuların takım uyumu puanları ile anlamlılık düzeyinde yordayıcısı olduğu anlaşılmaktadır ($R^2 = 0,189$). Ancak “sosyal destek ve ödüllendirici davranış” boyutlarıyla futbolcuların takım uyumu puanları arasından anlamlı bir ilişkiye rastlanmamıştır. Buna göre adı geçen beş yordayıcı değişken açıklanan varyansın % ~19’unu anlamlı bir şekilde açıklamaktadır.

TARTIŞMA VE SONUÇ

Analiz sonucunda futbolcuların yaş grupları ortalamaları ile takım kaptanlarının “eğitim ve öğretim, demokratik davranış, otokratik davranış ve ödüllendirici davranış” algılamaları boyutu arasında anlamlı bir farklılık görülmektedir. Sporda liderlik toplam puanı ile yaş değişkeni arasında da anlamlı farklılık bulunmuştur. Farklılaşma bulgularına göre, 15-19 yaş grubundaki sporcuların, takım kaptanlarının “eğitici-öğretici davranışlarına, demokratik davranışlarına ve ödüllendirici davranışlarına” ilişkin algıları diğer yaş gruplarındaki sporculara göre daha olumludur. Bunun altında takım kaptanlarının takım içerisinde daha çok genç

sporculara yönelmesi, onlarla ilgilenmesi ve gelişimlerine katkıda bulunduğu düşüncesi yatmaktadır. Ancak otokratik davranışa ilişkin algıları 25-29 yaş grubundaki sporcularda daha yüksek olduğu tespit edilmiştir. Futbolcuların yaş artıkça başkalarına olan güvenin azaldığı ve kendi kararlarının daha doğru olduğuna inandıkları düşüncesi, takım kaptanlarının otokratik davranışlarını benimsedikleri düşünülebilir.

Futbolcuların yaş değişkenine göre takım birlikteliği algılamaları alt boyutları incelendiğinde “grup çekiciliği-sosyal, grup çekiciliği-görev, grup bütünlüğü-sosyal ve grup bütünlüğü-görev” puan ortalamaları arasında anlamlı bir farklılık bulunmuştur. Farklılığın 15-19 yaş aralığı lehine gerçekleştiği belirlenmiştir. Genç yaştaki sporcuların kendilerini kanıtlamak adına ve takım içi görev ve sosyal eğilimlerde aktif olduğu düşünüldüğünde sonucun anlamlı çıkması beklenen bir sonuç olmaktadır.

Futbolcuların mevkii değişkenine göre sporda liderlik algılamaları alt boyutları incelendiğinde demokratik davranış puan ortalamaları arasında anlamlı bir farklılık bulunmuştur. Farklılığın orta saha mevkinde oynayan futbolcular lehine gerçekleştiği belirlenmiştir. Orta saha mevkisinde yer alan futbolcuların takımdaki hem defansif hem de ofansif alanda bir köprü görevi görmesinden dolayı ve iki alanla da sürekli iletişim halinde olması düşüncesi, takım kaptanından daha çok demokratik davranışı beklediği söylenebilir.

Futbolcuların mevkii değişkenine göre takım birlikteliği algılamaları alt boyutları incelendiğinde “grup çekiciliği-sosyal, grup çekiciliği-görev, grup bütünlüğü-sosyal ve grup bütünlüğü-görev” puan ortalamaları arasında anlamlı bir farklılık bulunmamıştır. Hangi mevkide oynarsa oynasın oyuncu galibiyet için elinden geleni yapmaktadır. Başarı için ise takım olmak beraber olmak şartı yer almaktadır. Bu bağlamda bulgular sonucu da ortalamaların aynı düzeyde olduğunu göstermektedir.

Futbolcuların eğitim düzeyi değişkeni ile takım kaptanlarının sporda liderlik davranışlarından “eğitim ve öğretim, demokratik davranış ve sosyal destek” algılamaları arasında anlamlı farklılık bulunmaktadır. Farklılığın lisans mezunu futbolcular lehine olduğu tespit edilmiştir. Eğitim düzeyi artan bireyler daha sosyal, insan ilişkilerine ve iletişimine daha açık bir hale gelmektedir. Bu sonuçla kaptanlarından gördükleri ve benimsedikleri davranış şekilleriyle örtüşmektedir.

Futbolcuların eğitim düzeyi değişkenine göre takım birlikteliği alt boyutları incelendiğinde “grup çekiciliği-sosyal, grup çekiciliği-görev, grup bütünlüğü-sosyal ve grup

bütünlüğü-görev” puan ortalamaları arasında anlamlı bir farklılık bulunmuştur. Farklılığın lise mezunu futbolcular lehine gerçekleştiği belirlenmiştir. Bu anlamda sporcuların eğitim düzeyi arttıkça takıma olan bağlılıkları ve uyumları azalmaktadır. Bu duruma sporcuların bilgi düzeyinin yükselmesi ile sorumluluk alma, bağımsız karar verme, uygulama ve kişisel inisiyatif alma özelliklerinin artmasına neden olmaktadır.

Takım kaptanlarının sporda liderlik ve takım birlikteliği (uyumu) davranışlarının farklı açıdan incelendiği sporcuların dahil olduğu bu çalışmada; takım kaptanlarının liderlik davranışları ile futbolcuların takım birlikteliği algılamaları arasında düşük düzeyde ve pozitif yönde doğrusal bir ilişki olduğu görülmüştür. Cotterill ve Fransen (2016) de sporcu liderliğinin takım uyumu ve performansı üzerinde olumlu bir etkisi olduğunu tespit etmiş ve sporcu liderliğinin oyuncular arasında birlik ve anlayışı geliştirdiğini öne sürmüştür. Ayrıca başka bir çalışmada eğitim ve öğretim ile sosyal desteğin sporcu liderliği davranışları görev ve sosyal uyum ile pozitif yönde ilişkili bulunurken, demokratik davranış görev uyumu ile pozitif yönde, otokratik davranış ise görev ve sosyal uyum ile negatif yönde ilişkili olduğu tespit edilmiştir (Vincer ve Loughhead, 2010). Elde edilen sonuçlar ile çalışmamızın sonucu benzerlik göstermektedir.

Yapılan regresyon analizi sonucunda ise sporda liderlik algılamaları takım birlikteliği algılamalarının yordayıcısı olduğu ve takım birlikteliği için açıklanan varyansın %19’unun sporda liderlik alt boyutlarından olan “eğitim ve öğretim, demokratik davranış, otokratik davranış, sosyal destek ve ödüllendirici davranış” boyutlarından kaynaklandığı tespit edilmiştir.

Sonuç olarak sporcuların takım kaptanlarının “eğitim-öğretim, demokratik, sosyal ve ödüllendirici davranışlarının” pozitif yönde takım birlikteliğini veya takım uyumunu arttırdığı, ancak otokratik davranışın ise negatif yönlü bir ilişki oluşturduğu sonucuna ulaşılabilir. Çalışmamız sonucundaki bilgiler ışığında bazı önerilerde bulunulabilir. Spor kaptanlığı rolü sporcuya iyice anlatılmalı ve kendisinden ne beklendiği açıklanmalıdır. TFF’nin antrenörlere yönelik açmış olduğu kurslar ve seminerlerdeki eğitimlerin takım kaptanlarını kapsayacak şekilde yapılması ve sayılarının artırılması takım kaptanlarının takım uyumuna yönelik becerilerini, motive edici ve performans artırıcı yönlerinin gelişmesine katkı sağlayacaktır. Araştırmanın Türkiye geneline uyarlanması ve daha kapsamlı bir inceleme yapılması araştırmacılara tavsiye edilmektedir.

Kaynaklar

- Kaplan, T., Atılgan, D., Aktaş, S., Tükel, Y. (2016). Okul Yöneticilerinin Öğretmenler Tarafından Algılanan Etik Liderlik Davranışları. *Akademik Sosyal Araştırmalar Dergisi*, 4(31), s. 180-193
- Loughead, T. M., Hardy, J., & Eys, M. A. (2006). The nature of athlete leadership. *Journal of Sport Behavior*, 29, 142–158
- Loughead, T. M. (2017), “Athlete leadership: a review of the theoretical, measurement, and empirical literature”, *Current Opinion in Psychology*, 16:58–61
- Newman T.J., Lower L.M. & Brgoch S.M. (2019), Developing sport team captains as formal leaders, *Journal of Sport Psychology in Action*, 10:3, <https://doi.org/10.1080/21520704.2019.1604590>
- Konter E. (2004), “Profesyonel Futbolcuların Kaptan Olup Olmamlarına Göre Psikolojik Becerilerinin Araştırılması”, *Gazi Beden Eğitimi ve Spor Bilimleri Dergisi (Gazi BESBD)*, IX, 1 : 25 – 34
- Lott, A. J., & Lott, B. E. (1965). Group cohesiveness as interpersonal attraction: A review of relationships with antecedent and consequent variables. *Psychological Bulletin*, 64, 259-309.
- Spink, K. S. (2016). Group Cohesion in Sport and Exercise. In P. R. E. Crocker (Ed.), *Sport and exercise psychology: A Canadian perspective* (3rd ed., pp. 228-255). Toronto, ON: Pearson Education, Inc.
- Festinger, L. (1950). Informal social communication. In L. Festinger, K. Back, S. Schachter, H. Kelley, & J. Thibaut (Eds.), *Theory and experiment in social communication* (pp. 3-17). Ann Arbor, MI: University of Michigan.
- Festinger, L., Schachter, S., & Back, K. (1963). *Social pressures in informal groups*. Stanford, CA: Stanford University Press.
- Carron, A. V. (1982). Cohesiveness in sport groups: Interpretations and considerations. *Journal of Sport Psychology*, 4, 123-138.
- Carron, A. V., Brawley, L. R., & Widmeyer, W. N. (1998). The measurement of cohesiveness in sport groups. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 213-226). Morgantown, WV: Fitness Information Technology, Inc.
- Carron AV, Brawley LR. (2012). Cohesion: conceptual and measurement issues. *Small Group Res.* 2012;43(6):726– 743; doi: 10.1177/1046496412468072
- Nascimento-Júnior JRA, Vissoci JRN, Codonhato R, Fortes LS, Oliveira DV, Oliveira LP, et al.(2018). Effect of the coaches’ leadership style perceived by athletes on team cohesion among elite Brazilian futsal players. *Cuad Psicol Deporte.* 2018;18(3):252–267
- Do Nascimento Junior JRA, Silva AA, Granja CTL, de Oliveira DV, de Sousa Fortes L., (2019). Do sporting experiences predict team cohesion in youth athletes? *Cuad Psicol Deporte.* 2019;19(3):102–112; doi: 10.6018/cpd.365201.
- Jowett S., (2017). Coaching effectiveness: the coach-athlete relationship at its heart. *Curr Opin Psychol.* 2017;16: 154–158; doi: 10.1016/j.copsyc.2017.05.006.
- Jowett S, Adie JW, Bartholomew KJ, Yang SX, Gustafsson H, Lopez-Jiménez A., (2017). Motivational processes in the coach-athlete relationship: a multi-cultural selfdetermination approach. *Psychol Sport Exerc.*, 32: 143–152; doi: 10.1016/j.psychsport.2017.06.004.
- Chelladurai, P. & Saleh, S. D. (1980). Dimensions of leaderbehavior in sports: development of a leadership scale. *Journal of Sport Psychology*, 2(1), 34-45.
- Unutmaz V. ve Gençer R:T., (2011). Spor İçin Liderlik Ölçeği - Sporçunun Antrenör Davranışını Algılaması Versiyonu’nun Psikometrik Özelliklerinin İncelenmesi, *CBÜ Beden Eğitimi ve Spor Bilimleri Dergisi*, 7(1), 27-34

- Carron, A., Widmeyer, W. & Brawley, L. (1985). The development of an instrument to assess cohesion in sport teams - The Group Environment Questionnaire. *Journal of Sport Psychology*, 7(3), 244-266. [DOI:10.1123/JSP.7.3.244](https://doi.org/10.1123/JSP.7.3.244)
- Unutmaz V., Kiremitçi O. ve Gençer R.T. (2011). Takım Birlikteliği Envanteri'nin Psikometrik Özelliklerinin İncelenmesi, *CBÜ Beden Eğitimi ve Spor Bilimleri Dergisi*, 6(2),
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6. Baskı). Boston, ABD.
- Cotterill, S. T., &Fransen, K. (2016). Athlete leadership in sport teams: Current understanding and future directions. *International Review of Sport and Exercise Psychology*, 9(1), 116-133. [DOI: 10.1080/1750984X.2015.1124443](https://doi.org/10.1080/1750984X.2015.1124443)
- Vincer, D. J., & Loughhead, T. M. (2010). The relationship among athlete leadership behaviors and cohesion in team sports. *The Sport Psychologist*, 24, 448-467.

**ENRICHMENT OF FINE-GRAIN CHROME ORE WITH MULTI GRAVITY
SEPARATOR, PILOT SCALE YIELD ANALYSIS**

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ABSTRACT

Chromium is one of the important metals used in industry such as iron, aluminium and copper. Chromite, found in the earth's crust as iron chromium oxide (FeCr_2O_4), is one of the 25 minerals containing the most chromium element. The beneficiation methods applied in chromite ores are determined according to the degree of liberation of the chromite and the properties of the ore. However, fine-grained chromites (0.1mm) are directly added to the waste. In this study, fine-grained chromite in Eti Krom INC./Elazığ was enriched with a multi-gravity separator (MGS). In addition, yield analyses were calculated. The most important and sensitive variable affecting the performance in MGS systems is the drum rotation speed. In the experimental studies, the drum rotation speed was adjusted as 105, 120 and 135 rpm. Sieve analysis and grain size analysis of fine grained chromites were performed. Microscopic images of the feed, product and waste used in the studies were examined. Then, chemical analyses were made using XRF in Eti Krom Analysis Laboratory. Enrichment with optimum operating parameters was also obtained from the feed material containing 15.39% Cr_2O_3 and a concentrate with 43.7% Cr_2O_3 grade with 60% yield. In enrichment studies with MGS, it was observed that drum rotation speed and tilt angle were the most effective operating parameters, while other variables (wash water amount, feed solid ratio, vibration amplitude and frequency) were less effective.

Keywords: Chromium; Chromite; Multi Gravity Separator; Drum Rotation Speed; Yield.

İNCE TANELİ KROM CEVHERİNİN MULTİ GRAVİTY SEPARATÖR İLE
ZENGİNLEŞTİRİLMESİ, PİLOT ÖLÇEKLİ VERİM ANALİZLERİ

ABSTRACT

Krom, demir, alüminyum ve bakır ile birlikte endüstride en çok kullanılan önemli metallere biridir. Yerkabuğunda demir krom oksit halinde $FeCr_2O_4$ olarak bulunan bir spinel grubu olan kromit, en fazla krom elementi içeren 25 mineralden biridir. Kromit cevherlerinde uygulanan zenginleştirme yöntemleri, kromitin serbestleşme derecesine ve cevherin özelliklerine göre belirlenmektedir. Fakat ince taneli (0.1mm) olan kromitler doğrudan atığa katılmaktadır. Bu çalışmada Elazığ Eti Krom firmasında bulunan ince taneli kromitin multi gravity separatör (MGS) ile zenginleştirilmiştir. Ayrıca verim analizleri hesaplanmıştır. MGS sistemlerde performansı etkileyen en önemli ve hassas değişken tambur dönüş hızıdır. Deneysel çalışmalarda tambur dönüş hızı 105, 120 ve 135 devir/dakika olarak ayarlanarak yapılmıştır. İnce taneli kromitlerin elek analizi ve tane boyutu analizleri yapılmıştır. Çalışmalarda kullanılan besleme, ürün ve atığın mikroskop görüntüleri irdelenmiştir. Daha sonra Eti Krom Analiz Laboratuvarında XRF kullanılarak kimyasal analizleri yapılmıştır. Optimum çalışma parametreleriyle yapılan zenginleştirmede %15,39 Cr_2O_3 içerikli besleme malzemesinden %43,7 Cr_2O_3 tenörlü konsantre %60 verimle elde edilmiştir. MGS ile yapılan zenginleştirme çalışmalarında tambur dönüş hızı ve eğim açısının en etkin işletme parametreleri olduğu, diğer değişkenlerin (yıkama suyu miktarı, besleme katı oranı, titreşim genliği ve frekansı) ise daha az etkili olduğu gözlenmiştir.

Anahtar Kelimeler: Krom; Kromit; Multi Gravity Separatör; Tambur Dönüş Hızı; Verim

INTRODUCTION

Chromium; it is one of the most important metals used in industry along with iron, aluminium and copper. There are significant reserves in the world and in our country, and large amounts of chromium are produced every year. Metallurgy, refractory and chemistry are the main industries where chromium is used. However, chromium ores extracted from the quarry often do not provide the product properties desired by these industries. Therefore, bringing the chrome ores extracted from the quarry to the properties desired by the industry, in other words, becoming a saleable product is only possible with effective enrichment processes [1]. Gravity methods (shaking tables, jigs, troughs, spirals, etc.), which is to separate the valuable mineral from the worthless parts in a fluid environment (usually water) by making use of the difference between the densities of the precious mineral and gangue minerals, are frequently used in the enrichment of chromite ores today. However, grain size is the limiting factor in classical gravity methods together with triage (hand sorting), and these methods can only be applied in fragmented ores and ores that can be released in large sizes. With the decrease of this type of ores today, the application areas of classical gravity methods are getting narrower [1, 2]. For this reason, enrichment of fine-grained chromite wastes is increasing its importance day by day. In general, enrichment methods based on specific gravity difference are used in the enrichment of chrome ores. Separation methods such as heavy media and jigs are used in large sizes. If it is less than 1 mm, shaking table, spiral, magnetic separation and flotation are used. During this process, fine-grained chromites below 0.1 mm are seen as direct waste, and waste containing 10-15% Cr_2O_3 reduces plant efficiency. Flotation, high field intensity wet magnetic separation and slime table are used for the enrichment of these fine chromites (0.1 mm). Although the best results in terms of efficiency are obtained in flotation, both the cost of this process is high and it affects the environment negatively [3]. For these reasons, the use of multi gravity separator (MGS) is much more advantageous in the enrichment of fine-grained chrome ores.

The multi-gravity separator (MGS) is one of the fine particle mineral concentration machines based on gravity separation. The parameters that affect the performance of MGS are the drum speed, tilt angle, shake amplitude, shake frequency, wash water flow rate and feed solids [4]. Successful concentration with MGS depends on the selection of suitable operating conditions and minerals [5]. Therefore, it is important to determine the operating parameters at which the response reaches its optimum [6]. MGS optimization requires many tests. However, the total number of experiments required can be reduced depending on the experimental design technique [5]. It is essential that an experimental design methodology is very economical for

extracting the maximum amount of complex information while saving significant experimental time, material used for analyses and personnel costs [7]. Experimental design methods and response surface methodologies have been applied for modelling process parameters to mineral processing systems. Central composite design has been successfully used to design an experimental program to provide data to model the effects of inlet pressure, feed density, and length and diameter of the inner vortex finder on the operational performance of a 150 mm three product cyclone [8]. Box–Behnken experimental design method has been employed for modelling and optimization of a multi-gravity separator to produce celestite concentrate by Aslan [9]. Response surface methodology and Box–Behnken design has been discussed for modelling of some Turkish coals by Aslan and Cebeci [10]. Gülcan et al. have worked on the enrichment of manganese ore by creating a gravity enrichment flow chart [11]. Aslan and Canbazoğlu investigated the enrichment of fine chrome ores with MGS. In their study, they emphasized that grain size is very important in enrichment with MGS. They observed that the separation was good in fine sizes, and the sensitivity of separation decreased in large sizes [3]. MGS offers the possibility to change the operating parameters as a reference. In addition, several literatures were found on the detail of operational mechanism of MGS [12-15].

In this study, the effect of drum rotation speed on production and yield in the enrichment process with MGS used in process conditions in Eti Krom INC./Elazığ was examined. Sieve analysis and particle size analysis were performed. Sample releases were examined with a microscope. Chemical analysis of feed, product and waste were performed with X-Ray Fluorescence (XRF) spectrometer. At the last stage, the efficiency calculation was made and the necessary parameters for the use of MGS in process conditions were determined.

METHODOLOGY

In the enrichment of fine chromite wastes (-0.1 mm); Technologies such as jet flotation, column flotation, high field intensity wet magnetic separators and multi gravity separator (MGS) are used. The multi gravity separator is a unique enhanced gravity separator for the separation of fine and ultra-fine minerals. The schematic diagrams of multi-gravity separator and its separation mechanism has shown in Figure 1.

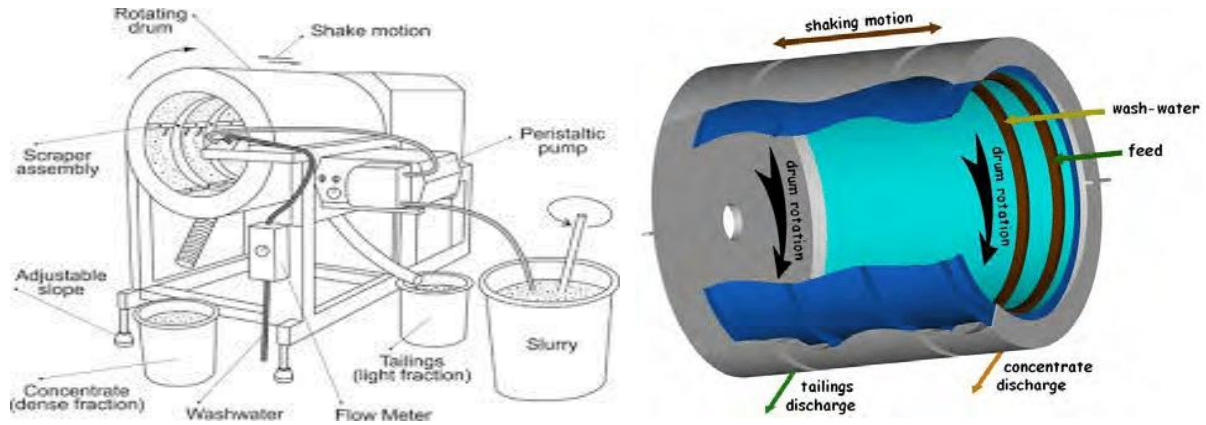


Figure 1. Schematic representation of MGS internal mechanism and working principle.

The parameters affecting the efficiency of separation on the MGS are reported as the drum speed (100 to 300 rpm), tilt angle (0° to 9°), shake amplitude (10 to 20 mm), shake frequency (4.0-5.7 cps), wash water (0 to 10 l/min) and pulp density of the feed slurry (10% to 50% by mass) [6]. In the experimental studies, MGS located in the Eti Krom INC./KEF region was used. MGS tests were carried out with the Salter Cyclones SCMG2 model double drum industrial scale device. In the KEF Concentrate Facility, MGS device connections were made to the hydrosizer 1st chamber outlet that feeds the slurry tables. Particle size analysis was performed by taking samples from the hydrosizer outlets before the connection was made. The operational parameters of the MGS device are given in Table 1.

Table 1. Operational Parameters of Industrial Scale MGS Device

Capacity	2 t/h per drum (on dry basis)
Feed particle size	2-100 μm
Pulp density of the feed slurry	%25-45
Drum rotation speed	85-150 rpm (max: 150 rpm-65 Hz-% 100 Ort: 140 rpm-60 Hz-%92,3 min: 85 rpm-36,3 Hz-%55,8)
Shake frequency	4-6,4 cps
Shake amplitude	15 mm
Shake speed	Max: 384 rpm-60 Hz-%100 Ort: 348 rpm-54,2 Hz-%90,3 Min: 240 rpm-37,4 Hz-%62,3
Drum tilt angle	$7,5^{\circ}$ (5° - 10° adjustable)
Wash Water	per drum Max. 0-40 l/s Ort. 12-25 l/s

According to the device parameters, the particle size of the feed material should be below 100 μm . Pulp density of the feed slurry should be between 25-45%. In MGS experiments, the feed particle size and some of the operational parameters (drum tilt angle, shake amplitude, etc.) were kept constant, drum rotation speed and shake speed were determined as variable. Then, sieve analysis and grain size analyses of fine-grained chromite were carried out. Microscopic

images of the feed, product and waste used in the studies were examined. Chemical analyses were performed using XRF in Eti Krom INC. Analysis Laboratory. The study was concluded by calculating the enrichment yield with the optimum working parameters.

RESULTS AND DISCUSSION

Before the experimental study, a sample was taken from the hydrosizer outlets and particle size analysis was performed. In order to determine the particle size distribution of the samples used in the experiments, sieve analyses were performed using sieves with dimensions of 600, 425, 300, 150, 106, 75, 53 and 38 microns. Sieve analysis results are given in Table 2. In addition, the grain size analysis is given in the graph in Figure 2.

Table 2. Sieve analysis results

Sampling place	Sample Weight (gr)									
hydrosizer 1st chamber	500									
hydrosizer 2nd chamber	500									
hydrosizer 3rd chamber	500									
Fractions	geometric mean (µm)	hydrosizer 1st chamber			hydrosizer 2nd chamber			hydrosizer 3rd chamber		
		(gr)	(%)	∑↓cumulative weight (%)	(gr)	(%)	∑↓cumulative weight (%)	(gr)	(%)	∑↓cumulative weight (%)
(+) 3.35 mm	3350	0.00	0.00	100	0.00	0.00	100	0.00	0.00	100
(-) 3.35 mm (+)2.36 mm	2812	0.00	0.00	100	0.00	0.00	100	0.00	0.00	100
(-) 2.36 mm (+) 1.7 mm	2003	0.00	0.00	100	0.00	0.00	100	0.00	0.00	100
(-) 1.7 mm (+)1.18 mm	1416	0.00	0.00	100	0.00	0.00	100	0.00	0.00	100
(-) 1.18 mm (+) 850 µm	1001	0.00	0.00	100	0.00	0.00	100	0.00	0.00	100
(-) 850 µm (+) 600 µm	714	0.95	0.19	99,81	0,25	0,05	99,95	1,14	0,,23	99,77
(-) 600 µm (+) 425 µm	505	3,34	0,65	99,16	1,17	0,23	99,72	3,18	0,64	99,14
(-) 425 µm (+) 300 µm	357	9,43	1,89	97,27	5,87	1,18	98,54	11,03	2,21	96,93
(-) 300 µm (+) 212 µm	252	22,19	4,45	92,82	18,02	3,61	94,92	27,2	5,44	91,49
(-) 212 µm (+) 150 µm	178	29,04	5,82	87,01	35,21	7,06	87,86	45,03	9,01	82,48
(-) 150 µm (+) 106 µm	126	43,68	8,75	78,25	53,65	10,76	77,1	81,22	16,25	66,23
(-) 106 µm (+) 75 µm	89	94,30	18,90	59,36	93,88	18,83	58,26	93,33	18,67	47,56
(-) 75 µm (+) 53 µm	63	100,03	20,04	39,31	85,18	17,09	41,18	85,65	17,14	30,42
(-) 53 µm (+) 38 µm	45	104,86	21,01	18,3	126,8	25,44	15,74	88,95	17,8	12,63
(-) 38 µm	38	91,34	18,30	0	78,47	15,74	0	63,12	12,63	0
Total		499,06	100,00		498,5	100		499,85	100	

According to the sieve analysis, 80% of the hydrosizer 1 and hydrosizer 2 mesh samples contain particles of 90 µm size, while 80% of the sample taken from the hydrosizer 3 mesh contain particles of 125 µm size.

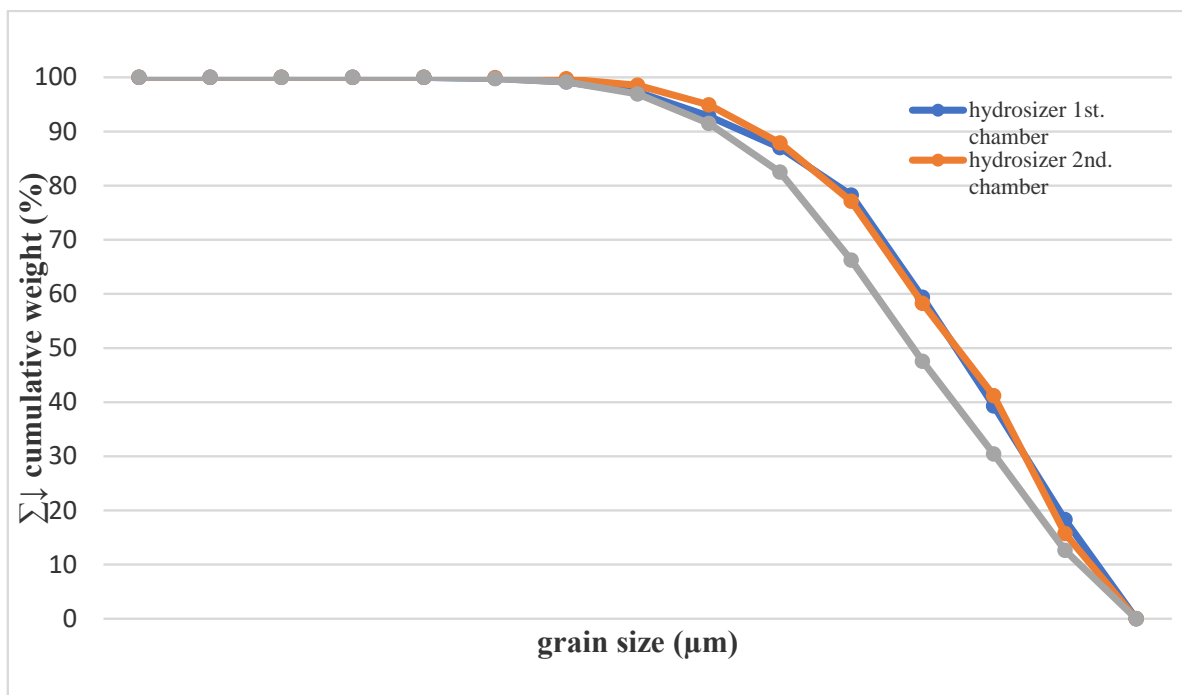


Figure 2. The grain sizes of the sieve analysis before MGS studies.

Aslan and Canbazoğlu mentioned the reduction of the liberalization grain size to increase the high grade and yield in MGS. The purpose of grinding the ore below 150-micron grain size is to achieve a further degree of liberation [3, 4]. According to MGS device parameters, the particle size of the feed material should be below 100 µm. Solid density should be between 25-45%. Due to the low solid density in the hydrosizer 3rd chamber, the hydrosizer 1st.chamber was used as eye feeding. In addition, slime tables were closed during the experiment. Then the working parameters were determined (Table 1). Sieve analysis was performed on the first concentrate, which was taken at a vibration rate of 60%. Sieve analysis results are given in Table 3. The size through which 80% of the concentrate passes was determined as 80 µm. The proportion of chromite grains released with decreasing grain size is linear. Studies have shown that yield increases with decreasing grain size [14-18].

Table 3. Sieve analysis of the product obtained in MGS

Sampling place	Sample Weight (gr)			
MGS Product	500			
Fractions	geometric mean (μm)	MGS Product		
		(gr)	(%)	Σ cumulative weight (%)
(+) 3.35 mm	3350	0.00	0.00	100
(-) 3.35 mm (+)2.36 mm	2812	0.00	0.00	100
(-) 2.36 mm (+) 1.7 mm	2003	0.00	0.00	100
(-) 1.7 mm (+)1.18 mm	1416	0.00	0.00	100
(-) 1.18 mm (+) 850 μm	1001	0.00	0.00	100
(-) 850 μm (+) 600 μm	714	0,00	0,00	100
(-) 600 μm (+) 425 μm	505	0,32	0,06	99,94
(-) 425 μm (+) 300 μm	357	2,08	0,42	99,52
(-) 300 μm (+) 212 μm	252	10,01	2,00	97,52
(-) 212 μm (+) 150 μm	178	26,71	5,33	92,19
(-) 150 μm (+) 106 μm	126	43,40	8,67	83,52
(-) 106 μm (+) 75 μm	89	114,62	22,89	60,63
(-) 75 μm (+) 53 μm	63	102,58	20,49	40,14
(-) 53 μm (+) 38 μm	45	149,23	29,80	10,34
(-) 38 μm	38	51,77	10,34	0
Total		500,72	100,00	

The images of the product and waste obtained as a result of MGS experiments are given in Figure 3. In addition, the microscope images of the product are given in Figure 4.



Figure 3. Images of feed, product and waste used in experimental studies

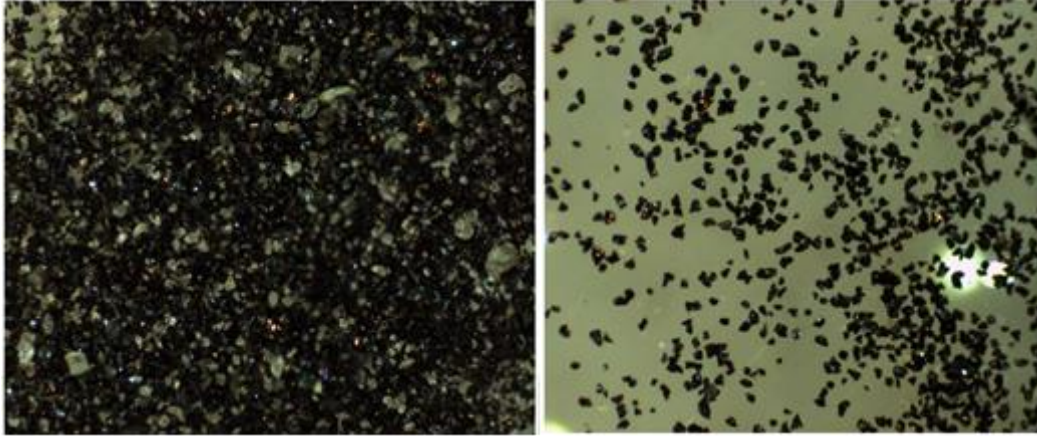


Figure 4. Microscope images of the product

Figure 3 shows that most of the product is separated from the waste. In addition, it is seen in Figure 4 that most of the product is chromite and free chromite grains. The importance of the size of the free chromium grains has been demonstrated in the applications made with MGS. It has been shown that the grain size should be larger than 40 μm for an ideal enrichment in these applications. In the studies, it was observed that the performance decreased in the grain size range from -40 μm to +20 μm . It was also observed that this decrease increased more in fine grains than 20 μm [19]. Gravity enrichment yield decreases with decreasing grain size (for -20 μm). However, this problem can be eliminated by increasing the centrifugal force and the fluid medium. Decreasing the grain size (below 20 μm) causes an increase in engine power and cost [19-21]. In the study, it is seen that the grain size varies between 100 μm and 20 μm (Fig. 2). For this reason, MGS study parameters affected the result more than grain size.

In experimental studies, drum rotation speed and frequency parameters were changed. The product, waste amounts and tenor obtained in the experimental studies are given in Table 4. Then, feed, product and waste were sent to Eti Krom Analysis Laboratory for XRF analysis. The XRF analyses are given in Table 5.

Experimental studies were carried out in Eti Krom INC./KEF under process conditions. In Table 4, it is seen that the yield decreases with the increase of the drum rotation speed. This may be due to the fact that the fine particles move away from the structure due to the centrifugal force. Optimum operating parameters (for yield and tenor) determined in the enrichment of chrome ore with MGS; drum rotation speed was 105 rpm, amplitude was 15 mm, drum tilt angle was 7.5°, frequency was 4.48 cps, wash water 4 l/s and feed grain size were -100 μm . With the optimum operating parameter, a concentrate with 43.7% Cr_2O_3 tenor was obtained from the feed material containing 15.39% Cr_2O_3 with 60% metal recovery efficiency.

Table 4. Experiment parameters and data obtained.

Test No	Drum Rotation Speed (rpm)	Drum Tilt Angle (°)	Wash Water (l/s)	Feed slurry (%)	Amplitude (mm)	Frequency (cps)	Feeding Amount (kg)	Feeding Tenor (%Cr ₂ O ₃)	Product Amount (kg)	Product Tenor (%Cr ₂ O ₃)	Waste Amount (kg)	Waste Tenor (%Cr ₂ O ₃)	Yield (%)
1	105	7,50	4	25	15	3,84	120	15,39	12	45,33	108	12,07	29
2	105	7,50	4	25	15	4,48	120	15,39	25	43,7	95	7,78	60
3	105	7,50	4	25	15	5,12	120	15,39	22	43,91	98	8,96	52
4	105	7,50	4	25	15	5,31	120	15,39	17	43,41	103	10,64	41
5	120	7,50	4	25	15	3,84	120	15,39	2	36,41	118	15,02	4
6	120	7,50	4	25	15	4,48	120	15,39	5	36,82	115	14,49	10
7	120	7,50	4	25	15	5,12	120	15,39	17	40,98	103	11,07	38
8	120	7,50	4	25	15	5,76	120	15,39	10	38,98	110	13,19	22
9	120	7,50	4	25	15	6,4	120	15,39	8	39,41	112	13,78	16
10	135	7,50	4	25	15	5,76	120	15,39	11	39,11	109	13,06	23
11	135	7,50	4	25	15	4,48	120	15,39	7	33,21	113	14,3	12
12	135	7,50	4	25	15	5,12	120	15,39	12	32,01	108	13,49	21
13	135	7,50	4	25	15	5,76	120	15,39	16	31,58	104	12,92	27

Table 5. XRF analysis results of product and waste obtained in different parameters.

Sample	Drum Rotation Speed (rpm)	Frequency (cps)	%Cr ₂ O ₃	%Fe ₂ O ₃	%Al ₂ O ₃	%MgO	%SiO ₂	%CaO	%NiO	%TiO ₂	Cr/Fe
Feed			15,39	9,54	5,3	36,63	26,2	0,54	0,29	0,12	1,59
Product	105	3,84	45,33	16,7	15,13	17,34	3,85	0,08	0,14	0,27	2,68
Waste	105	3,84	12,07	8,44	3,71	40,13	31,51	0,54	0,32	0,09	1,41
Product	105	4,48	43,7	16,41	14,66	18,17	4,86	0,11	0,15	0,26	2,63
Waste	105	4,48	7,78	5,87	5,69	40,3	33,41	0,66	0,35	0,09	1,32
Product	105	5,12	43,91	16,04	15,32	15,37	2,68	0,07	0,13	0,21	2,68
Waste	105	5,12	8,96	6,86	6,62	39,86	30,62	0,64	0,34	0,1	1,3
Product	105	5,31	43,41	16,11	14,35	18,92	5,07	0,09	0,15	0,26	2,66
Waste	105	5,31	10,64	7,15	7,06	38,24	30,58	0,5	0,32	0,12	1,48
Product	120	3,84	36,41	14,61	12,86	23,34	9,05	0,12	0,18	0,23	2,48
Waste	120	3,84	15,02	9,5	5,38	36,45	26,39	0,69	0,28	0,13	1,56
Product	120	4,48	36,82	14,89	12,99	23,01	9,12	0,12	0,18	0,24	2,45
Waste	120	4,48	14,49	9,39	5,3	36,62	26,58	0,67	0,29	0,12	1,53
Product	120	5,12	40,98	15,6	14,45	19,89	5,77	0,1	0,16	0,26	2,6
Waste	120	5,12	11,07	8,61	4,5	37,5	28,39	0,72	0,32	0,1	1,27
Product	120	5,76	38,98	15,06	13,61	21,84	7,45	0,11	0,17	0,24	2,56
Waste	120	5,76	13,19	7,37	6,5	36,76	28,89	0,61	0,26	0,15	1,78
Product	120	6,40	39,41	15,19	13,94	21,4	7,03	0,11	0,17	0,24	2,57
Waste	120	6,40	13,78	8,99	4,83	37,21	27,53	0,74	0,29	0,12	1,52
Product	135	5,76	39,11	15,34	13,56	20,82	6,73	0,11	0,17	0,24	2,52
Waste	135	5,76	13,06	8,02	4,67	39,42	27,12	0,15	0,27	0,12	1,62
Product	135	4,48	33,21	14,37	10,28	25,18	11,23	0,18	0,21	0,2	2,3
Waste	135	4,48	14,3	8,84	5,27	36,65	27,33	0,73	0,28	0,13	1,61
Product	135	5,12	32,01	13,44	11,16	27,02	12,74	0,17	0,2	0,22	2,35
Waste	135	5,12	13,49	9,01	4,72	37,66	27,96	0,78	0,29	0,12	1,48
Product	135	5,76	31,58	13,76	11,06	26,92	13,08	0,15	0,2	0,21	2,27
Waste	135	5,76	12,92	8,89	4,19	39,63	30,57	0,52	0,31	0,1	1,44

The results were balanced as a result of the obtained data and the yield percentages obtained according to the results are given in Table 6. In Table 6, it is seen that the balanced yield is 60% and the yield is 71.33% according to the results. Özgen studied on enrichment of Fethiye/Üç Köprü chromite plant wastes with knelson and Falcon Concentrator. As a result, Falcon Concentrator obtained 67.25% yield and 43.89% Cr₂O₃ tenor from chromite waste containing 13.27% Cr₂O₃. In addition, Knelson Concentrator obtained 72.51% yield and 47.32% Cr₂O₃ tenor [22]. In the study, 60% yield and 43.7% Cr₂O₃ tenor were obtained with MGS from fine chromite concentrate containing 15.39% Cr₂O₃. This study is important in that it was carried

out under process conditions, fine chromite ore was used and only two parameters were changed in MGS. This study has shown that with an MGS system to be added to classical gravity enrichment plants such as Eti Krom/KEF Concentrate Plant INC., the overall plant efficiency can be increased by evaluating very fine waste.

Table 6. The highest yield values obtained according to the results.

balanced							
Flow No		Pulp Weight (kg/h)	W/W	Solid Weight (kg)	Cr ₂ O ₃ (%)	Cr ₂ O ₃ (gr)	yield (%)
1	Calculated Feed	480	25%	120	15,39	18	100
2	Added Water	240	0%	0	0	0	0
3	Product	126	20%	25	43,91	11	60,1
4	Waste	594	15,96%	95	7,78	7	39,9
according to the results							
Flow No		Pulp Weight (kg/h)	W/W	Solid Weight (kg)	Cr ₂ O ₃ (%)	Cr ₂ O ₃ (gr)	yield (%)
1	Calculated Feed	480	25%	120	15,39	18	100
2	Added Water	240	0%	0	0	0	0
3	Product	150	20%	30	43,91	13	71,33
4	Waste	570	15,79%	90	7,78	7	37,91

CONCLUSIONS

In this study, fine-grained chromite in Elazig Eti Krom was enriched with a multi-gravity separator (MGS). In addition, yield analyses were calculated.

Enrichment with optimum operating parameters was also obtained from the feed material containing 15.39% Cr₂O₃ and a concentrate with 43.7% Cr₂O₃ grade with 60% yield. In enrichment studies with MGS, it was observed that drum rotation speed and tilt angle were the most effective operating parameters, while other variables (wash water amount, feed solid ratio, vibration amplitude and frequency) were less effective.

According to the results obtained, it has been shown that the overall plant efficiency can be increased by evaluating very fine wastes with an MGS system to be added to classical gravity enrichment plants such as Eti Krom/KEF Concentrate Plant.

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REFERENCES

- [1] Sönmez, E., Turgut, B., (1998), Enrichment of low-grade Karaburhan chromite ores by gravitational methods. In: Atak, S., Onal, G., Celik, T. (Eds.), *Innovation in Mineral and Coal Processing*. Balkema, Rotterdam, The Netherlands, pp. 723–726.
- [2] Murty, Y. R., Tripathy, S. K., Kumar, C. R., (2011), Chrome ore beneficiation challenges & opportunities-A review, *Minerals Engineering*, 24, 375-380.
- [3] Aslan, N., Canbazoglu, M., (1995), Investigations on Multi-Gravity Separation Concentration of Fine Chromite Ores, pp. 437-442.
- [4] Aslan, N., Canbazoglu, M., (1996), Processing of Thickener Underflow from Celestite Concentrator by Multi-Gravity Separator, M. Kemal, V. Arslan, A. Akar (Eds.), *Changing Scopes in Mineral Processing*, A.A. Balkema, pp. 103-106.
- [5] Özbayoğlu, G., Atalay, M. U., (2000), Beneficiation of Bastnaesite by a Multi-Gravity Separator *Journal of Alloys and Compounds*, 303–304, pp. 520-523.
- [6] Aslan, N., (2008), Application of Response Surface Methodology and Central Composite Rotatable Design for Modeling and Optimization of A Multi-Gravity Separator for Chromite Concentration, *Powder Technology*, Vol. 185, 1 (10), pp. 80-86.
- [7] Kincl, M., Turk, S., Vrečer, F., (2005), Application of experimental design methodology in development and optimization of drug release method, *International Journal of Pharmaceutics*, 291, pp. 39-49.
- [8] Obeng, D. P., Morrell, S., Napier-Munn T. J., (2005), Application of central composite rotatable design to modeling the effect of some operating variables on the performance of the three-product cyclone *International Journal of Mineral Processing*, 76, pp. 181-192.
- [9] Aslan, N., (2007), Modeling and Optimization of Multi Gravity Separator to Produce Celestite Concentrate, *Powder Technology*, 174, pp. 127-133.
- [10] Aslan, N., Cebeci, Y., (2007), Application of Box–Behnken design and response surface methodology for modeling of some Turkish coals *Fuel*, 86, pp. 90-97.
- [11] Gülcan, E., Gülsoy, Ö. Y., Ergün, Ş. L., (2022), Gravity beneficiation flowsheet development studies for manganese ore, *Bulletin of the Earth Sciences Application and Research Centre of Hacettepe University*, 43 (3), pp. 263-278.
- [12] Luttrell, G.H., Honaker, R.Q., Phillips, D.I., (1995), Enhanced gravity separators: new alternatives for fine coal cleaning, *Proceeding of 12th International Coal Preparation Conference*, Lexington, Kentucky, pp. 281-285.
- [13] Bhaskar, K.U., Govindarajan, B., Barnwal, J.P., Venugopal, R., Jakhu, M.R., Rao, T.C., (2002), Performance and modeling studies of an MGS for graphite rejection in a lead concentrate, *International Journal of Mineral Processing*, 67 (1-4) pp. 59-70.
- [14] Tucker, P., Chan, S.L., Mozley, R.H., Childs, G.J.C., (1991), Modelling the multigravity separator, *XVII International Mineral Processing Congress*, Dresden, Germany, pp., 77-89.
- [15] Yerriswamy, P., Barnwal, J.P., Govindarajan, B., Gupta, B.K., Rao, T.C. (2002), Influence of variables of multigravity separator on rejection of graphite from a lead concentrate, *Mineral Processing and Extractive Metallurgy*, 111 (3) pp., 156-159.
- [16] Tripathy, S. K., Yanamandra, R. M., Tathaveadkar, V., Denys, M. B., (2012), Efficacy of Multi Gravity Separator for Concentrating Ferruginous Chromite Fines, *Journal of Mining and Metallurgy*, 48 A (1), pp., 39-49.
- [17] Rath, R. K., Dey, B., Mohanta, M. K., Prusty, L. K., And Singh, R., (2017). “Recovery of chromite values from tailings of COB plant using enhanced gravity concentrator”, *International Conference on Mineral Processing Technology*, Indian Institute of Mineral Engineers, Chennai, 644-649.

- [18] Özgen, S. (2012). "Clean Chromite Production from Fine Chromite Tailings by Combination of Multi Gravity Separator and Hydrocyclone", *Separation Science and Technology*, 47 (2012) 1948-1956.
- [19] Traore, A., Conil, P., Houot, R., Save, M., (1995). "An evaluation of the Mozley MGS for fine particle gravity separation," *Miner. Eng.*, Vol. 8 (7), pp. 767–778.
- [20] Ancia, P, H., Frenay, J., Dandois, H., (1997). "Comparison of the Knelson and Falcon centrifugal separators," in *Innovation in physical separation technologies: Richard Mozley Symposium*, pp. 53–62.
- [21] McKeon, T., Luttrell, H., (2012). "Optimization of multistage circuits for gravity concentration of heavy mineral sands," *Miner. Metall. Process.*, Vol. 29 (1), pp. 1-5.
- [22] Özgen, S., (2020). 'Enrichment of Chromite Processing Plant Tailing with Knelson and Falcon Concentrator', *Dicle University Journal of Engineering*, Vol. 11(39), pp. 1233-1239.

**HASHİMOTO TİROİDİTLİ ANNELERİN ÇOCUKLARINDA ERKEN USG –
DOPPLER BULGULARI**

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ÖZET

Hashimotolu annelerin çocuklarında erken ultrasonografi (USG) ve Renkli Doppler (RDUSG) bulguları tesbit edilmiştir. Çalışmamızda 34 Hashimoto tanısı konulmuş annelere ve bunların toplam 42 çocuğuna USG ve RDUSG incelemeleri yapılmış, elde edilen bulgular retrospektif olarak araştırılmıştır. 42 çocuktan 11'inde (%26.2) normal USG bulguları izlenmiştir. 16 (%38.1) çocukta milimetrik boyutu aşmayan, sayıca az TI-RADS 1 nodüller saptanmıştır. Bu çocuklarda gland normal boyut ve ekopattern özelliği göstermekteydi. 9 (%21.4) çocukta erken evre Hashimoto bulguları tesbit edilmiştir. Bu bulgular glandda diffüz heterojen pattern, yamalı hipoeoik sahalar, psödonodüler infiltrasyon sahaları ve hiperekojen fibröz septal yapılar olarak özetlenebilir. Bu vakaların hiçbirinde glandda ekspansiyon veya hipervasülarizasyon saptanmamıştır. 6 (%14.3) çocukta ise erken evre Hashimoto bulguları yanında TI-RADS 1 mikronodüller saptanmıştır. Hashimoto tiroiditi etiyolojik olarak genetik yatkınlığı olan bireylerde çevresel faktörlerin etkisiyle ortaya çıktığı düşünülmektedir. Tanı konulmamış hipotiroid çocuklarda büyüme hızında yavaşlama görülebilir. Tedavi edilmezse bu durumda fiziksel büyüme geriliği ve zeka geriliği gibi yıkıcı sonuçları olabilir. Bu da erken tanının önemini daha da artırmaktadır. Hashimoto tanısı almış annelerin çocuklarında, noninvaziv bir yöntem olan USG + RDUSG tetkiki tarama amaçlı kullanılarak erken evre bulgular tesbit edilebilmektedir. Böylelikle olguların erken dönemde tedavi ve takip olanağı şansı olmaktadır.

GİRİŞ

Hashimoto tiroiditinde erken tanı, tedavi ve takip önemlidir. Hashimotolu annelerin çocuklarında erken ultrasonografi (USG) ve Renkli Doppler (RDUSG) bulgularını tesbit etmek erken tanı ile tedavi ve takip olanağı sağlamaktır.

MATERYAL VE METOD

USG ve RDUSG incelemeleri GE Logiq 730 pro, GE Logiq 9, GE Logiq S7 expert cihazları ile 4-15MHz, 5-13MHz lineer transducerler kullanılarak gerçekleştirildi. Her iki tiroid lobu ve isthmus farklı düzlemlerde incelendi.

Vaskülarizasyon özellikleri değerlendirildi.

Nodül varlığında TI-RADS skorlaması yapıldı.

Çalışmamızda 34 Hashimoto tanısı konulmuş annelere ve bunların toplam 42 çocuğuna USG ve RDUSG incelemeleri yapılmış, elde edilen bulgular retrospektif olarak araştırılmıştır.

BULGULAR

Çocukların yaş aralıkları 4-13, ortalaması 7.5 dur. 22'si kız, 20 tanesi erkektir.

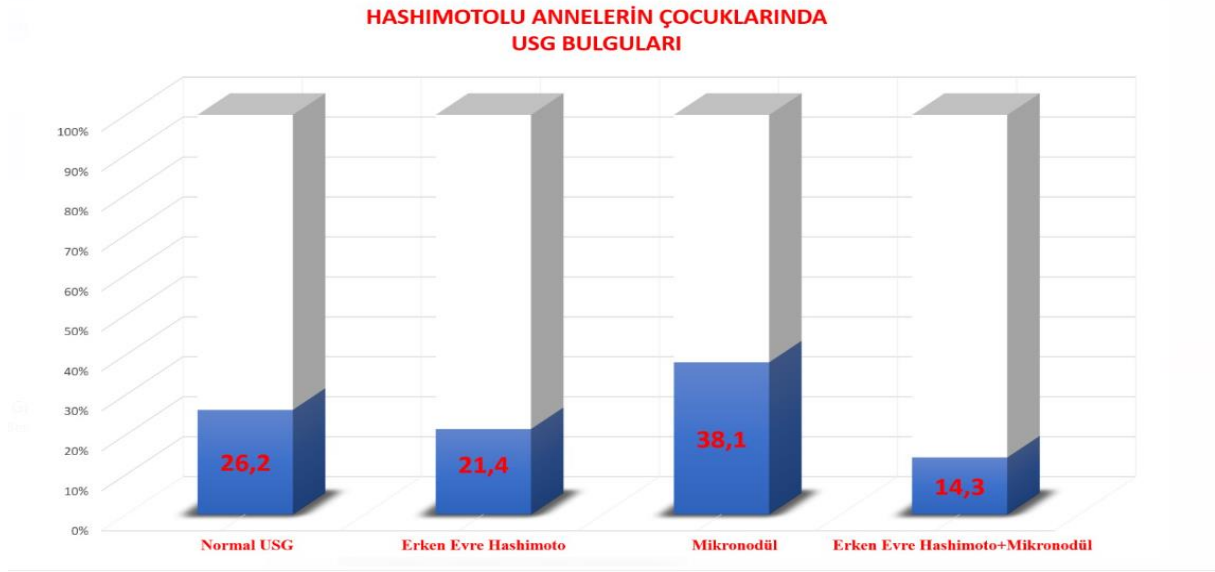
42 çocuktan 11'inde (%26.2) normal USG bulguları izlenmiştir.

16 (%38.1) çocukta milimetrik boyutu aşmayan, sayıca az TI-RADS 1 nodüller saptanmıştır.

Bu çocuklarda gland normal boyut ve ekopattern özelliği göstermekteydi.

9 (%21.4) çocukta erken evre Hashimoto bulguları tesbit edilmiştir. Bu bulgular glandda diffüz heterojen pattern, yamalı hipoekoik sahalar, psödonodüler infiltrasyon sahaları ve hiperekojen fibröz septal yapılar olarak özetlenebilir. Bu vakaların hiçbirinde glandda ekspansiyon veya hipervasülarizasyon saptanmamıştır.

6 (%14.3) çocukta ise erken evre Hashimoto bulguları yanında TI-RADS 1 mikronodüller saptanmıştır.



TARTIŞMA

Kronik otoimmün tiroidit ya da kronik lenfositik tiroidit olarak bilinen Hashimoto tiroiditi en sık orta yaşlı kadınlarda görülmekle birlikte çocukluk yaş grubunda en sık görülen tiroidittir ve edinsel hipotiroidizmin ana nedenidir. Hashimoto hastalığı çocukların yaklaşık %1'ini etkilemektedir. Çeşitli hücre ve antikor aracılı immün sürece ve lenfositik infiltrasyona bağlı gelişen tiroid foliküllerinin harabiyeti ile karakterizedir.

Etiyolojik olarak genetik yatkınlığı olan bireylerde çevresel faktörlerin etkisiyle ortaya çıktığı düşünülmektedir.

Tanı konulmamış hipotiroid çocuklarda büyüme hızında yavaşlama görülebilir.

Ek semptomlar arasında halsizlik, solgunluk, kuru ve kaşıntılı kafa derisi, soğuğa karşı artan hassasiyet ve kabızlık yer alır. Tedavi edilmezse bu durumda fiziksel büyüme geriliği ve zeka geriliği gibi yıkıcı sonuçları olabilir.

Hipotiroidizm çocuklarda her yaşta, hatta infantlarda bile tiroid problemi ile doğabilir.

Ayrıca okul çağındaki çocuklar arasında en yaygın endokrin bozukluk tiroid kaynaklıdır. Hashimoto hastalığının yıllarca asemptomatik olarak seyredildiği bilinmektedir.

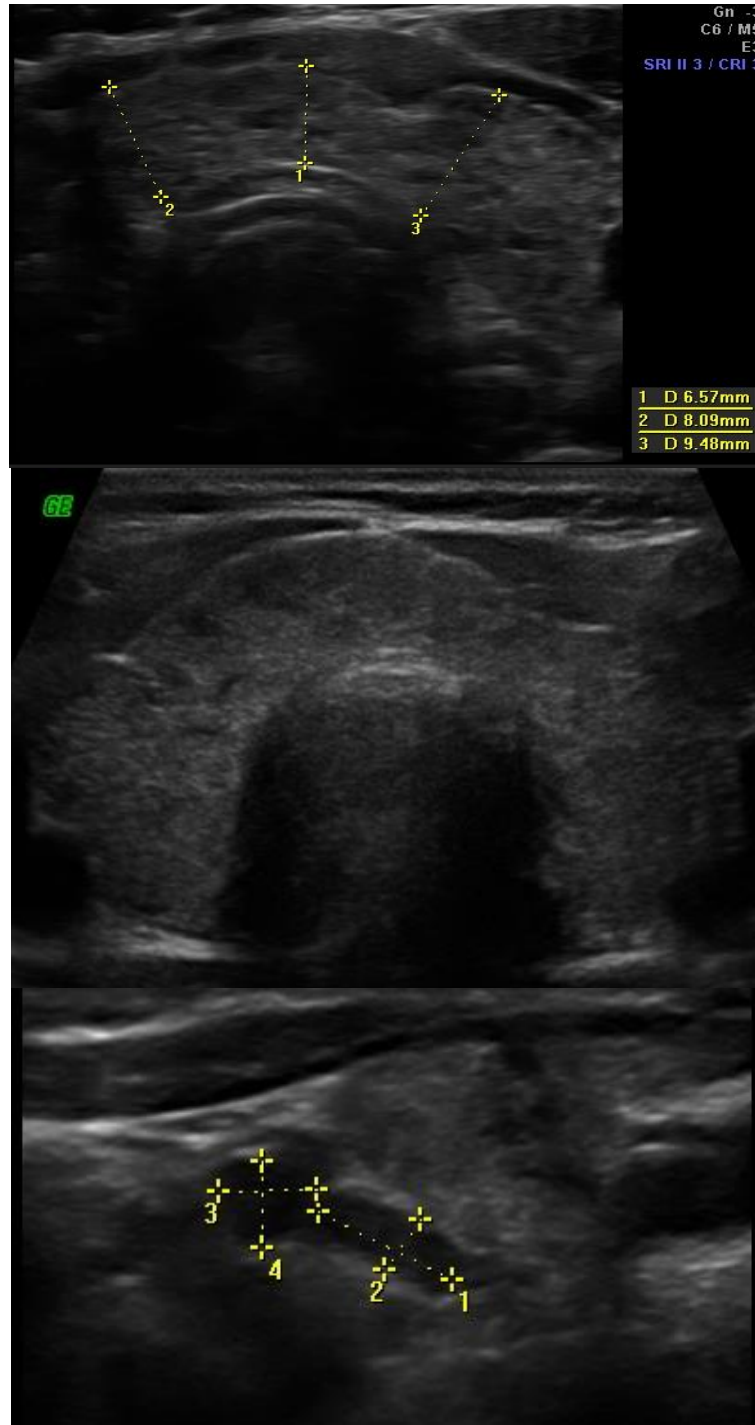
Bu da erken tanının önemini daha da artırmaktadır.

SONUÇ

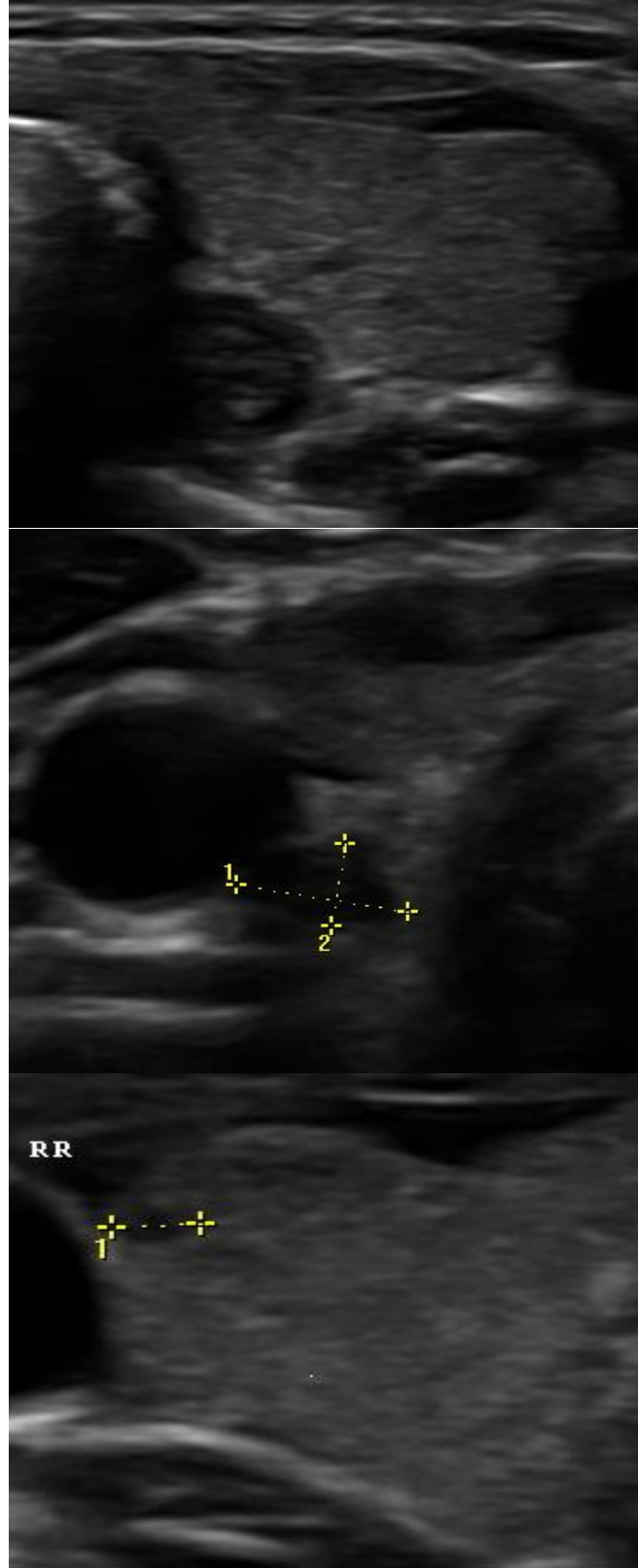
Hashimoto tanısı almış annelerin çocuklarında, noninvaziv bir yöntem olan USG + RDUSG tetkiki tarama amaçlı kullanılarak erken evre bulgular tesbit edilebilmektedir.

Böylelikle olguların erken dönemde tedavi ve takip olanağı şansı olmaktadır.

OLGU 1

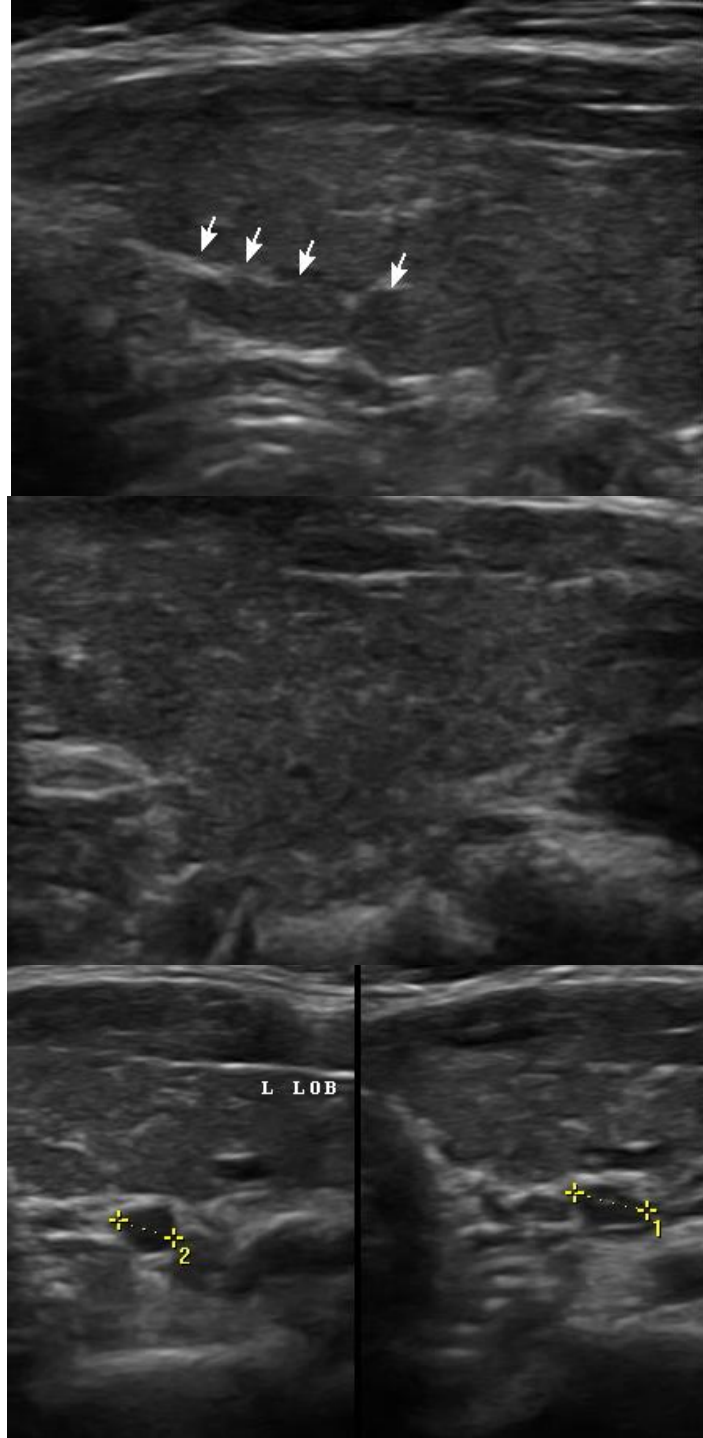


Klinik olarak sadece terleme şikayeti olan, 39 yaşında takipteki annede; glandda ekspansiyon, diffüz heterojen pattern, psödonodüler hipoekoik infiltrasyonlar ve infratiroidal lenf nodları varlığı ile karakterize Hashimoto bulguları

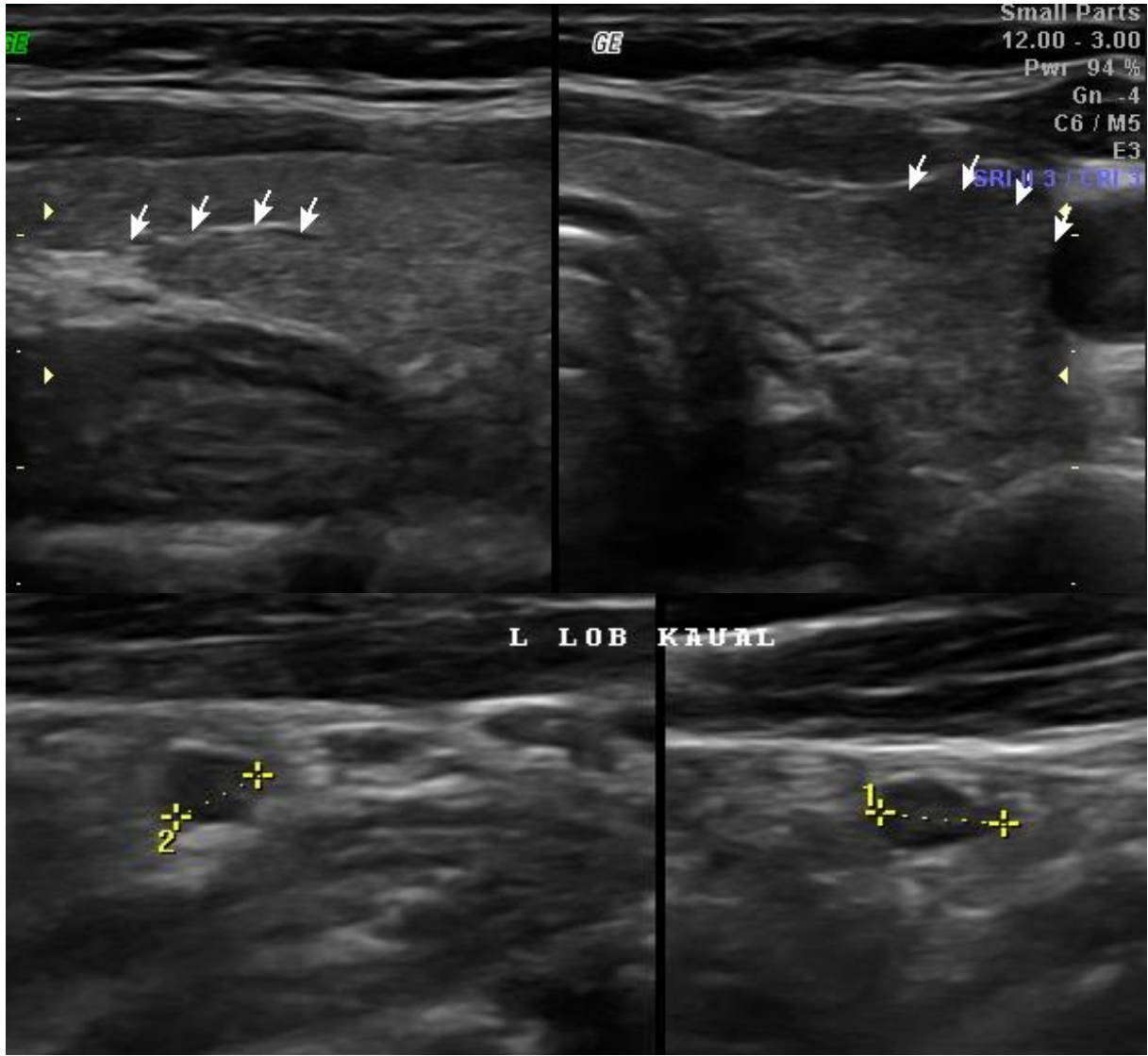


Bu annenin 4 yaşında klinik şikayeti bulunmayan kız çocuğunda; normal boyuttaki glandda diffüz heterojen yamalı hipoekoik pattern, infratiroidal birkaç adet lenf nodlarının varlığıyla karakterize erken evre Hashimoto bulguları ve sağ lobda 1, sol lobda 2 adet olmak üzere toplam 3 adet, 2-3mm çaplı TI-RADS 1 nodüller

OLGU 2



Klinik olarak seyrek çarpıntı ve avuç içi yanma şikayeti olan, 38 yaşında takipteki anne; normal boyuttaki glandda diffüz heterojen pattern, alt pollerde hiperekojen karakterde septal yapılar ve infratiroidal lenf nodları varlığı ile karakterize Hashimoto bulguları

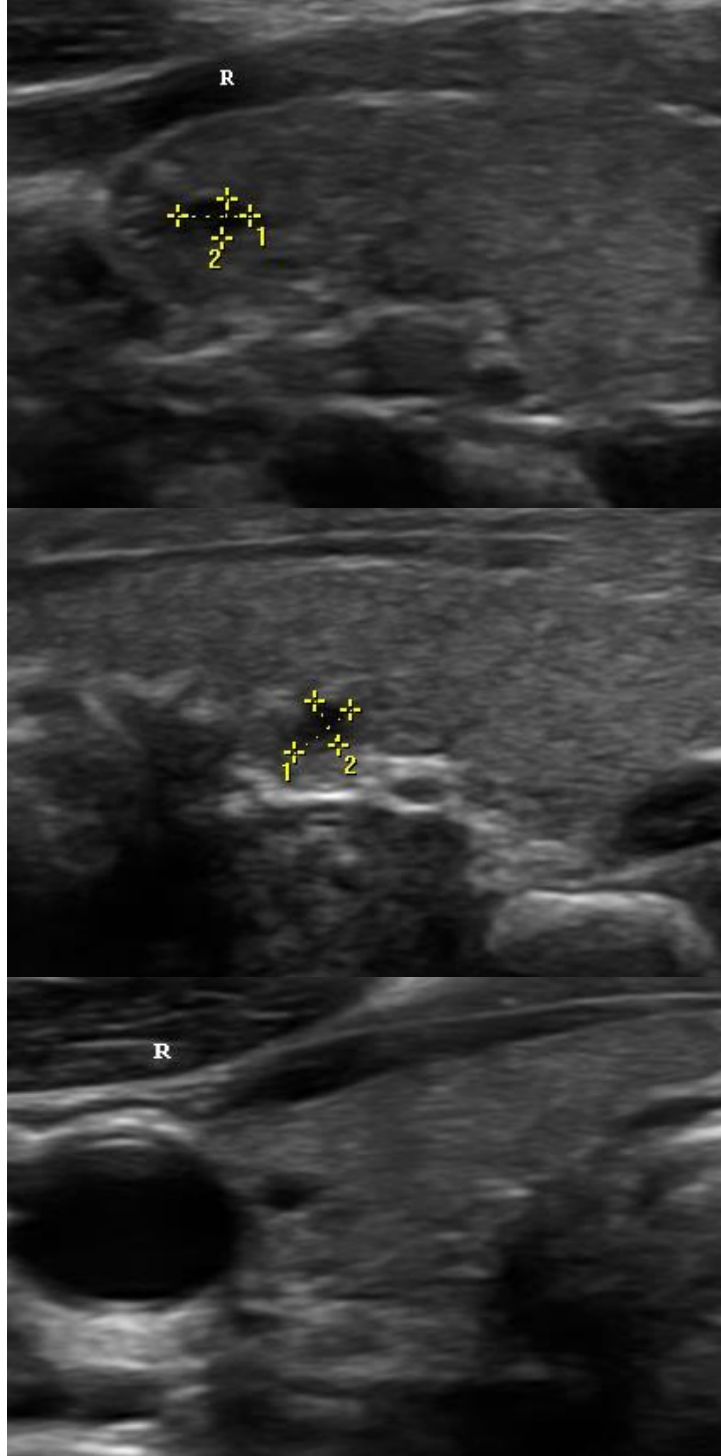


Bu annenin 12.5 yaşında klinik şikayeti bulunmayan erkek çocuğunda; normal boyuttaki glandda diffüz heterojen yamalı hipoekoik pattern, yer yer psödonodüler alanlar ve infratiroidal birkaç adet lenf nodlarının varlığıyla karakterize erken evre Hashimoto bulguları. Nodül gelişimi saptanmadı.

OLGU 3



Klinik olarak kilo kaybı ve ellerde titreme şikayeti olan, 31 yaşında annede; normal boyuttaki glandda diffüz heterojen pattern, psödonodüler hipoekoik infiltrasyonlar ve peritiroidal lenf nodları varlığı ile karakterize Hashimoto bulguları



Bu annenin klinik şikayetleri bulunmayan 6 yaşındaki kız ve 7 yaşındaki erkek çocuklarında; normal boyut ve ekopatterndeki glandlarda 2.0-2.5mm çaplı birer adet TI-RADS 1 soliter nodüller

ANALYSIS AND DESIGN OF RESIDENTIAL BUILDING ON WIND LOAD
ANALYSIS BY USING STAAD PRO

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ABSTRACT

On demand of growing population construction of high-rise building is being made compulsory for avoiding land scarcity in future. As these high rise buildings are difficult to design manually so many computerized commercial software's are available for analysing a structure. The structural elements are designed manually using IS 456 and IS 875. Here STAAD PRO is used to analyse the residential building. STAAD PRO is also one of the software used to structural analysis and design. Analysing structures, maximum shear force, bending moments and maximum displacements are compared by using STAAD PRO. A general structure of 7 storeys is considered for analysis and design considering wind loads in according with Indian codal provision.

Keywords: Wind load, Displacement, Shear force, Bending moment.

1. INTRODUCTION

A Building is a structure with a roof and walls standing more or less permanently in one place, such as a House or Factory. Buildings constructed in a variety of sizes, shapes and functions from building materials available. Buildings serve several societal needs primarily as shelter from weather, security, living space, privacy, to store belongings, and to comfortably live and work).

Residential Buildings

These building include any building in which sleeping accommodation provides for normal residential purposes, with or without cooking and dining facilities. It includes single or multi-family dwellings, apartment houses, lodgings or rooming houses, restaurants, hostels, dormitories and residential hostels.

Educational Buildings

These include any building used for school, college or day-care purposes involving assembly for instruction, education or recreation and which is not covered by assembly buildings.

Institutional Buildings

These buildings are used for different purposes, such as medical or other treatment or care of persons suffering from physical or mental illness, diseases or infirmity, care of infants, convalescents or aged persons and for penal detention in which the liberty of the inmates is restricted. Institutional buildings ordinarily provide sleeping accommodation

Assembly Buildings

These are the buildings where groups of people meet or gather for amusement, recreation, social, religious, assembly halls, city halls, marriage halls, exhibition halls, museum places of work ship, etc.

Business Buildings

These buildings are used for transaction of business, for keeping of accounts and records and for similar purposes, offices, banks, professional establishments, courts houses, libraries. The principal function of these buildings is transaction of public business and keeping of books and records.

Mercantile Buildings

These buildings are used as shops, stores, market, for display a sale of merchandise either wholesale or retail, office, shops, storage service facilities incidental to the sale of merchandise and located in the same building.

Industrial Buildings

These are buildings where products or materials of all kinds and properties are fabrication, assembled, manufactured or processed, as assembly plant, laboratories, dry cleaning plants, power plants, pumping stations, smoke houses, laundries etc.

Storage Buildings

These are used primarily for the storage or sheltering of goods, wares or merchandise vehicles and animals, as ware houses, cold storage, garages, trucks. In this Project a Residential building is designed. Residential Buildings are can be constructed based on the size of the site and Economy of the people such as High class, Middle class and Low-class people. In this project a residential building facilitated with all required rooms such as living room, Kitchen etc., with required plot size is designed.

2. SOFTWARES USED

The following software are used for the analysis and design of residential building in this project:

AUTOCAD Software

STAAD PRO Software

AUTOCAD

AUTOCAD is a commercial computer-aided design (CAD) and drafting software application. Developed and marketed by AutoCAD was first released in December 1982 as a desktop app running on microcomputers with internal graphics controllers. Before AutoCAD was introduced, most commercial CAD programs ran on mainframe computers or minicomputers, with each CAD operator (user) working at a separate graphics terminal AUTO CAD is used across a wide range of industries, by architects, project managers, engineers, graphic designers, and many other professionals. The main use of AUTOCAD software is to draw or drafting the plan, elevation and sections of structures in 2D or 3D view For the present project AUTOCAD is used for representing the plan of considered Residential Building.

STAAD PRO

STAAD (STAAD Pro) is a structural analysis and design computer program originally developed by Research Engineers International at Yorba Linda, CA in 1997. In late 2005, Research Engineers International was bought by Bentley Systems. The commercial version, STAAD.PRO, is one of the most widely used structural analysis and design soft ware products worldwide. It supports several steels, concrete and timber design codes. The design of considered Residential Building design is done with the help of STAAD PRO software.

3. OBJECTIVES

1. To analyze the residential building for dead load , live load wind load using STAAD PRO.
2. To design RCC Residential building using STAAD PRO.
3. To validate the manual calculation with analytical results.

4. LITERATURE REVIEW

1.ROHITH KUMAR “ANALYSIS AND DESIGN OF MULTI STOREY STRUCTURE USING ETABS”:

This project investigates that most buildings are of straight forward geometry with horizontal beams and vertical columns. Although any building configuration is possible with ETABS in most cases, a simple rigid system defined by horizontal floors and vertical columns lines can establish building geometry with minimum effort, most of the floor’s level in buildings are similar. This can reduce the modelling and design time. The main aim of this project is to complete a multi storey building and to ensure that the structure is safe against gravity loading conditions and to fulfil the function for which the structures have been built for the design of structure dead loads and live loads have been considered. The analysis and design of the structure is done by using Etabs Software and also with the confirmation of IS 456-2000.

2. SHIVHAR ’STUDY ON ANALYSIS AND DESIGN OF A COMMERCIAL BUILDING’.

This paper investigates about the Analysis and Design of a Commercial Building by using ETABS software and also gain sufficient knowledge in complete Analysis and Design Procedure. In this research they checked on G+4 Commercial Building frame made up of Reinforced Concrete. Providing with all necessary specifications. This project mostly stressed on Indian Standard Code Books and National Building Code (NBC) because planning and design of any building will be recognized as per the standards by these design aids. This paper provides information about the design procedure Analysis Results i.e. Shear Force, Bending Moment, Deflections etc. and various IS Code books. 9

3. MADHURIMA DUTTA “WIND ANALYSIS AND DESIGN OF A MULTI STORIED STRUCTURAL FRAME CONSIDERING USING STAAD PRO”:

This study was carried out for a few load cases and only wind load was taken as dynamic load. Different combination of load cases can be considered further with different kinds of dynamic loads as for a multi storied building dynamic loads play a major role.

4. S. RAMANARAYAN “SEISMIC ANALYSIS AND DESIGN OF RESIDENTIAL BUILDING (G+4) USING STAADPRO (2018)”:

From this journal we are understood the analysis and design part of residential building using Staid pro. And they analyzed structure is safe against seismic load.

5. SUPRAJA DUPPATI “Earthquake resistant design of G + 5 multi-storey residential building using STAAD.pro (2021)”:

In this journal they have done analysis on earth quake resistance in various zones (3,4,5) of residential building and they have taken shear force, bending moments, and deflection values.

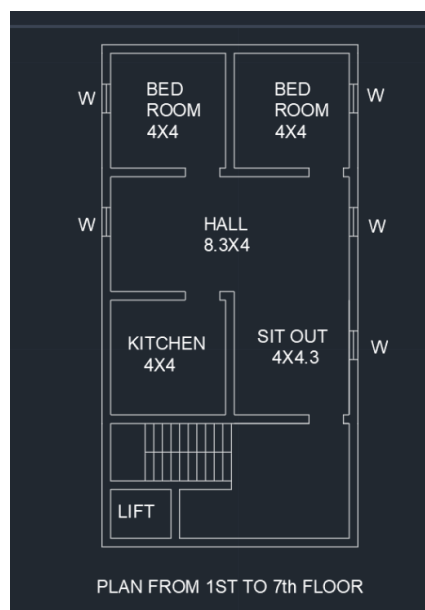
5. PLANNING OF A BUILDING

Planning is a projected course of action and through planning we can achieve goal. Planning is deciding in advance what to do, how to do it, when to do it and who to do it

Stages in structural planning

Once the type of structure is finalized and planned, design of structure involves the corresponding stages in the planning. This is the main stage which decides the total

- a) Column positioning
- b) Orientation of columns
- c) Beam location
- d) Spanning of slabs
- e) Layout and planning of stairs and
- f) Type of footing



Plan from 1st to 7th floor

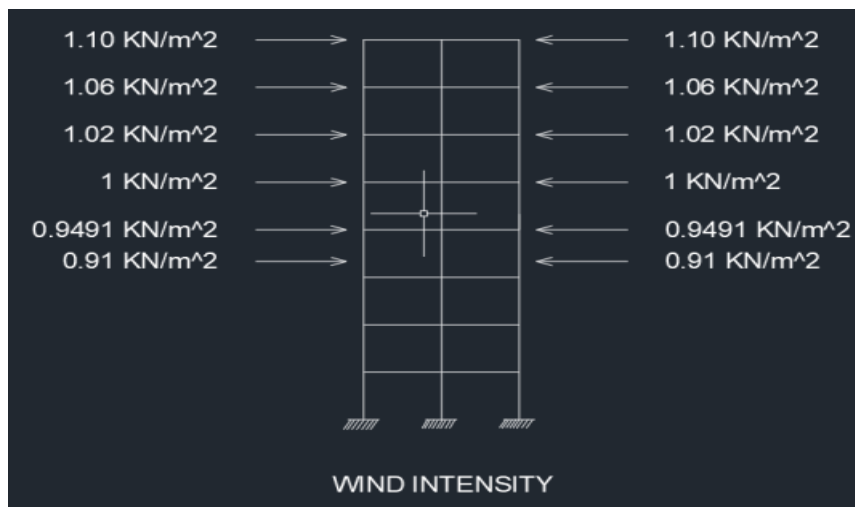
6. LOADS AND CALCULATIONS

Wind Load Calculations

- Basic wind speed at 10 m for height for some important cities/town

WI ND LO AD S ON ST OR EY	STOR EY HEIG HT (M)	Total HEIG HT (M)	K2	Vz(m/ sec)	Pz (KN/ m ²)	Pd (KN/ m ²)	Eff height (M)	Cf	F(x) Along +ve (KN)	F(x) Along -ve (KN)	Cf	F (z)Along +ve (KN)	F(Z) Along -ve (KN)
1(G)	3	3	1	39	0.91	0.637	0.15	1.6	12.23	12.23	1.25	19.11	19.11
2	3	6	1	39	0.91	0.637	3	1.6	24.46	24.46	1.25	38.22	38.22
3	3	9	1	39	0.91	0.637	3	1.6	24.46	24.46	1.25	38.22	38.22
4	3	12	1.02	39.78	0.949	0.664	3	1.6	25.46	25.46	1.25	39.84	39.84
5	3	15	1.05	40.95	1	0.7	3	1.6	26.88	26.88	1.25	42	42
6	3	18	1.062	41.418	1.02	0.714	3	1.6	27.41	27.41	1.25	42.84	42.84
7	3	21	1.078	42.042	1.06	0.742	3	1.6	28.49	28.49	1.25	44.52	44.52
8	3	24	1.102	42.978	1.10	0.77	3	1.6	29.568	29.56	1.25	46.2	46.2

Wind load calculation.



Assigning of wind loads

LOADS AND COMBINATION:

The structures should be analyzed for combination of loads as in practice. we have number of loads in various directions act

Some of the combinations checked are:

- 1.2(DL+LL)
- 1.2(DL+WL)
- 1.2(DL+LL+WL)

7. ANALYSIS AND DESIGN OF RESIDENTIAL BUILDING USING STAAD PRO SOFTWARE.

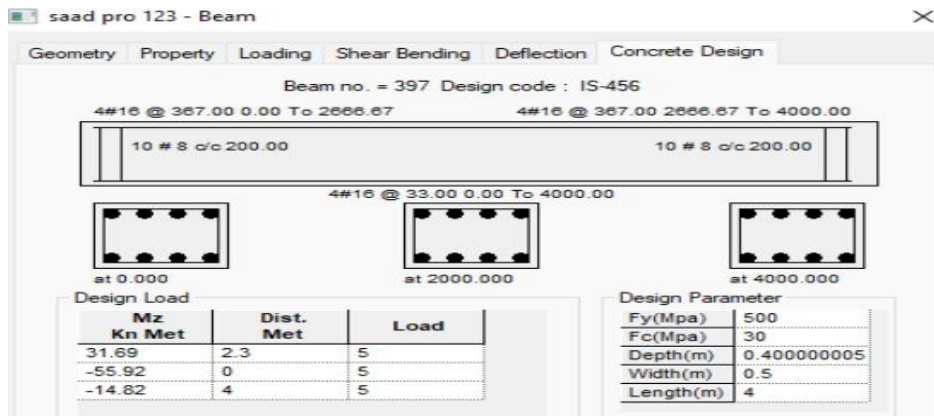
Procedure for Analyzing the Residential Building using STAAD PRO software:

- Double click on STAAD PRO software select new project select space and change the file name and location and give units Meters kilo Newton next add beam finish
- Click on geometry run structural wizard
- select frame models bay frame.
- Length 16M - Height 3M - Width 8M
- Number of bays along length and edit distances in dialog box as required apply transfer models- yes -ok.
- Select on column - click on geometry - translational repeat select required direction with distances and number click on link steps - ok - Repeat the translational repeat option (Y = 24M) and project the entire structure.
- Click on general property define rectangle Yd 0.4m, Zd 0:3m add close.
- Select the rectangle 0.3x0.3 assign to view assign - yes. -Click on support -fixed - add select support- use cursor to sign - place supports on required positions. - Click on the load and deflection - load case details - add change title as dead load - loading type as dead add - title as live load type as live add close.
- Click on dead load option add differ types of loads and assign them on required positions. Click on live load option add differ types of loads and assign them on required positions. Analyze run analyze ave go to post processing done. Click on results view value beam results select maximum and mid points, annotate.
- Click on SFD BMD options to view SFD BMD.
- Click on SFD (Fx Max value =76.762Kn) @beam no 442) BMD (Moment (Mz max 51.604knm) Beam no 14) options to view SFD BMD.

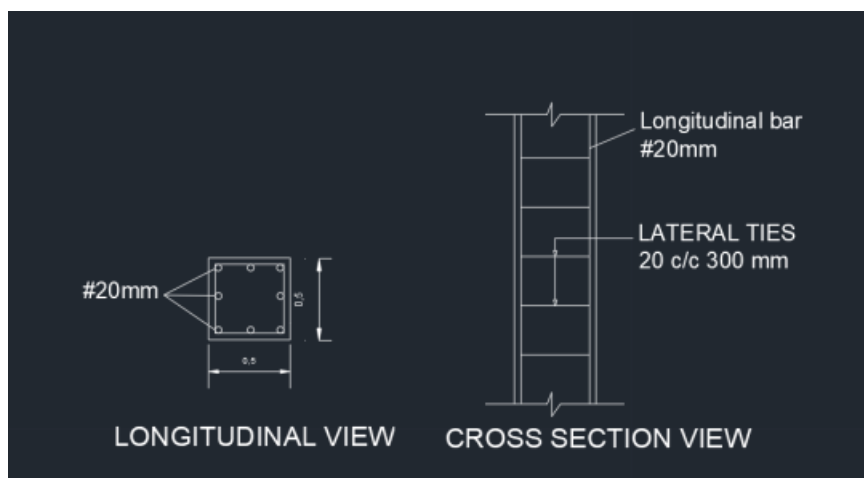
Procedure for Design of the Residential Building using STAAD PRO.

- Click on Design - concrete current code IS456- click on the design define parameters
- Select fck, fymin, Fymin, Maxmain, Maxsec, Minmain, Minsec, ok-select define parameters values - add -close- select each of them-assign to view -assign - yes.
- Select commands select design beam - add - select design slab element-add select take off - add - close. Select design beam - select beams parallel to X directions - beams parallel to Z direction - assign to selected beams - assign - yes.

- Select design column - select beams parallel to Y direction - assign to selected beams - assign - yes - Select design column - select beams parallel to Y direction- assign to selected beams assign - yes. -Select design slab element - assign to view - yes. - Go to analysis print - add - close. - Go to analyze - run analysis - save.
- Check concrete design information of each beam and find the critical section.



Design of beam



Design of column

8. CONCLUSIONS

From the above analysis we conclude the following points:

1. Tough our building is in Kurnool region is not much effecting due to wind loads.
2. There is less displacement after applying wind loads so it is negligible.

9. References

1. Madhurima dutta (2021) “Wind analysis and design of a multi storied structural frame considering using STAAD PRO.”
2. S . Ramanarayan (2018) “Seismic analysis and design of residential building (g+4) using STAAD PRO.”
3. Supraja duppati (2021) “Earthquake resistant design of g + 5 multi-storey residential building using STAAD PRO.”
4. Shivhar(2017) “ study on analysis and design of a commercial building.” 5. Rohith kumar (2018) “analysis and design of multi storey structure using etabs.”

TARLA BİTKİLERİNDE HASAT ZAMANININ ÖNEMİ

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ÖZET

Tarımsal üretim, bitkisel üretim ve hayvansal üretim olmak üzere iki gruba ayrılmaktadır. Bahçe bitkileri ve tarla bitkileri bitkisel üretim kaynaklarını oluşturmaktadır. İnsanların beslenme, giyinme, barınma ve tedavi gibi temel ihtiyaçlarını büyük ölçüde karşılayan en önemli ürünler tarla bitkileridir. Tarla bitkileri üretimi bu bakımdan büyük önem arz etmektedir. Tarla bitkileri; tahıllar, yemelik tane baklagiller, endüstri bitkileri, çayır mera ve yem bitkileri olmak üzere 4 gruba ayrılmaktadır. İlk kültüre alınan tarla bitkileri tahıllardır. Ayrıca tahıllar, en fazla yetiştiriciliği yapılan tarla bitkileridir. Bunu yemelik tane baklagiller takip etmektedir.

Anahtar Kelimeler: Tarla bitkileri, tahıllar, baklagiller, yem bitkileri

IMPORTANCE OF HARVEST TIME IN FIELD CROPS

ABSTRACT

Agricultural production is divided into two groups as crop production and animal production. Horticultural crops and field crops constitute the plant production resources. The most important products that meet the basic needs of people such as nutrition, clothing, shelter and treatment are field crops. The production of field crops is of great importance in this regard. Farm plants; It is divided into 4 groups as cereals, legumes, industrial crops, meadow pasture and forage crops. The first cultivated field crops are cereals. In addition, cereals are the most cultivated field crops. This is followed by edible legumes.

Keywords: Field crops, cereals, legumes, forage crops

GİRİŞ

Tarım; bitki yetiştirme (fitotekni) ve hayvan yetiştirme (zootekni), bitkisel ve hayvansal ürünler elde etme, bitkisel ve hayvansal ürünlerin nitelik ve niceliklerini iyileştirme, bitkisel ve hayvansal ürünleri pazara hazırlama (marketing ve standardizasyon) ve saklama (depolama), bitkisel ve hayvansal ürünleri işleyip, değerlendirme (teknoloji) bilim ve sanattır. Bitkisel üretim ise bahçe tarımı ve tarla tarımı olarak ikiye ayrılmaktadır (Çiftçi, 2002). Tarla tarımı; güneş, toprak, hava ve su gibi doğal kaynakları kullanarak insan ve hayvan beslenmesi için elzem olan protein, karbonhidrat ve yağ gibi birincil; alkaloid, terpenoid ve fenolik maddeler gibi ikincil temel organik metabolitlerin üretimini gerçekleştirme bilimi ve sanattır (Baydar, 2012).

Tarla bitkileri; tarlada yetiştirilen, genellikle otsu yapılı, tek yıllık ve bazen çalimsı veya odunsu çok yıllık kültür bitkileridir. Tarla bitkileri; tahıllar, yemeklik tane baklagiller, endüstri bitkileri, çayır mera ve yem bitkileri olmak üzere 4 gruba ayrılmaktadır. Tahıllar; serin iklim ve sıcak iklim tahılları olarak ikiye ayrılmaktadır. Buğday, arpa, çavdar, yulaf ve tritikale serin iklim tahılları alt grubunu oluştururken, mısır, çeltik, koca darı, kum darı, cin darı, kuşyemi ise sıcak iklim tahıllarındandır. Yemeklik tane baklagiller; serim mevsim ve sıcak mevsim baklagilleri olarak iki alt grubu oluşturmaktadır. Nohut, mercimek, bakla ve bezelye serin mevsim baklagili iken, kuru fasulye ve börülce sıcak mevsim baklagilidir (Baltacıoğlu, 2013).

Endüstri bitkileri; lif bitkileri, yağ bitkileri, nişasta-şeker bitkileri, tıbbi ve aromatik bitkiler, keyf bitkileri olarak sınıflandırılmıştır. Lif bitkileri içerisinde, başta pamuk, keten, kenevir, jüt, rami, hibiskus (kenaf), rosella, güneş keneviri, lif kabağı, kapok, manila keneviri ve sisal keneviri sayılabilir. Bu bitkilerden liflerin elde edilmiş yerlerine göre sınıflandırıldığında; tohumundan lif elde edilen pamuk, saplarından lif elde edilenler, keten, kenevir, jüt, rami, kenaf, rosella, güneş keneviri, meyvesinden lif elde edilenler, lif kabağı ve kapok, yapraklarından lif elde edilenler de manila ve sisal kenevirleri olarak karşımıza çıkmaktadır (Eripek, 1995). Yağ bitkileri; 1. sınıf yağ bitkileri olarak isimlendirilen ayçiçeği, soya, kolza (kanola), yer fıstığı, susam, haşhaş, aspir ve yağ şalgamı bitkileridir. Doğrudan insan beslenmesinde içerdikleri yağın yağ asitleri kalitesinin uygun olmaması nedeniyle 2. sınıf yağ bitkileri olarak isimlendirilenler ise ızgın, ketencik, pelemir, hardal, hintyağı ve jojoba bitkileridir. Patates, yer elması ve tatlı patates nişasta bitkileri alt grubunda yer alırken, şeker pancarı ve şeker kamışı şeker bitkilerindedir. Kimyon, kişniş, kekik, hardal, karabiber ve çemen önemli aromatik bitkilerdendir. Haşhaş, melisa, adaçayı, meyan kökü, banotu, yüksükotu, datura ve atropa ise tıbbi bitkiler alt grubunda yer almaktadır. Tütün, anason ve şerbetçiotu ise keyf bitkileri arasında yer almaktadır (Baydar, 2012).

Yem bitkileri; çayır-meralar, baklagil ve buğdaygil yem bitkileri olmak üzere alt gruplara ayrılmaktadır. Baklagil yem bitkileri alt grubunu yonca, korunga, üçgül, fiğ, burçak, mürdümük, yem bezelyesi vb. oluşturmaktadır. Sorgum, sudan otu, ayrıklar, yumaklar, salkımlar, bromlar vb. buğdaygil yem bitkilerindedir (Uçar ve Soya, 2020). Bu bitkilerin morfolojileri, yetiştirme şekilleri ve vejetasyon

dönemlerinin birbirinden farklı olduğu gibi hasat zamanları ve hasat şekilleri de birbirinden farklılık göstermektedir.

BAZI TARLA BİTKİLERİNİN HASAT ZAMANLARI

Serin iklim tahıllarından buğday için tanedeki nem oranı % 13,5 olduğu zaman en uygun hasat zamanıdır. Bitkiler tamamen sarardığı ve tanelerin sertleştiği dönemde bitkiler hasat edilmelidir (Çığ ve ark., 2021a). Triticale buğdayla yaklaşık aynı zamanda hasat olgunluğuna gelmekte ve hasadı yapılmaktadır. Arpa hasadı, taneler sertleşip tane nemi %13'ün altına düştükten sonra yapılmalıdır (Çığ ve ark., 2021b). Çavdarın çiçek kavuzları taneyi gevşek tuttuğundan ve dış kavuzlar dar olduğundan tane dökme önemli bir sorundur. Bu nedenle çavdarın hasat zamanının seçimi önemlidir. Orak veya tırpanla hasat sarı olum dönemi sonunda; biçerdöverle hasat ise tam olum dönemi başında ve günün erken saatlerinde yapılmalıdır (Köse ve Mut, 2022). Yulaf tarımında en uygun hasat zamanının seçilmesi önemlidir. Kardeşlenme fazla olduğundan, bir bitkideki tanelerin tümünün olumu için gerekli süre, diğer serin iklim tahıllarına göre daha uzundur. Yulaf genellikle ana saptaki danelerin sarı olum ile tam olum arasında olduğu devrede biçilmelidir. Saplar hasat sonrasında tarlada 3-5 gün yeterince kurutulduktan sonra harman edilmelidir (Sabandüzen ve Akçura, 2017). Mısır bitkisi hasat zamanı geldiğinde bitkinin sap, yaprak ve tablaları tamamen kuruyup kahverengileşir. Danelik ürün için mısırdaki hasat zamanının geldiği koçan kavuzlarının kuruyup, danenin sertleşip normal görünen rengini alması, danenin sömeğe bağlandığı yerde siyah noktanın oluşması ile anlaşılır. Siyah nokta görülmeye başlamasından itibaren dane rutubeti atarak hasat süresini beklemeye başlamaktadır. Mısır koçanının orta kısımlarından alınan her 4 tanenin 3'ünde siyah nokta görülür ise, mısır olgunlaşmasını tamamlamış demektir (Saygı ve Toklu, 2017). Sıcak iklim tahılları grubunda yer alan cin darı tohumların renklendiği ve gerçek sertliğini kazandığı tam olgunlaşma döneminde ise tohum için hasat edilmelidir (Olak ve Tan, 2016). Çeltikte salkımların %80'nin saman rengini aldığı, alt kısımdaki danelerin sert mum dönemine ulaştığı zaman çeltik hasat edilir. Bu dönemde danelerin rutubet oranı % 22-24 arasındadır (Şavşatlı ve ark., 2008).

Serin mevsim baklagillerinden olan mercimekte hasadın zamanında yapılması çok önemlidir. Hasat zamanında tanede nemin düşük seviyede olması istenir. En uygun hasat zamanı mercimek bitkilerinin sarardığı ancak tam olarak kurumadığı zamandır (Ceritoğlu ve Erman, 2020). Nohut bitkisinde tane dökme durumu, mercimek bitkilerindeki kadar büyük bir sorun olmamakla birlikte hasat zamanında dikkat edilmesi gereken konulardandır. Nohut bitkileri sarardığı tanelerin sertleştiği dönemde sabahın erken saatlerinde hasat edilmelidir (Soysal ve Erman, 2020). Baklanın hasadına meyvelerin büyük çoğunluğu siyahlaştıktan ve tohumlar sertleştikten sonra başlanmalıdır. Bu dönemde gövdenin üzerindeki tüm yapraklar dökülmüş ama gövde ve yaprak sapları halen yeşil durumdadır (Uçar ve ark., 2020). Kuru tane üretimi amacıyla yapılan bezelye yetiştiriciliğinde hasat, bitkinin alt kısımlarındaki baklaların sarardığı fakat çatlayarak tane dökmeden önce yapılmalıdır (Alan ve Geren, 2012). Sıcak mevsim baklagillerinden olan börülce hasadında taneler bakla içinde sertleşmiş bakla kırıldığında hemen dışarı çıkabilecek durumdadır. Elle börülce hasadı durumunda bitkiler iyice

kurutulduktan ve tanelerdeki nem oranı % 10'a kadar düştükten sonra harmanlanır. Kuru fasulyede normal hasat zamanı baklaların büyük çoğunluğunun sarardığı fakat henüz kupkuru olmadıkları zamandır (Özçelebi ve Erman, 2021).

Endüstri bitkileri grubunda yer alan pamuk hasadına kozaların olgunlaşması ile başlanır. Hasat tarihi iklim koşullarına, ekim tarihine ve sulama koşullarına göre değişim gösterebilir. Tarlada açılmış koza oranı yaklaşık %60'a vardysa 1. el hasada başlanabilir (Bozbek ve Ünay, 2005). Soya bitkisinde tanede nemin % 13-14 oranında olduğu dönemde yapılmalıdır. Yaprakların sararıp dökülmesinden 4-5 gün sonra soya hasadına başlayıp kısa sürede bitirilmelidir. Ekim zamanına ve çeşitlerin erkenci ya da geççi olmasına bağlı olarak soyada hasat dönemi farklılık göstermektedir (Arslan ve ark., 2018). Ayçiçeği hasadı bitki yapraklarının ve tabla üzerindeki çiçeklerinin kuruyup döküldüğü, tablanın etli kısmının da kurumuş olduğu ve tane neminin % 15'in altına düştüğü dönemde yapılmalıdır (Katar ve ark., 2012). Susam için hasat zamanı çiçeklenmenin bittiği, yaprak ve kapsüllerin sarardığı, alt yaprakların kısmen döküldüğü ve alt kapsüllerdeki tohumların renk değiştirdiği, sararak uçlarının çatlamaya başladığı dönemdir (Arslan ve ark., 2014). Yer fıstığı, yapraklar sarardığında, danelerin büyük çoğunluğu koyulaşır normal iriliğe ulaştığında, kapsüllerin iç zarında kahverengi çizgiler görüldüğünde hasat edilmelidir. Depolanacak kabuklu fıstıklarda nem oranı %7-8 seviyesinin üstüne çıkmamalıdır (Arioğlu ve ark., 2016). Patates bitkisi, yaprak ve sapları sararıp kurduğunda, yumruları normal büyüklüğüne ulaşır bitkiden kolayca ayrılabilirdiği dönemde hasat edilmelidir (Gezgin ve Uyanöz, 1998). Şeker pancarı sonbahar aylarında hasada hazır hale gelir. Ülkemizde genel olarak karasal iklimin hakim olduğu alanlarda ekimi yapılan şeker pancarları eylül ve ekim ayının sonlarına doğru hasat edilmektedir (Okut ve Yıldırım, 2004). Şeker pancarı hasadına bitkinin yetiştirme süresi ve şeker fabrikaları tarafından alınan bitki örneklerinin şeker içeriğine göre karar verilmektedir.

Tıbbi ve aromatik bitkiler arasında yer alan kekik, çiçeklenme başlangıcı ile çiçeklenme dönemi arasında hasat edilmelidir. Hasattan sonra alınan kekik bitkileri gölge bir alanda, doğal koşullar altında kurutulmalıdır. Kurutulan alanın gölge olması kekik kalitesi için büyük önem taşımaktadır. Güneşte kurutma sonucu, bitkilerin rengi değişmekte ve yağ içeriği v kalitesi düşmektedir. Kurutulan bitkiler, saplarından ayrılarak çuvallanıp, ışık almayan ve nemsiz alanlarda saklanmalıdır. Saplarından ayrılan kekiklerin nem oranının maksimum %13 olması gerekmektedir (Sarıhan, 2006). Adaçayı, yaprakları (taze ve kuru) ve uçucu yağı için hasat edilir. Çiçeklenme aşamasında hasat ettiğimizde, maksimum kalitede ve miktarda uçucu yağ elde edildiği, ikinci el hasatta (normalde yaz sonu – Ağustos) birinci el hasada kıyasla (ilkbahar sonu-Mayıs), kuru yaprak ve uçucu yağ veriminin daha yüksek olduğu belirtilmiştir (Karık, 2015). Tıbbi papatya, bitkideki uçucu yağ oranı çiçek açıldıktan 3-5 gün sonraki dönem en fazla olduğu için hasat bu dönemde yapılmalıdır. Anason, bitkinin ana çiçek dallarındaki taneler kahverengileşmeye başladığında hasat yapılmalıdır (Tan, 2016).

Yem bitkilerinden fiğler, yeşil ot elde etmek amacıyla bitkilerde toprağa yakın birkaç baklanın tam şeklini aldığı ve tanelerin dolduğu dönemde, tane elde etmek için ise alttan birkaç baklanın sarardığı

tanelerin sertleştiği dönemde hasat yapılmalıdır (Uçar ve Soya, 2020). Yoncada ve korungada ot üretimi için % 10 çiçeklenme döneminde (çiçeklenme başlangıcı) hasat yapılmalıdır. Tane üretimi için salkımların alt kısımlarındaki meyvelerin kahverengileşmeye başladığı dönemde bitkiler hasat edilmelidir (Turan ve Çelen, 2017).

SONUÇ

Tahıllarda erken hasat durumunda kavuzlar tam kurumadığından renk atmakta, tanelerin buruşuk-solgun olmasına neden olmaktadır. Geç hasatta ise çeşit özelliğine bağlı olarak başakta tane dökülmeleri, yağışa ve rüzgâra bağlı olarak bitkide yatmalar ve bazı çeşitlerde başaktaki tanede çimlenmeler görülebilmektedir. Endüstriyel baklagiller, yemeklik tane baklagillerde ve baklagil yem bitkilerinde erken dönemde hasat buruşuk taneye sebep olmakta iken, geç hasat tane dökülmesine ve buna bağlı olarak verim kaybına neden olmaktadır. Endüstri bitkilerinden susam, soya, ayçiçeği vb. bitkiler erken hasat edildiğinde nem oranı yüksek olduğundan tanelerin bozulmasına, verim kaybına neden olmakta ve depolanmasını zorlaştırmaktadır. Tıbbi-aromatik bitkiler genel olarak sabahın erken saatlerinde havalar çok ısınmadan ve yağış olmayan zamanlarda hasat edilmelidir. Tıbbi-aromatik bitkilerde uçucu yağın kalitesini ve konsantrasyonunu korumak için hasat zamanı oldukça önemlidir. Bitkisel üretimin ön koşulu iyi tohumluk seçimi, toprak hazırlığı ve zamanında ekimdir. Ancak başarılı bir üretim için bunlar tek başına yeterli değildir. Bitkisel üretim ekimden hasat-harmana kadar bütün bir süreçtir. Uygun zamanda yapılan bir hasat ile bu süreç başarıya ulaşabilir. Erken veya geç hasadın verim ve kalite kaybına neden olduğu yapılan üretimler sonucu çiftçiler tarafından defalarca tecrübe edilmiştir. Sağlıklı, verimli ve kaliteli üretim için zamanında hasat yapılması gereklidir.

KAYNAKLAR

- Alan, Ö. & Geren, H., 2012. Bezelye'de (*Pisum sativum* L.) farklı ekim zamanlarının tane verimi ve diğer bazı tarımsal özellikler üzerine etkisi. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 49(2), 127-134.
- Arıoğlu, H. , Bakal, H. , Güllüoğlu, L. , Kurt, C. & Onat, B., 2016. Ana Ürün Koşullarında Yetiştirilen Bazı Yerfıstığı Çeşitlerinin Önemli Agronomik ve Kalite Özelliklerinin Belirlenmesi . *Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi*, 24-29 .
- Arslan, H., Onder-Ucar, O., & Arslan, D. (2018). Determination of the performance of some soybean (*Glycine max* (L.) Merr.) varieties/lines. *Fresenius Environmental Bulletin*, 27(1), 526-532.
- Arslan, H. , Hatipoğlu, H. & Karakuş, M. (2014). Şanlıurfa Yöresinde Tarımı Yapılan Susam Genotiplerinden Seçilen Bazı Hatların İkinci Ürün Koşullarında Verim ve Verim Unsurlarının Belirlenmesi . *Türkiye Tarımsal Araştırmalar Dergisi*, 1(2), 109-116 .
- Baltacıoğlu, U. B. (2013). Sırayı takip edebilen hassas çapalama makinasının geliştirilmesi (Master's thesis, Namık Kemal Üniversitesi).
- Baydar H. (2012). *Tarla Bitkileri (Genel)*. Süleyman Demirel Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü, <http://ziraat.sdu.edu.tr/assets/uploads/sites/138/files/tarlabitkilerine-giris-16112012.pdf>
- Bozbek, T. & Ünay, A. (2005). Ekim Zamanı ve Bitki Sıklığının Pamuk Verimi Üzerine Etkisi. *Anadolu Ege Tarımsal Araştırma Enstitüsü Dergisi*, 15 (1), 34-43 .
- Ceritoğlu, M., & Erman, M., 2020. Farklı ekim zamanlarında uygulanan vermikompostun mercimek (*Lens culinaris* Medik.)'te verim ve verim öğeleri üzerine etkisi. *Journal of International Environmental Application and Science* 15 (3), 158-166.
- Çığ, F., Erman, M., Sönmez, F., Uçar, Özge, Bilmez Özçınar, A., & Soysal, S. (2021a). Determination of Bread Wheat (*Triticum aestivum* L.) Varieties Suitable For The Ecological Conditions of Siirt Province. *MAS Journal of Applied Sciences*, 6(3), 508–517.
- Çığ, F., Erman, M., Sönmez, F., Uçar, Ö., Özçınar, A. B., & Soysal, S. (2021b). Farklı İki Sıralı Arpa (*Hordeum vulgare* conv. *distichon*) Çeşitlerinin Siirt İli Ekolojik Koşullarında Bazı Tarımsal Özelliklerinin Belirlenmesi. *MAS Journal of Applied Sciences*, 6(3), 524-530.
- Çiftçi, C.Y., 2002. 157. Yılında Zirai Öğretim. *Tarım ve Mühendislik Sayı*: 64-65, S:68-77.
- Eripek, S., 1995. *Tarla Bitkileri*. Anadolu Üniversitesi Yayın No: 1357, Açıköğretim Fakültesi Yayın No: 724.
- Gezgin, S., & Uyanöz, Ş. (1998). Değişik azot kaynaklarının patates bitkisinin verim ve bazı özelliklerine etkisi. *Tr. J. of Agriculture and Forestry*, 22, 81-86.
- Karık, Ü. (2015). Ege ve batı Akdeniz florasındaki Anadolu adaçayı (*Salvia fruticosa* mill.) populasyonlarının bazı verim ve kalite özellikleri. *Tekirdağ Ziraat Fakültesi Dergisi*, 12(2): 32-42.
- Katar, D. , Bayramın, S. , Kayaçetin, F. & Arslan, Y. (2012). Ankara ekolojik koşullarında farklı ayçiçeği (*Helianthus annuus* L.) çeşitlerinin verim performanslarının belirlenmesi. *Anadolu Tarım Bilimleri Dergisi*, 27 (3), 140-143.

- Köse, Ö.D.E., & Mut, Z., 2022. Farklı ekim sıklıklarında çavdar genotiplerinin tane verimi ve bazı yem kalite özelliklerinin belirlenmesi. Kahramanmaraş Sütçü İmam Üniversitesi Tarım ve Doğa Dergisi, 25(4), 778-786.
- Okut, N., & Yıldırım, B. (2004). Van koşullarında şeker pancarı (*Beta vulgaris* var. *saccharifera* L.)'nda çeşit ve ekim zamanının verim, verim unsurları ve kalite üzerine etkisi. Yuzuncu Yıl University Journal of Agricultural Sciences, 14(2), 149-158.
- Olak, H., & Tan, M. (2016). Farklı Azot Dozlarının Cin Darı (*Panicum italicum* L.)'da Verim ve Bazı Özelliklere Etkisi. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 6(2), 131-138.
- Özçelebi, H. Ş., & Erman, M., 2021. Bazı Börülce (*Vigna unguiculata* L. Walp) Yerel Popülasyonlarının ve Tescilli Çeşitlerinin Siirt Ekolojik Koşullarına Adaptasyonunun Belirlenmesi. ISPEC Journal of Agricultural Sciences, 5(1), 235-245.
- Sabandüzen, B., & Akçura, M. (2017). Bazı yulaf genotiplerinin Çanakkale koşullarında verim ve verim unsurlarının incelenmesi. Türk Tarım ve Doğa Bilimleri Dergisi, 4(2), 101-108.
- Sarıhan, E.O., 2006. Farklı sıra arası ve sıra üzeri mesafelerinin kekik (*Origanum vulgare* var. *hirtum*)'de verim ve verim öğeleri üzerine etkisi. Journal of Agricultural Sciences, 12(03).
- Saygı, M., & Toklu, F. (2017). Çukurova Bölgesinde birinci ürün koşullarında yetiştirilen bazı danelik mısır (*Zea mays indentata* sturt.) çeşitlerinin dane verimi, bazı bitkisel özellikler ve karakterler arası ilişkiler yönünden değerlendirilmesi. KSÜ Doğa Bilimleri Dergisi, 20, 308-312.
- Soysal, S., & Erman, M., 2020. Siirt ekolojik koşullarında mikrobiyolojik ve inorganik gübrelemenin Nohut (*Cicer arietinum* L.)'un verim, verim öğeleri ve nodülasyonu üzerine etkilerinin araştırılması. ISPEC Journal of Agricultural Sciences, 4(3), 649-670.
- Şavşatlı, Y. , Gülümser, A. & Sezer, İ. (2008). Samsun ekolojik şartlarında yetiştirilen çeltik genotiplerinin verim ve verim unsurları bakımından karşılaştırılması. Anadolu Tarım Bilimleri Dergisi, 23 (1), 7-16 .
- Tan, U. (2016). Mayıs papatyası (*Matricaria recutita* L.)'nda farklı ekim zamanları ve çeşitlerin agronomik-teknolojik özelliklere etkisi (Master's thesis, Adnan Menderes Üniversitesi, Fen Bilimleri Enstitüsü).
- Turan, N. & Çelen, A.E., 2017. A Research On The Yield And Yield Characteristics Of Some Alfalfa (*Medicago sativa* L.) Cultivars Grown In Different Sowing Times. ISPEC Journal of Agricultural Sciences, 1(1), 7-37.
- Uçar, Ö., Soysal, S., & Erman, M., 2020. Siirt İli Ekolojik Koşullarında Yetiştirilen Bazı Bakla (*Vicia faba* L.) Çeşitlerinin Tane Verimi ve Verim Özelliklerinin Belirlenmesi. ISPEC Journal of Agricultural Sciences, 4(3), 542-549.
- Uçar, Ö. & Soya, H., 2020. Tokat/Niksar koşullarında bazı yaygın fiğ (*Vicia sativa* L.) çeşitlerinde farklı ekim zamanlarının ot ve tohum verimi ile verim özelliklerine etkisi. Ejons International Journal, 4(13), 112-119.

CUTANEOUS FIBROSARCOMA IN A PERSIAN CAT

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ABSTRACT

Fibrosarcoma is a mesenchymal tumor of malignant fibroblasts in a collagen background. It was reported in all species, but most commonly in older dogs and cats. This tumor often occurs on the head and limbs, but may also occur anywhere on the body. A 6-year-old male Persian cat (3/5 kg) with a raised mass on the right anterior limb was referred to the veterinary hospital. Based on owner information, within the previous 2-month period, the mass had become evident and grew larger. Finally, complete surgical removal was selected. On gross examination, the mass was approximately 8×10×12 mm in size. Macroscopically, the mass was well circumscribed, ulcerated, firm and white to yellow. Tissue samples of the mass were fixed in 10% neutral buffered formalin and routinely processed, dehydrated, embedded in paraffin wax, sectioned at 5µm in thickness and stained with Hematoxylin and Eosin and Masson's trichrome. Immunohistochemical studies of the mass sections were performed using Vimentin, SMA and Desmin. Microscopically, the mass was encapsulated and the dermis and subcutaneous area were expanded by spindle-shaped to polygonal neoplastic cells in the interwoven pattern and contained a single ovoid to polygonal nucleus and a moderate amount of eosinophilic cytoplasm. Nucleoli were often prominent. Mitotic figures were infrequent. The sections were positive for Masson's trichrome and Vimentin and negative for Desmin and SMA. Based on histopathological features, a well differentiated fibrosarcoma was diagnosed. No new growth of the mass was observed six months following the surgical procedures. The incidence of fibrosarcoma in cats has been rising in the last 20 years, most likely associated with vaccination. Similar to this case, surgical excision is the treatment of choice in this tumor.

Keywords: Cat, Cutaneous, Fibrosarcoma, Pathology

INTRODUCTION

Fibrosarcoma is a mesenchymal tumor of malignant fibroblasts in a collagen background with immature proliferating fibroblasts or undifferentiated anaplastic spindle-shaped cells arranged in distinct interwoven patterns (Hendrick, 2017). These tumors occur commonly in all domestic animal species (Hendrick, 2017; Modiano & Breen, 2007) and have been reported in cats (Strong et al., 2016), dogs (de Paula et al., 2021) and horses (Bass et al., 2017). This paper is about the macroscopic, surgical, and histopathological findings of a well differentiated cutaneous fibrosarcoma in a Persian cat.

CASE DESCRIPTION

In December 2022, a 6-year-old male Persian cat (3.5 Kg) with a raised mass on the lateral side of its right hind limb was referred to the hospital. Based on owner information, within the previous 2-month period the mass had become evident and grew larger. On physical examination vital signs such as pulse rate and respiratory rate were normal. Further clinical examination revealed no other physical abnormalities and complete surgical removal of the mass was chosen. The cat was anaesthetized with intravenous injections of ketamine and diazepam and maintained with 1%-2% isoflurane in oxygen. Analgesia was provided by subcutaneous injection of ketoprofen (for 3 days). On gross examination, the mass was approximately 8×10×12 mm in size. It was well circumscribed, ulcerated, firm and white to yellow. Tissue samples of the mass were fixed in 10% neutral buffered formalin, routinely processed, dehydrated, embedded in paraffin wax blocks, sectioned at 5µm thicknesses (Rotary Microtome RM2 145; Leica, Wetzlar, Germany) and stained with Hematoxylin & Eosin and Masson's Trichrome (Luna, 1968). Immunohistochemical studies of the mass were performed using Vimentin (V9, mouse monoclonal, dilution: 1/50, Dako, Denmark) (Luna, 1968), SMA (1A4, mouse monoclonal, dilution: 1/50, Dako, Denmark), and Desmin (D33, mouse monoclonal, dilution: 1/50, Dako, Denmark) (Vascellari et al., 2006). Sections were examined using a light microscope (E600; Nikon, Tokyo, Japan) and representative images were taken. Hemorrhage, necrosis and peripheral aggregates of lymphocytes were observed in the histopathological sections. Microscopically, the mass was encapsulated and the dermis were expanded by spindle-shaped to polygonal neoplastic cells. These cells were arranged in an interwoven pattern and contained a single ovoid to polygonal nucleus. Nucleoli were often prominent. Mitotic figures were infrequent. Some neoplastic cells had cellular and nuclear pleomorphism (Fig 1). Masson's trichrome demonstrated the positive and blue staining of

collagen. Immunohistochemically, the sections were uniformly positive for Vimentin and negative for Desmin and SMA. Based on histopathological, histochemical and immunohistochemical features, a well differentiated fibrosarcoma was diagnosed.

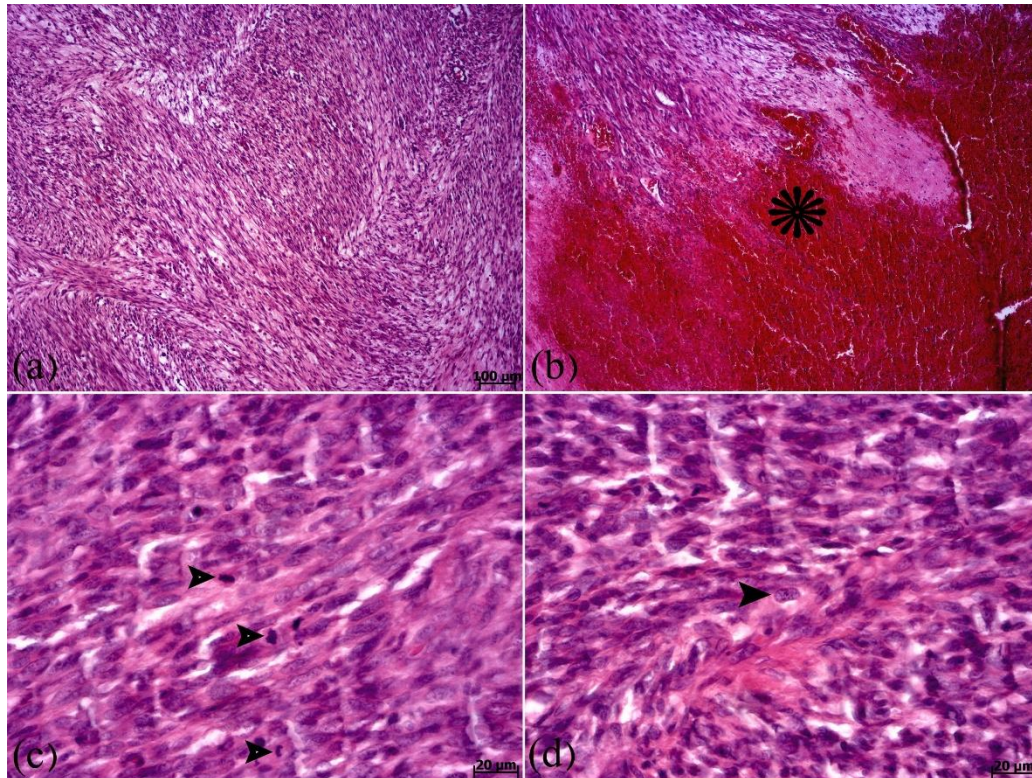


Figure 1: Well differentiated fibrosarcoma in a Persian cat. (a): spindle-shaped to polygonal neoplastic cells in an interwoven pattern. (b): Severe Hemorrhage (*). (c): Mitotic figures (arrowheads). (d): bizarre cell (arrowhead), H&E.

DISCUSSION

fibrosarcomas occur in all domestic animal species, but most commonly occur in adult and aged cats and dogs and can appear anywhere on the body (Hendrick, 2017). These tumors can range from well differentiated to more aggressive, but metastasis is uncommon (Hendrick, 2017). A well differentiated fibrosarcoma is composed of spindle cells, collagen and rare mitotic figures in the herringbone pattern (Hendrick, 2017; Van den Top et al, 2008). FeSV can also induce a rare and aggressive fibrosarcoma in cats. FeSV-induced tumors are multicentric and are found most frequently in young cats (Hartmann, 2011). These tumors are characterised by rapid growth. Metastasis to the lungs or other organs occurs with approximately 30% of virally induced fibrosarcomas in cats. However, only 2% of fibrosarcomas in cats are virally induced

(Vail et al. (2020). Fibrosarcoma is the most common tumor of the cat. Its incidence has increased over the past 20 years, most probably due to its association with vaccination. There is significant overlap between fibrosarcomas and leiomyosarcomas in histopathological findings, thus making the use of special stains and immunohistochemical identification, essential for the final diagnosis. Microscopically, leiomyosarcomas, unlike fibrosarcomas, have elongated nuclei, with blunt rounded ends and eosinophilic cytoplasm. Spindle cells with red cytoplasmic stain were not found among the blue collagen bundles on Masson's trichrome staining. The mass also stained negative for Desmin and SMA and positive for Vimentin. These results prove that this tumor could not have originated from muscle cells and it is a well differentiated fibrosarcoma. (Hendrick, 2017; Roccabianca et al, 2020). Similar this case, surgical excision is the treatment of choice for well differentiated fibrosarcoma (Hendrick, 2017).

CONCLUSION

Surgical excision remains the treatment of choice for fibrosarcomas in cats with radiation therapy as secondary treatment, particularly if surgical removal is difficult.

REFERENCES

1. Bass, K., Mochal-King, C. A., Cooley, A. J., & Brinkman, E. (2017). Equine mandibular fibrosarcoma in two horses: clinical, diagnostic, and therapeutic considerations. *Journal of Equine Veterinary Science*, 48, 31-38.
2. de Paula, L. V., do Amaral, A. V. C., Saturnino, K. C., & de Souza Ramos, D. G. (2021). Canine primary corneal fibrosarcoma—case report. *Topics in Companion Animal Medicine*, 42, 100494.
3. Hartmann, K. (2011). Clinical aspects of feline immunodeficiency and feline leukemia virus infection. *Veterinary immunology and immunopathology*, 143(3-4), 190-201.
4. Hendrick, M. J. (2017). Mesenchymal tumors of the skin and soft tissues. *Tumors in domestic animals*, 5, 142-175.
5. Luna, L.G., 1968. Manual of histologic staining methods of the Armed Forces Institute of Pathology.
6. Modiano, J., & Breen, M. (2007). The etiology of cancer. *Withrow and MacEwen's Small Animal Clinical Oncology*.
7. Roccabianca, P., Schulman, Y., Avallone, G., Foster, R., Scruggs, J., Dittmer, K. & Kiupel, M. (2020). *Surgical Pathology of Tumors of Domestic Animals. 3: Tumors of Soft Tissue*.
8. Strong, T. D., Tangeman, S., Ben-Shlomo, G., Haynes, J., & Allbaugh, R. A. (2016). Corneal fibrosarcoma in a cat. *Veterinary Ophthalmology*, 19, 131-135.
9. Van den Top, J. G. B., De Heer, N., Klein, W. R., & Ensink, J. M. (2008). Penile and preputial tumours in the horse: a retrospective study of 114 affected horses. *Equine Veterinary Journal*, 40(6), 528-532.
10. Vail, D. M., Thamm, D. H., & Liptak, J. (2019). *Withrow and MacEwen's Small Animal Clinical Oncology-E-Book*. Elsevier Health Sciences.
11. Vascellari, M., Melchiotti, E & Mutinelli, F. (2006). Fibrosarcoma with typical features of post injection sarcoma at site of microchip implant in a dog: histologic and immunohistochemical study. *Veterinary Pathology*, 43, 545-448.

**MACHINE LEARNING CLASSIFICATION ALGORITHMS FOR ENSURING
SMART MANUFACTURING IN WELDED JOINTS**

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ABSTRACT

Welding is one of the major processes in the automobile, construction, aviation, and other sectors. Manual welding requires high dexterity level of the operators. The expertise of the welder affects the surface appearance of the weld, including its shape, mix, ripples, and presence of any spatter. Manual welding exhibits low weld quality, high defect rates, and low efficiency. Due to localized heating and cooling, inappropriate mixing, and dilution in the weld solution result in the formation of bead excessive asymmetry, inadequate penetration, and many other problems at the welded joints. These defects result in the reduction of the cost-effectiveness of welding. So, there is a need to monitor and control in-process welding. It makes a closed loop

to get continuous feedback and adjust welding parameters automatically according to the required weld quality. Hence this aims to present a step towards the automation of welding in the arena of Industry 4.0. The purpose is to automate the monitoring of defects in real-time or in-process welding using the digitization of the high-resolution camera. For monitoring the welding process the images of already welded parts are taken and images are classified as good or bad images, and then through machine learning algorithms, the model is trained to classify any given images. After making the algorithm it is validated to be used for the welding process. The accuracy of the algorithm is determined, which is mainly based on the number of images taken to train the model. Thus, an intelligent robotic welding system is developed which can change its parameters by itself through the algorithm. The developed system is fast, efficient, cost-effective, and requires less skilled labor, thus it has brought great innovation in the entire fabrication process.

Keywords: Industry 4.0, Robotic welding, Automation, Machine Learning

INTRODUCTION

Systems and techniques for welding are crucial components of contemporary industrial production lines. Through technology development, automated welding systems using industrial robots have replaced many welding tasks requiring hand operation [1]–[3]. Despite being in use for years, welding robots are preprogrammed devices with little to no intelligence. Figure 1 shows that Intelligent manufacturing is implemented by the transformation of Human physical systems to Human cyber-physical systems with the aim of achieving specific manufacturing goals at an optimized level [4].

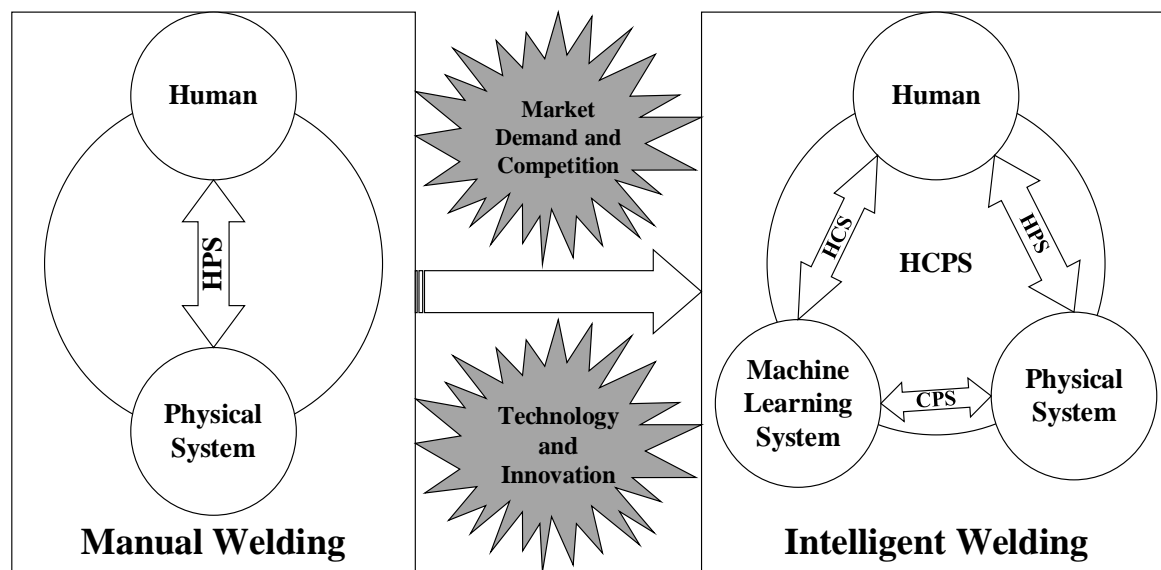


Figure 2: The advancement of welding systems from HPS to HCPS. [5]

There are presently several manufacturing businesses using machine learning techniques. In order to forecast specific mechanical properties, a variety of machine-learning techniques can be used. A smart manufacturing process is now using artificial intelligence techniques like machine learning and deep learning in a variety of ways. Machine learning analyses and gains knowledge from the dataset that is accessible, whereas Deep Learning models build Artificial Neural Network algorithms in a variety of layers based on the dataset's intended use. Machine learning has a major benefit over deep learning in that it requires less time to train the models than deep learning. [6]

The visual representation of algorithms and experimentation can improve the effectiveness of learning and teaching the principles of image processing. Because Python is an interpreted language with libraries devoted to specific tasks, it is a great choice for learning digital image

processing. This eliminates the need for expensive commercial software's ambiguous black boxes and allows for the manipulation of codes and crucial algorithms. [7]

The welding procedures used today are complex, rely on a lot of variables, and have a poorly understood mechanism. User and customer needs for welding are distinct, and they work in circumstances that are always changing. As a result, welding is shifting to more specialized production using cutting-edge welding equipment that can nimbly adapt to changing welding requirements while retaining excellent quality. Smart approaches for gathering and analyzing welding data are essential in the field of big data. Monitoring metrics before and after the welding process, for instance, can improve the welding process, performance, and service quality. Although there are numerous welding techniques, advances in information science and technology are enabling the transformation of traditional welding to intelligent one. Because of advances in computer science and artificial intelligence, intelligent automation is replacing manual work. Manufacturing research programs have all examined smart manufacturing, Industry 4.0, and the internet of things. In the future big data, intelligent manufacturing, human cyber-physical systems, and AI will revolutionize the industry. [4], [8]–[13]. The platforms, enablers, and drivers that are required for advancing welding systems to greater intelligence levels are being provided by these programmers. Welding technology has gone through four stages of development. In phase 1 it was done manually, which had some efficiency and quality issues. In Phase 2, automation was used along with robots but automatic parameter adjustment was the problem. In Phase 3 welding automation was made easier using "teach and playback" robots, but it was offline and had a limited capacity to respond to changes. Phase 4 is related to the welding systems that are made intelligent and upgraded to monitor and regulate the parameters and quality of the welding process more effectively.

From the above discussion, it can be concluded that automation of welding is a need for technological advancement. Hence this research presents a step toward the development of an intelligent welding system by controlling the in-process welding with the use of a supervised machine learning algorithm and a high-resolution camera.

METHODOLOGY

The formation of the paper is outlined in figure 2. Phase 1 includes the literature review of the intelligent welding system. Phase 2 "Technology design and development" is about collecting data and building algorithms. Phase 3 focuses on results and discussion and phase 4 is about the conclusion and recommendations of the research.

A thorough review of the literature on intelligent welding research was conducted in phase 1. The search was restricted to welding technologies for convenience, even if publications on intelligent manufacturing may have also turned up information on intelligent welding. In this stage, best practices in the creation of modern industrial welding are identified through a survey of the literature and other research. It comprised a thorough analysis of the pertinent literature in each of the project's important areas, including an examination and identification of best practices in the welding process design in the context of innovation. A detailed analysis of closed-loop welding is examined. It assisted in determining the current research problem. To develop the study, aim and objectives, innovation, and originality for this project, research questions are extracted based on the examined research problem.

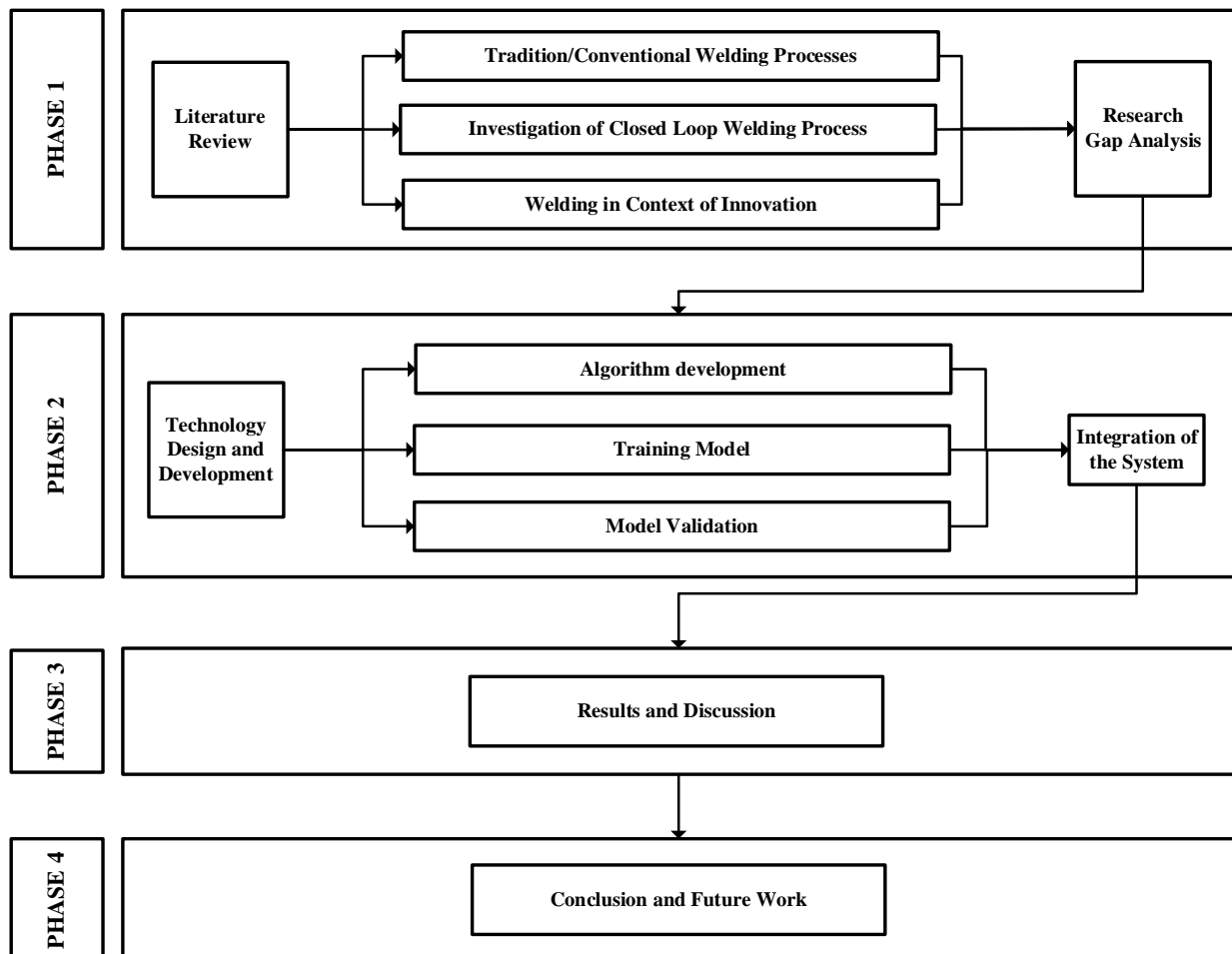


Figure 3: The Structure of the Research Methodology

In phase 2 The following steps need to be taken to perform the technology design development:

1. Image data of welded parts are collected.
2. It is passed to the classification model that recognizes whether a material is correctly welded or incorrectly welded, whether it is best welded or worst welded.

3. Machine Learning algorithm is made and trained on the image data collected.
4. After performing the inference task, our model will let us know about the class to which the material belongs such as correctly welded or incorrectly welded material.
5. Continuously improve the algorithm to get the maximum accuracy.
6. Integration of the complete system.
7. After the integration of the system, the complete model is validated to ensure that the model is behaving as intended as shown in figure 3 below.

The Schematic diagram is shown in Figure 3.

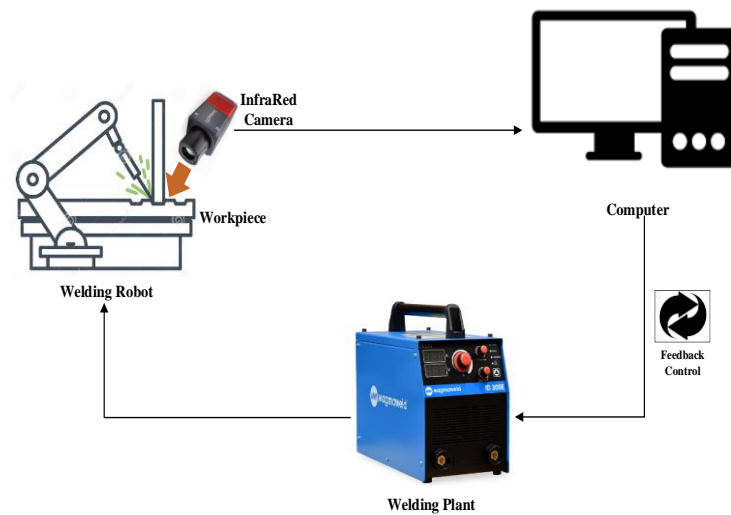


Figure 4: Schematic Diagram of Welding Monitoring Process

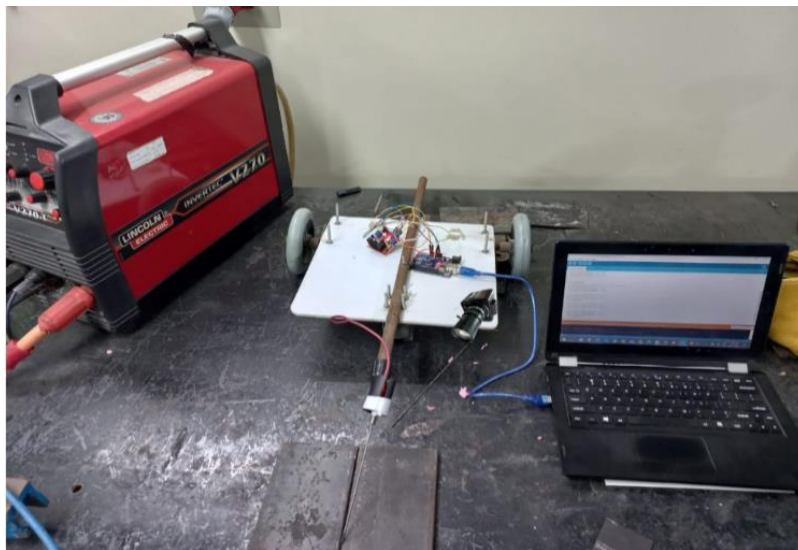


Figure 5: Experimental Setup of Welding Monitoring Process

First, we must make a dataset of images based on which the supervised learning algorithm will work. Then we'll make an algorithm using machine learning tools and using the python language.

The images of manual welding are classified as best or worst as shown in Figures 3 and 4. In the classification of the weld images, it is considered that the best weld has no cracks and holes in the bead, the bead is uniform, the width and height are appropriate, and the strength of the welding meets the requirements.



Figure 6: Worst Weld from manual welding



Figure 7: Best weld from manual welding

The machine learning algorithms help in determining the best and worst images. First of all, the Visual Studio environment is installed in the system. The necessary libraries are installed such as NumPy, matplotlib, cv2, etc. The libraries are imported, and the dataset is loaded for binary classification. After that, the model is trained on the dataset.

In Phase 4 there is an explained discussion of the results.

In the last phase, there is the conclusion of this work.

RESULTS AND DISCUSSION

This part of the paper presents the outcome of all the processes performed during the study starting from the data collection where images were captured and then classified according to the condition that whether the image is best or worst welded, and then we made image recognition using python language for the trial-and-error method.

It has been done through the Python language where Jupyter interfaces are used which provides interactive coding by using ipywidgets packages that can help explore and apply codes in a more interactive fashion. In addition, the Visual Studio Code interface is used for Python coding, which is also commonly referred to as VS code, loads really fast and takes less time. Having a modular approach to Code helps it perform better.

First, the necessary libraries have been imported into the respective interface, those libraries include cv2, NumPy, matplotlib, etc. After loading and importing the necessary libraries, binary classification was done which is classifying elements of a set into two groups based on a classification rule. The binary classification algorithm in machine learning categorizes new observations into one of two categories. It is a method of machine learning that uses predefined categories and categorizes new observations into those categories using supervised learning. When there are only two categories the problem is known as statistical binary classification. After loading and importing the necessary libraries, then the dataset of images that have been made is loaded to the interface, and the classification of images based on the respective dataset is done.

CONCLUSION AND FUTURE WORK

Though, this is a trial-to-error method, the detailed experimentation of the large dataset will be done later in future work. Based on the small dataset that has been given to the interface, the code has been executed to recognize the image that has been given to the model afterward. The model was trained on the dataset that has been made through the data collection phase, and after loading the respective dataset to the interface, and training the model accordingly, then a new image will be uploaded to the model, and based on the data, it will tell that whether the respective image is best welded or worst welded. When executing the model that has been trained on the dataset, the image can be detected easily by just giving an image of the welded part to it, and the model will detect whether it is best welded or worst welded.

Future Work is aimed to use a big data set of weld images to increase the prediction accuracy of the welding robot. The experimentation will be done by the integration of the algorithm with the welding robot for controlling the weld parameters by the continuous feedback control system. Further, the image classification will not be limited to binary but enhanced according to the big data. The parameters will be set for each type of image difference and the robot will be behaving accordingly. The codes will also be available on the cloud; so that anyone can access them and can make the welding processes run easily.

References

- [1] A. Rout, B. B. V. L. Deepak, and B. B. Biswal, "Advances in weld seam tracking techniques for robotic welding: A review," *Robotics and Computer-Integrated Manufacturing*, vol. 56. 2019. doi: 10.1016/j.rcim.2018.08.003.
- [2] Y. K. Liu and Y. M. Zhang, "Supervised Learning of Human Welder Behaviors for Intelligent Robotic Welding," *IEEE Transactions on Automation Science and Engineering*, vol. 14, no. 3, 2017, doi: 10.1109/TASE.2015.2453351.
- [3] T. S. Hong, M. Ghobakhloo, and W. Khaksar, "Robotic Welding Technology," in *Comprehensive Materials Processing*, vol. 6, 2014. doi: 10.1016/B978-0-08-096532-1.00604-X.
- [4] J. Zhou, Y. Zhou, B. Wang, and J. Zang, "Human–Cyber–Physical Systems (HCPSs) in the Context of New-Generation Intelligent Manufacturing," *Engineering*, vol. 5, no. 4, 2019, doi: 10.1016/j.eng.2019.07.015.
- [5] B. Wang, S. J. Hu, L. Sun, and T. Freiheit, "Intelligent welding system technologies: State-of-the-art review and perspectives," *Journal of Manufacturing Systems*, vol. 56. 2020. doi: 10.1016/j.jmsy.2020.06.020.
- [6] A. Mishra, "Machine Learning Approach for Defects Identification in Dissimilar Friction Stir Welded Aluminium Alloys AA 7075-AA 1100 Joints," *Journal of Aircraft and Spacecraft Technology*, vol. 4, no. 1, pp. 88–95, Jan. 2020, doi: 10.3844/jastsp.2020.88.95.
- [7] A. F. Jimenez Lopez, M. C. Prieto Pelayo, and A. Ramirez Forero, "Teaching Image Processing in Engineering Using Python," *Revista Iberoamericana de Tecnologías del Aprendizaje*, vol. 11, no. 3, 2016, doi: 10.1109/RITA.2016.2589479.
- [8] J. Zhou, P. Li, Y. Zhou, B. Wang, J. Zang, and L. Meng, "Toward New-Generation Intelligent Manufacturing," *Engineering*, vol. 4, no. 1. 2018. doi: 10.1016/j.eng.2018.01.002.
- [9] H. Kagermann, W. Wahlster, and J. Helbig, "Securing the future of German manufacturing industry initiative INDUSTRIE 4.0 implementing the strategic Recommendations for Final report of the Industrie 4.0 Working Group," 2013.
- [10] Y. Pan, "Heading toward Artificial Intelligence 2.0," *Engineering*, vol. 2, no. 4, 2016, doi: 10.1016/J.ENG.2016.04.018.
- [11] A. Kusiak, "Smart manufacturing must embrace big data," *Nature*, vol. 544, no. 7648. 2017. doi: 10.1038/544023a.
- [12] J. Davis *et al.*, "Smart Manufacturing," *Annu Rev Chem Biomol Eng*, vol. 6, pp. 141–160, Jul. 2015, doi: 10.1146/annurev-chembioeng-061114-123255.
- [13] F. Tao, Q. Qi, A. Liu, and A. Kusiak, "Data-driven smart manufacturing," *J Manuf Syst*, vol. 48, 2018, doi: 10.1016/j.jmsy.2018.01.006.

REGIONLARDA TURİZMİN İNKİŞAFININ MÜASİR VƏZİYYƏTİNİN
QIYMƏTLƏNDİRİLMƏSİ

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Xülasə:Məlum olduğu kimi hazırda ölkədə dövlətin apardığı siyasətin əsasını neft-qaz sektorundan gələn gəlirlərin qeyri neft sektorunun inkişafına yönəltməkdir.Qeyri neft sektoruna daxil olan sahələrin əsası da turizm sektorudur. Digər xidmət sahələri kimi, turizm sferasının inkişafı, ölkədə digər sahələrin inkişafına da stimül verir. Bu biznes əsasən sahibkarları turist xidmətlərinə günü-gündən artan tələbat, yüksək rentabellik, xərclərin qısa zaman kəsiyində ödənilməsi kimi xüsusiyyətləri ilə özünə cəlb edir. Azərbaycanda turizmin inkişafı dövlət siyasətidir. Ölkəmizdə turizmin inkişafı təkcə mərkəzi şəhərlərə turistlərin cəlb edilməsi ilə məhdudlaşmayıb.Regionların turizm potensialından maksimum istifadə də dövlətin prioritetlərindəndir.Ümummilli liderin siyasi kursunun layiqli davamçısı Prezident İlham Əliyevin 2004-cü ildən ardıcıl olaraq imzaladığı“Azərbaycan Respublikası regionlarının sosial-iqtisadi inkişafı Dövlət Proqramı haqqında” Sərəncamlar (2004-2008, 2009-2013, 2014-2018, 2019-2023-cü illər) ölkə iqtisadiyyatının, o cümlədən regionlarda turizmin inkişafı istiqamətində mühüm addımlar oldu. Azərbaycan Respublikası regionlarının inkişafı ölkədə uğurla həyata keçirilən davamlı sosial-iqtisadi inkişaf strategiyasının mühüm tərkib hissəsidir. Bu proqramların icrası nəticəsində regionlarda ardıcıl bir neçə beynəlxalq standartlara cavab verən kurort-sanatoriya,otel və istirahət mərkəzləri yaradıldı.44 günlük müharibədən sonra,torpaqlarımızın düşmən tapdaqları altından azad edilməsi nəticəsində həmin regionların turizm potensialından maksimum yararlanması üçün ölkədə sürətli yenidənqurma işləri gedir. Bu baxımdan da tədqiq olunan mövzu mövcud şəraitdə çox aktualıq kəsb edir.Məqalədə ölkədə regionlarda,xüsusilə azad edilmiş ərazilərdə turizmin inkişaf səviyyəsi təhlil edilmiş,onun postpandemiya dövründə mövcud və həlli yolları müəyyənləşdirilmişdir.

Açar sözlər:Turizm sektoru,turizmin inkişafiregional turizm,regional inkişaf

**ASSESSMENT OF THE CURRENT STATE OF TOURISM DEVELOPMENT IN
THE REGIONS**

Summary

As it is known, the basis of the state's policy in the country is to direct the revenues from the oil and gas sector to the development of the non-oil sector. The basis of the areas included in the non-oil sector is the tourism sector. Like other service areas, the development of the tourism sphere stimulates the development of other areas in the country. This business mainly attracts entrepreneurs with its features such as daily increasing demand for tourist services, high profitability, and payment of expenses in a short period of time. The development of tourism in Azerbaijan is a state policy. The development of tourism in our country is not limited to the attraction of tourists to the central cities. The maximum use of the tourism potential of the regions is one of the state's priorities. The Decrees "On the State Program for the Socio-Economic Development of the Regions of the Republic of Azerbaijan" signed by President Ilham Aliyev, a worthy follower of the national leader's political course, have been signed since 2004. (2004-2008, 2009-2013, 2014-2018, 2019-2023 years) were important steps towards the development of the country's economy, including tourism in the regions. The development of the regions of the Republic of Azerbaijan is an important component of the sustainable socio-economic development strategy successfully implemented in the country. As a result of the implementation of these programs, several resorts-sanatoria, hotels and recreation centers that meet international standards were created in the regions. After the 44-day war, as a result of the liberation of our lands from the enemy, rapid reconstruction is underway in the country in order to make the most of the tourism potential of those regions. From this point of view, the researched topic is very relevant in the current conditions. In the article, the level of development of tourism in the regions of the country, especially in the liberated areas, is analyzed, and the existing and solutions for it in the post-pandemic period are determined.

Keywords: Tourism sector, tourism development, regional tourism, regional development.

Azərbaycanda qeyri-neft sektorunun əsas sahələrindən biri olan turizm sahəsinin inkişafı İlham Əliyev prezident seçildikdən sonra yeni müstəviyə qədəm qoydu. Belə ki, ölkədə, o cümlədən regionlarda turizmin inkişafı üçün müxtəlif Dövlət proqramları, strateji yol xəritəsi və s normativ hüquqi aktlar qəbul edilmişdir. Təməlu ulu öndər tərəfindən qoyulan bu inkişafı İlham Əliyev fəaliyyətə başladığı gündən indiyədək imzaladığı dörd regionların sosial-iqtisadi inkişafı ilə əlaqədar Dövlət Proqramları (2003-2008, 2009-2013, 2014-2018, 2019-2023-cü illər) regionlarda turizmin inkişafına böyük təkan verdi.

2009-cu ildə Kurortların inkişafına dair 2009-2018-ci illər üçün Dövlət Proqramı, 2010-cu ildə Turizmin inkişafına dair 2010-2014-cü illər üçün Dövlət Proqramı qəbul edilmişdi.

Bundan əlavə 2011-ci il turizm ili elan edildi. Bununla da ölkəmizdə turizmin inkişafı üçün lazım olan sosial-iqtisadi və hüquqi baza yaradıldı.

Qəbul edilən proqramların əsas məqsədi, sənaye və dünya turizminin infrastrukturuna inteqrasiya, yüksək səviyyəli turizm xidməti göstərmək və milli turizm modelinin yaradılmasına yönəldilmişdir.

Bu proqramların əsas məqsədləri bunlardır:

- ❖ turizmin inkişafındakı nailiyyətlər;
- ❖ turizm sahəsində kiçik və orta sahibkarlığın inkişafı;
- ❖ rəqabətə davamlı turizm bazarının yaradılması;
- ❖ turistlərə göstərilən xidmətlərin keyfiyyətinin yaxşılaşdırılmasının təmin edilməsi;
- ❖ kurort müəssisələrinin planlı şəkildə inkişafı və təmin edilməsi onların effektiv istifadəsi.

Dövlətin inkişaf istiqamətində apardığı məqsədyönlü siyasət nəticəsində Azərbaycanın bölgələrindəki turizm böyüməsi bu sahədəki iqtisadi göstəricilərin inkişafından açıqca görünür. Otel infrastrukturunda iqtisadi göstəriciləri aşağıdakı cədvələ əsasən təhlil edək;

Cədvəl 1: Azərbaycan Respublikasında otellərin, motellərin və ümumi iqtisadi göstəriciləri bölgələrə görə turistlərin digər yerləşmə yerləri

Turizm bölgəsi	Köhnə otaqlar		Yeni otaqlar	
	2016	2017	2018	2019
1. Abşeron	11843	11866	1004422	1107625
2. Gəncə-Qazax	2842	3080	82231	31113
3. Şəki-Zaqatala	2203	2374	62751	64871
4. Yuxarı Qarabağ	2153	2245	31655	45286
5. Quba-Xaçmaz	8119	8703	279439	194871
6. Kəlbəcər-Laçın	130	1320	67423	8361
7. Dağlıq Şirvan	1139	1321	18376	19315
8. Lənkəran	2783	2884	76855	67637
9. Naxçıvan	1522	1448	84420	85897
10. Ümumi	31465	32600	1621813	1597300

Mənbə: <https://www.stat.gov.az/>

Cədvəldən göründüyü kimi, hesablamalar göstərir ki, ümumi iqtisadi göstəricilərin dinamikasında, otaq sayı və yataq sayı habelə, otellər, motellər və .s. ən böyük pay Abşeron iqtisadi rayonuna düşür. Belə ki, 2016-2017- ci ilin müqayisəsində otaq sayı turizm bölgəsi üzrə ən böyük göstərici Abşeron, Gəncə- Qazax, Şəki-Zaqatala iqtisadi rayonlarının payına düşür və ümumi göstərici bu illər üzrə 1.135 dəfə artmışdır. 2017-2018-ci illərin müqayisəsində bölgələr üzrə turizmin yerləşmə yeri 1.589 dəfə artmışdır. 2018-2019-cu illər üzrə artım temoi isə 2.454 dəfə artmışdır. Ümumi olaraq 2017-ci ildən 2019-cu ilə qədər isə 1.565 dəfə artmışdır. Belə ki, iqtisadi bölgə olaraq sırasıyla 2017-ci ilə əsasən, 36.4% və yüzdə 69.3% təşkil edir. Abşeron bölgəsinin belə bir hakim mövqeyi sahənin təmsil etdiyi böyük maraqla izah edilə bilər. Turistlər üçün, yəni: memarlıq və tarixi zəngin abidələr, bölgənin Xəzər dənizinin sahilindəki yeri, mərkəz və dünyanın hər yerindən iş adamlarını cəlb etmək və s. bütün bu amillər lazımi yerləşmə qurumlarının meydana gəlməsinə və eləcə də müəyyən bir iqtisadi bölgədə turizmin inkişafına zəmin yaradır. Daxili turizm müxtəlif bölgələrdə inkişaf etdikcə Azərbaycanda istirahət üçün lazım olan infrastruktur yaradılır. Amma rekreasiya zonalarının yaranma prosesi qeyri-bərabər paylanmışdır. Ölkəmizin bəzi mənzərəli guşələri hələ unudulmaqda qalır, digərləri isə əksinə, turizmin inkişafı müşahidə olunur. Bu zonalara dəniz kənarı, xüsusən Quba-Xaçmaz iqtisadi rayonun bir hissəsi olan Nabran bölgəsi ümumi iqtisadi dinamikasında ikinci sırada turistlərin yerləşməsi üçün müvafiq olaraq 26,7% və 12,2% olan göstəricilər iştirak etdi. Hələ 80-ci illərdə bu yerlərin dövlət əhəmiyyətli bir turizm zonası kurortuna çevrilməsi lazım idi. Ancaq bu proyektə, əhəmiyyətli səbəblərdən investisiya yatırımı həyata keçirilmədi. İndi suverenliyin əldə edilməsi və bazar münasibətlərinin inkişafı ilə, yerli iş adamları, xüsusi şirkətləri məmnun etməyə çalışır.

Regionlarda turizmin sürətli inkişafı digər sosial-iqtisadi göstəricilərə də, böyük müsbət təsirini göstərmişdir. Bunları ayrı-ayrılıqda aşağıdakı cədvəldə aydın şəkildə izah edək.

Cədvəl 2: Azərbaycan Respublikasının regionlarda turizmin sürətli inkişafına təsir edən digər sosial-iqtisadi göstəricilər (min.manat)

Göstəricilər	2010	2015	2016	2017	2018	2019
Əhalinin xərcləri, milyon manat	19251,5	30799,6	34963,4	39775,0	44498,4	47370,5
Muzdlu işçilərin orta aylıq nominal əmək haqqı, manat	331,5	444,5	466,9	499,8	528,5	544,6
Balans dəyəri ilə iqtisadiyyatda əsas fondlar (ilin sonuna), milyon manat	66659,5	110677,9	124008,4	169120,3	182788,5	193491,0
Ümumi daxili məhsul:						
cəmi, milyon manat	42465,0	59014,1	54380,0	60425,2	70337,8	79797,3
əhalinin hər nəfərinə, manat	4753,0	6268,0	5706,6	6269,6	7226,0	8126,2
Faktiki son istehlak, milyon manat	21336,1	33238,8	37575,7	43228,5	48482,2	50552,9
Ümumi yığım, milyon manat	7669,0	16234,8	15179,4	15518,1	17147,6	16019,6
Sənaye məhsulu, milyon manat	27978,2	32110,3	26369,4	32300,2	39892,5	47677,0
Kənd, meşə və balıqçılıq təsərrüfatı məhsulu, milyon manat	3968,1	5431,7	5836,8	5874,3	6853,5	7274,5
Əsas fondların istifadəyə verilməsi, milyon manat	5961,3	9336,3	9933,3	10157,4	8617,4	12357,8
Əsas kapitalla yönəldilmiş vəsaitlər, milyon manat	9905,7	17618,6	15957,0	15772,8	17430,3	17244,9

Mənbə: <https://stat.gov.az/>

1.Regionların sosial-iqtisadi inkişaf proqramı 2009-2013

2.Regionların sosial-iqtisadi inkişaf proqramı 2014-2018

3.Regionların sosial-iqtisadi inkişaf proqramı 2019-2021

Cədvəldən göründüyü kimi, regionlarda turizmin inkişafına təsir edən sosial-iqtisadi göstəricilər əhalinin xərcləri, 2010-2015-ci illərin müqayisəsində 2.124 dəfə artım olmuşdur. Balans dəyəri ilə iqtisadiyyatda əsas fondlar (ilin sonuna) 2015-2016-cı illin müqayisəsində isə 8,936 dəfə artım müşahidə edilir. 2016-2017-ci illərin müqayisəsində 6.875 dəfə artım qeydə alınıb. Əsas kapitalla yönəldilmiş vəsaitlər 2017-2018-ci ilin müqayisəsində 4.475 dəfə artım qeyd olunur. Əsas fondların istifadəyə verilməsi 2018-2019-cu illərin müqayisəsində isə 3.688

dəfə artım müşahidə edilib. Ümumi olaraq regionlarda turizmin sürətli inkişafına təsir edən digər sosial-iqtisadi göstəricilər üzrə 2010- 2019-cu illər üzrə 2.737 dəfə artım qeydə alınıb.

Təsadüfi deyil ki, turizmin inkişafının əsas istiqamətləri hökumətin ümumi iqtisadi siyasətinin ayrılmaz hissəsi, yoxsulluğa və iqtisadi böyüməyə qarşı mübarizə proqramı, işsizlərin sayının azaldılması üçün bir fəaliyyət planı müəyyənləşdirir, böyük ölçüdə bu sənayedəki inkişafın sayəsində kiçik sahibkarlığın inkişafı və regional infrastrukturun yaxşılaşdırılmasını həyata keçirir. Öz növbəsində, bölgələrin sosial-iqtisadi inkişafı dövlət proqramı da turizm mərkəzləri, evlər və istirahət zonaları şəbəkəsinin inşasını stimullaşdırmaq, sanatoriyalar, xəstəxanalar və s. nəzərdə tutulmuşdur. Bir-birini qarşılıqlı şəkildə tamamlayan bütün bu tədbirlər nəticədə turizm biznesinin inkişafına təkan verən olmalıdır. Xarici təcrübənin də göstərdiyi kimi kənd turizmi onsuz da inkişaf edir və bir neçə onillik və xüsusilə son bir neçə ildə aktivdir.

Qeyd etmək lazımdır ki, Azərbaycanca kənd turizmi turizm sahələrindən biridir. Kəndin iqtisadi inkişaf yolları, əlavə imkanı sakinləri üçün qazandırır. Hal hazırda Şəkiddə "ailə səyahəti birliyi" yaradılıb. Şirkət Göyçaya kiçik turist qruplarından mövcud olan və göndərilən turistlər burada yerləşən villada istirahət edir. Bu cür qruplar üçün şirkət fərdi evlərdə tətillər təşkil edir (gündəlik səhər yeməyi və digər xidmətlər ilə adam başına dollar). Avropanın ucuz kənd təsərrüfatı təcrübəsini tətbiq edərsə və ekoloji turizm düzgün təşkil edildiyi təqdirdə, yeni iş yerləri açacaq və bununla da problemi həll edəcəkdir. Bundan əlavə fikrimizcə, Azərbaycan iqtisadiyyatı, xeyli fayda götürər. Regional məşğulluq və yoxsulluğun azaldılmasına da, müsbət təsir göstərəcək. Bu, şübhəsiz ki, yalnız yerli turistləri deyil, həm yalnız kənd istirahəti ilə, həm də, orijinal həyat tərzini ilə kəndlərimizin həyat tərzini və adətləri maraqlanan xariciləri cəlb edəcəkdir. Bununla yanaşı, ölkənin sənaye inkişafına baxmayaraq bir çox təbii mənzərələr orijinal görünüşünü və ekoloji təmizliyini qoruyub saxlamışdır. Son bir il yarımında qorunan təbiət zonalarının sahəsi 8-dən artırılmışdır. Azərbaycan ərazisinin 7% -ə qədər bir neçə milli park yaradılmışdır, ekoturizmin təşkili üçün böyük imkanlara malik olunmuşdur. Qeyd olunduğu kimi, 2009-cu ilin aprel konfransında "ölkəmizdə davamlı ekoturizm və milli parklar sistemi", ölkənin bunun üçün bütün imkanlarını yaratdı. Bunun təsdiqində bu günü dağlarda aktiv, sərgüzəştli bir sərvət, tətillərdə olduğunu orta hesabla da olsa bir ailə üçün olduqca əlverişli bir zövqdür. Tətillərini dağlarda mənzərəli yerdə keçirməyi sevənlər üçün Kiçik və Böyük Qafqazın yerləri, ərazidə istirahət zonaları var. Məsələn, Quba, Zaqatala, Qax, Masallı, Şamaxı və Qusar rayonlarını göstərə bilərik. Əsasən bu istirahət zonaları yaxınlıqdadır və dağların ətəkləri turistlərə xidmətlər təklif edilir. Qusar rayonunda yerləşən turistik Ekstremal yüksək hündürlük 4 ildir fəaliyyət göstərir.

Gələcəkdə turizm biznesinin daha da inkişaf etdirilməsinin bütün istiqamətləri ilə eyni zamanda, kurort biznesinin inkişafı, otel biznesi, yeni turizm komplekslərinin yaradılması, ixtisaslı kadrların hazırlanması, infrastrukturun inkişafı, xüsusən otellərdə, mərkəzlər, tətill evləri, sanatoriyalar, restoranlar, əyləncə mərkəzləri yerli əhəlinin mədəniyyəti və yaşayış şəraiti turistlərdə yüksək keyfiyyətli xidmət göstərilməsi ilə eyni vaxtda getməsi tamamilə aydındır. Ancaq müşahidələrimizə görə, müstəqillik illərində kurortlar nəinki ölkə iqtisadiyyatına ciddi bir töhfə vermiş, əksinə dövlətin subsidiyalarını alaraq aşağı gəlirliliklə fəaliyyət göstərirlər.

Lakin cədvəllərdən də göründüyü kimi, 2019-cu ildən bəri başlayan Covid-19 pandemiyası bütün dünyada o cümlədən Azərbaycanda turizm sahəsini iflic etdi. Artıq indi yavaş yavaş bu sahə özünə gəlməyə başlayır. Azərbaycanda isə turizmin inkişafı üçün yeni mərhələ başlayır. Belə ki, 44 günlük Vətən müharibəsi nəticəsində Ali Baş komandanın rəhbərliyi altında rəşadətli ordumuz uzun illər ermənilərin əsarəti altında olan torpaqlarımızı azad etdi. Hazırda orada böyük quruculuq işləri gedir. Məlum olduğu kimi Qarabağın turizm potensialı həddindən artıq çoxdur. Bu səbəbdən də qeyd olunanların hamısı və Qarabağ və Şərqi zəngəzur iqtisadi rayonlarında yenidən təşkil olunmalıdır:

- turizm məkanlarının çox hissəsinin özəlləşdirilməsini təşkil etmək;
- turizm məkanlarının iqtisadi və maliyyə müstəqilliyini təşkil etmək;
- turizm məkanlarında mülkiyyət növündən asılı olmayaraq turizm məkanlarını tam iqtisadi və maliyyə müstəqilliyi ilə təmin etmək;
- turizm məkanlarında mülkiyyət növündən asılı olmayaraq, göstərilən xidmətlər üçün müvafiq strukturların cəlb edilməsi ilə "Gənclər və İdman Nazirliyi" və Turizm Agentliyi tərəfindən hazırlanmalı olan keyfiyyət standartlarını tətbiq etmək;
- xarici investisiyaların cəlb edilməsi və kurort işinin yaxşılaşdırılması üçün istənilən mülkiyyət formasında birgə müəssisələr yaratmaq;
- İdarəetmənin demokratikləşməsi, müstəqilliyin daha da genişləndirilməsi, iqtisadi idarəetmə metodlarının dərinləşdirilməsi.

Ədəbiyyat siyahısı

- 1.Mərkəzi bankın statistik bülleteni. Noyabr 2019.71 səh.
- 2."Turizm fəaliyyəti haqqında" Azərbaycan Respublikasının qanunu 2021
- 3.Ə.Q. Əlirzayev "Turizm iqtisadiyyatı və idarə edilməsi" Bakı-2010 494 səh
4. Azərbaycan Respublikasında ixtisaslaşmış turizm sənayesinin inkişafına dair strateji yol xəritəsi 2016-cı il
- 5.DSK-nın rəsmi bülleteni 2019-cu il.806 səh.
- 6.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2004-2008)
- 7.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2009-2013)
- 8.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2014-2018)
- 9.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2019-2023)
10. Azərbaycan Respublikası Dövlət Turizm Agentliyinin rəsmi internet səhifəsi.
- 11.ATMU-nun rəsmi internet səhifəsi.

The Impact Of Chatgpt On Human Resource Management

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Abstract

The most precious asset in a company is its people. With the help of ChatGPT, an AI-powered natural language processing tool, can communicate with the chatbot in a variety of human-like ways. The language model can provide information and support for tasks like writing emails, articles, and code. OpenAI, a corporation that conducts research in artificial intelligence, developed ChatGPT. ChatGPT was introduced on November 30, 2022, by the research company. By responding to inquiries from candidates regarding the job specifications, corporate culture, and application procedure, Chat GPT can be used to automate the hiring process. In addition to making sure that candidates have timely and correct information, this can free up HR workers to concentrate on other activities. The GPT-4 Chat has a huge impact on human resource specialists. It may help cut down on the time and effort required to complete typical HR duties, allowing HR employees to concentrate on more important projects. Additionally, it can give workers a more tailored experience, which can boost engagement and productivity. This study gathered data based on a survey of the literature and secondary sources for statistical information. Writing policies and procedures could be aided by ChatGPT. Again, even if this could be very helpful, nothing can replace years of experience or some of the subtleties that go into developing an HR policy and can only be understood by having actually done it. In conclusion, ChatGPT can be a useful tool for HR departments, offering a variety of advantages like improved applicant and employee experiences, increased efficiency, and streamlined operations. HR professionals may anticipate seeing additional opportunities as AI technology develops to use language models like ChatGPT to streamline their processes and propel corporate success.

Keywords: ChatGPT, openAI, human resource management, HR professionals, technology

Introduction

The impact of Artificial Intelligence (AI) on numerous businesses is growing increasingly pronounced as the world continues to adopt it. The GPT-4 Chat is a key AI development that has the potential to completely change the HR sector. The GPT-4 Chat is a conversational agent powered by AI that can mimic human conversations. This technology is intended to comprehend natural language, pick up knowledge from human encounters, and offer tailored responses. The GPT-4 Chat can be used by HR professionals to streamline a number of processes, including hiring, onboarding, training, and employee engagement.

The GPT-4 Chat has a huge effect on HR workers. It may assist cut down on the time and effort required to complete typical HR duties, allowing HR employees to concentrate on more important projects. Additionally, it can give workers a more tailored experience, which can boost engagement and productivity. Nevertheless, there might be drawbacks to using GPT-4 Chat in HR. The possibility of bias in the AI's decision-making process is one cause for concern. The GPT-4 Chat may produce biased results and engage in discriminatory HR practices if the data used to train the AI is biased. As a result, HR personnel need to make sure that the data being used to train the GPT-4 Chat is representative and diverse. The potential loss of the personal touch in HR is another issue. The sensitivity and emotional intelligence of a human HR expert cannot be replaced by the GPT-4 Chat, despite the fact that it may offer personalized responses. In order to keep a human touch in their contacts with employees while employing AI to expedite operations, HR professionals must strike a balance.

ChatGPT's unethical issues like considering that ChatGPT can produce conversational text, there are ethical questions about the likelihood that it won't produce false or misleading information. Serious consequences could result from this, including damage to reputations, the dissemination of untrue information, or even the incitement of violence. For those working in human resources, ChatGPT may change the rules of the game. Businesses can utilize ChatGPT to streamline activities, increase productivity, and enhance the entire work experience as the need for efficiency in the workplace grows.

Review of Literature

Yogesh K. Dwivedi et al. (2023), entitled "So what if ChatGPT wrote it? Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy, Transformative artificially intelligent tools, such as ChatGPT, designed to generate sophisticated text indistinguishable from that produced by a human, are applicable across a wide range of contexts." The technology offers advantages as well as

frequent moral and legal difficulties, and it has the ability to have both good and bad effects on organizations, society, and individuals. Identifying the knowledge, tools, and resources required to handle generative AI; examining the biases of generative AI attributable to training datasets and processes; investigating business and societal contexts best suited for generative AI implementation; figuring out the best combinations of humans and generative AI for various tasks; figuring out how to assess the accuracy of text produced by generative AI; and discovering the ethical and legal implications.

Viriya Taecharungroj (2023). Titled “What Can ChatGPT Do? Analyzing Early Reactions to the Innovative AI Chatbot on Twitter”, the investigation also revealed that ChatGPT has the capacity to have both positive and bad effects on both technology and people. The quest for artificial general intelligence, the evolution of occupations, a new technical landscape, and the progress-ethics problem are the four major concerns that the author identifies as needing to be addressed while a outcome of this AI advancement.

Tufan. Adiguzel, et al. (2023) in this research “Revolutionizing education with AI: Exploring the transformative potential of ChatGPT” In the educational setting, artificial intelligence (AI) brings new tools that have the potential to revolutionize the way that lessons are taught and learned. This paper provides a thorough overview of AI technology, including possible uses in education and associated challenges. We cover chatbots and associated algorithms that can mimic human interactions and produce text that appears human, depending on input from natural language. Modern chatbots like ChatGPT have many benefits, but they also present significant ethical and practical problems when used in education. In order to assist instructors and students and to advance responsible and ethical use, the authors hope to offer valuable information on how AI may be successfully introduced into the educational environment.

ChatGPT

'Artificial Intelligence Chatbot' ChatGPT was created by OpenAI, a research facility that specializes in 'AI' research. It builds on the GPT 3.5 model from OpenAI by using a 'large language model' that has been improved through supervised reinforcement-based training. The GPT, or "Generative Pre-trained Transformer," offers thorough responses to user inquiries. The responses might not always be factually accurate, but they always offer thorough explanations, and they can even recall what they previously said and make corrections if necessary.

Impact of ChatGPT on Human Resource Management

Technology professionals have been in awe of ChatGPT ever since it was released. It makes sense why the clever chatbot has evolved into a sort of demi-god among digital applications

because its skills are so all-encompassing. As technology has recently become more important to human resources, chatGPT is prepared to take over this division as well. However, it remains to be seen whether the AI chatbot can actually produce results given that human volition and judgement are needed in human resources to select the best candidate or interact with them for the advancement of the business and the individual as well. Because chatGPT makes it simple for HR professionals to quickly generate texts, create effective responses, and analyse user data to derive insightful conclusions, it is vital to consider the other side of the coin as well. Beyond what is apparent, chatGPT's effects on HR are possible.

Advantages of using chatGPT

- **Effectiveness:** It is clear that chatGPT can handle tedious and routine HR operations like scheduling interviews and composing mass emails, allowing users to concentrate on things that create value.
- **Efficiency:** By offering feedback and filling out the appraisal forms with candidate information, it helps hasten the process and allows management to make judgments more quickly.
- **Better communication:** ChatGPT can assist HR leaders in honing their communication tactics. The software serves as a knowledge base and trustworthy human-like Wikipedia.
- **Improved data management:** ChatGPT's real-time updates and insights will significantly relieve HR of their workload. It can carry out all the labor-intensive tasks in data-driven processes that enhance HR operations.

Cons of using chatGPT

- **Limitations in difficult situations:** While chatGPT continues to struggle to offer accurate factual information, there is little hope for helping HR executives in circumstances when empathy and judgement are needed.
- **Privacy compromised:** There is a good probability that AI programmes may act erratically. Saving private employee data in that situation is virtually impossible.
- **Technology dependence:** ChatGPT is so compulsive that HR recruiters rely on it a lot. As a result, the entire reason the department exists—the human touch—may be lost in HR operations. The USP of HR leaders, the ability to balance, will be lost in the race to be agile.

Relevance of ChatGPT for the HR Department

As a general-purpose AI chatbot, ChatGPT has a variety of applications. Because it is interactive, it can quickly offer top-notch employee support. The chatbot can therefore address the majority of employee inquiries, relieving HR personnel from having to continuously respond to the same queries. Using ChatGPT to resolve queries can also cut down on the expense, time, and effort needed to maintain employee engagement. The AI chatbot can quickly and intelligently respond to staff questions. It might even offer insightful conclusions that boost business productivity. Because of its adaptability, ChatGPT can be utilized in a variety of circumstances. Therefore, ChatGPT can be applied in a number of ways to help the HR department perform its duties.

Advantages of ChatGPT for the HR Department

ChatGPT deployment has a number of benefits, including increased cost-effectiveness, employee engagement, simpler management, improved insights, and more. So let's go into detail about the various benefits of implementing ChatGPT for the HR department.

❖ Simplified Query Resolution

Because ChatGPT is so adept at demystifying complicated ideas, it is the ideal chatbot for answering these kinds of questions. Given that the employee won't have to remember complicated menu paths, it will speed up the query resolution process.

❖ Improved Employer Branding

It guarantees that the staff members are happy with their work and actively support the business. Having a chatbot also aids in recruiting because candidates get to interact with an AI-based chatbot and learn something new and exciting. The aforementioned factors aid in motivating workers effectively, which in turn raises the calibre of their output. As a result, the company's goods and services are of much higher quality, which boosts both its employer brand and its own brand.

❖ AI-based Analytics

The personnel database can be examined using ChatGPT to draw insightful results. Additionally, AI-based analytics can assist in comprehending minute details that affect an organization success. It can, for instance, assist you in understanding the patterns of employee absence, attendance, and breaks and alert you to any instances of workplace laziness. These in-depth insights can assist you in streamlining your operations by retaining your workforce and improving their job performance.

How to reduce bias in the Chat GPT-4 results with AI and equality in HR: To guarantee that the technology is applied fairly and ethically, it is critical to reducing bias in the findings produced by the Chat GPT-4 in Human Resources. The following actions can be taken by HR professionals to lessen bias in the outcomes produced by the Chat GPT-4.

- ❖ **Ensure diverse training data:** HR professionals should make sure that the training data used to teach the AI is diverse and representative in order to reduce bias in the Chat GPT-4. To eliminate biases based on gender, race, ethnicity, or any other demographic aspect, the training data should represent a diverse spectrum of voices, opinions, and experiences.
- ❖ **Continually audit and update training data:** HR professionals should continuously review and update the training data used to train the Chat GPT-4. By doing this, any biases in the training data will be discovered and swiftly fixed.
- ❖ **Utilized numerous data sources:** When training the Chat GPT-4, HR professionals should make use of multiple data sources to lessen the potential for bias. Using a wider variety of data sources, will ensure that any specific biases or flaws in one dataset are balanced out.
- ❖ **Track findings:** To spot any biases or inaccuracies, HR professionals should constantly track and assess the results produced by the Chat GPT-4. By doing so, they will be able to fix any problems and raise the fairness and accuracy of the conclusions drawn.
- ❖ **Take into account various viewpoints:** When using the Chat GPT-4, HR professionals should take various viewpoints from various stakeholders into account. To make sure that the technology is utilized in a fair and equitable manner, this includes requesting feedback from staff members, managers, and other stakeholders.

These actions can be taken by HR professionals to ensure that the technology is applied fairly and ethically in the human resources sector and to help reduce bias in the results produced by the Chat GPT-4.

Conclusion

This article, discuss how the GPT-4 Chat has the ability to transform the HR sector by reducing processes and giving workers individualized experiences. However, when interacting with employees, HR professionals need to keep a human touch and be aware of any potential biases. HR executives may maximize the advantages of the GPT-4 Chat while ensuring fair and compassionate treatment of employees by finding a balance between AI and human contact. Effective employee engagement ensures devoted staff members who actively work to lead the

business toward success. Finally, OpenAI's ChatGPT, one of the most sophisticated publicly available chatbots, will be ideal for assisting the HR team in taking care of the employees.

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Reference

- Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*, 15(3), ep429. <https://doi.org/10.30935/cedtech/13152>
- Chavez, M. R., Butler, T. S., Rekawek, P., Heo, H., & Kinzler, W. L. (2023). ChatGPT(Generative Pre-trained Transformer): Why we should embrace this technology. *American Journal of Obstetrics and Gynecology*. <https://doi.org/10.1016/j.ajog.2023.03.010>
- Deng, J., & Lin, Y. (2023). The Benefits and Challenges of ChatGPT: An Overview. *Frontiers in Computing and Intelligent Systems*, 2(2), 81–83. <https://doi.org/10.54097/fcis.v2i2.4465>
- Gabbiadini, A., Dimitri, O., Baldissarri, C., & Manfredi, A. (2023). Does ChatGPT Pose a Threat to Human Identity? *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4377900>
- Viriya Taecharunroj (2023). “What Can ChatGPT Do? Analyzing Early Reactions to the Innovative AI Chatbot on Twitter”, *Big Data Cognitive Computing*,7(1), 35. <https://doi.org/10.3390/bdcc7010035>
- Yogesh K. Dwivedi et al. (2023), entitled that “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy, *International Journal of Information Management*, 71 (2023) 102642.

**TARIMSAL ATIKLARIN KULLANIM ALANLARINA İLİŞKİN ÜRETİCİ
EĞİLİMLERİNİN DEĞERLENDİRİLMESİ**

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ÖZET

Tarımsal atıklar, bitkisel ve hayvansal ürünlerin işlenmesi veya sonrasında ortaya çıkan artıklardır. Tarımsal atıkların ortaya çıkışında ve miktarında, üretilen ürün miktarının yanı sıra üretimin gerçekleştiği toplumun sosyoekonomik özellikleri, beslenme alışkanlıkları, gelenekler, coğrafi koşullar, iklim, sanayi tesisine olan uzaklık, eğitim gibi birçok etken mevcuttur. Tarımsal atıkların alternatif alanlarda değerlendirilmesi, yenilenebilir enerji kaynaklarına olan ihtiyaç, çevre sorunlarının çözümü, tarımsal istihdamın artması gibi birçok etken nedeniyle önemlidir. Bu çalışmada üreticilerin tarımsal atıklar ve değerlendirilmesiyle ilgili yaklaşımları incelenmiştir. Çalışmada 190 üreticiyle görüşülmüştür. Üreticilerin, tarımsal atıkların, ekonomik değeri olan ürünlere dönüştürülmesi yönündeki görüşlerinin olumlu yönde olduğu tespit edilmiştir. Biyogaz ve biyoyakıt gibi enerji üretimine yönelik değerlendirmeler üreticilerin sırasıyla %51,1'i ve %33,2'si tarafından bilinmesine rağmen uygulamaya geçen üreticiye rastlanmamıştır. En yaygın değerlendirme uygulamaları, bitkisel üretimde gübre olarak, ahırlarda altlık, hayvan beslenmesi, yakacak olarak kullanımdır. Üreticilerin %82'si bireysel biyogaz tesisi kurma konusunda isteksiz olmasına karşılık, %70'i hayvansal atıkların ortak bir tesiste değerlendirilmesine olumlu bakmaktadır. Enerji açığının ve nüfusun sürekli arttığı günümüzde, tarımsal atıkların değerlendirilmesi Türkiye için büyük bir avantaj sağlayacaktır. Atıkların değerlendirilmesinin çevreye sağladığı yarar da göz önüne alındığında bu alanda kapsamlı politikaların geliştirilmesi gerektiği sonucuna varılmıştır.

Anahtar Kelimeler: Tarımsal Atık, Yenilenebilir Enerji, Çiftçi Yaklaşımları

**EVALUATION OF PRODUCER AWARENESS ON THE POTENTIAL USES OF
AGRICULTURAL WASTES**

ABSTRACT

Agricultural waste refers to the byproducts that arise from the processing or post-production of plant and animal products. The quantity and occurrence of agricultural waste are impacted by various factors such as the amount of produced goods, socio-economic characteristics of the society, dietary habits, traditions, geographical conditions, climate, distance to industrial facilities, education, and many others. The utilization of agricultural waste in alternative areas is crucial due to various reasons such as the necessity for renewable energy sources, resolving environmental problems, and increasing agricultural employment. This study examines the approaches of producers towards agricultural waste and its utilization. 190 producers were interviewed, and it was observed that the producers had a favorable attitude towards converting agricultural waste into economically valuable products. While 51.1% and 33.2% of the producers were aware of energy production such as biogas and biofuels, respectively, no producer had implemented such practices. The most common utilization practices include using agricultural waste as fertilizer in plant production, bedding in animal shelters, animal feed, and fuel. Although 82% of the producers were hesitant to establish individual biogas plants, 70% of them were in favor of the collaborative assessment of animal waste in a shared facility. With the ever-increasing energy deficit and population, the utilization of agricultural waste will provide significant advantages to Turkey. Considering the environmental benefits of waste reuse, it is concluded that comprehensive policies should be developed in this area.

Keywords: Agricultural Waste, Renewable Energy, Farmer Approaches.

* Sorumlu yazar

**Bu çalışma Bađnu olakođlu'nun Yksek Lisans tezinden tretilmiřtir.

GİRİŞ

İnsanlar ilk yerleşik yaşama geçtikleri andan itibaren doğal kaynakları tükenmeyecek gibi kullanmışlardır. Sanayi devrimi ile birlikte doğal kaynakların tüketimi, nüfus ve çevre sorunları hızla artmıştır. Bu sorunu fark eden ve çözüm arayan gelişmiş ülkeler önceleri sanayi üretimlerini geliştirmekte olan ülkelere kaydırmıştır. Son yıllarda ise çevre sorunlarının bölgesel değil küresel çözüm gerektirdiği anlaşılmış ve bununla ilgili birçok çalışma yapılmıştır. Yapılan çalışmalar göstermektedir ki; kirliliğin oluşumu ve önlenmesi kadar doğal kaynakların etkin tüketimi ve yeniden kullanılabilirliği büyük önem taşımaktadır.

Tarım sektörüne üretim girdilerinin artırılması sonucu üretilen ürünün kalitesinin ve miktarının artması ancak belli bir seviyeye kadar mümkündür. Bu noktadan sonra eklenecek olan her türlü girdi üretimde verimin ve kalitenin düşmesine neden olacaktır. Dünya nüfusunun hızla artması ve tarımı yapılan alanların ise aynı kalması sonucu biyokütle atıklarının değerlendirilmesi sınırlı kaynakların kullanımı açısından da son derece önemlidir.

Birçok atık, hammaddeye dönüştürülerek ya da yeni bir kullanım alanı yaratılarak hem çevre kirliliği önlenmekte, hem de ekonomik açıdan yeni iş kolları ve istihdam alanları oluşturulmaktadır.

Tarımsal atıkların ortaya çıkışında ve miktarında, üretilen ürün miktarının yanı sıra üretimin gerçekleştiği toplumun sosyoekonomik özellikleri, beslenme alışkanlıkları, gelenekler, coğrafi koşullar, iklim, sanayi tesisine olan uzaklık, eğitim gibi birçok etken mevcuttur. Tarımsal atıkların alternatif alanlarda değerlendirilmesi, yenilenebilir enerji kaynaklarına olan ihtiyaç, çevre sorunlarının çözümü, tarımsal istihdamın artması gibi birçok etken nedeniyle önemlidir.

Bu çalışmada üreticilerin tarımsal atıklar ve değerlendirilmesiyle ilgili yaklaşımları incelenmiştir.

MATERYAL VE YÖNTEM

Araştırmanın ana materyalini Tekirdağ ili Hayrabolu ilçesi ve ona bağlı mahallelerdeki tarımsal üretim ile uğraşan üreticiler ile yüz yüze yapılan anket çalışmalarından elde edilen orijinal (birincil) veriler oluşturmaktadır.

Üretici sayısının Hayrabolu ilçesi ve ona bağlı mahallelerde ÇKS'ye kayıtlı üreticilerin listesi ve üreticilere ilişkin arazi varlıkları alınmıştır.

$$n = \frac{N * \sigma^2}{(N - 1) * D^2 + \sigma^2}$$

N=4160,000, Varyans: 12179,15543, Ortalama: 128,688, std_sapma: 110,3592109, d: 12,86877575, t: 1,645

n: Örnek hacmi, N: Üretici sayısı, σ^2 : Popülasyon varyansı, D^2 : $(d/t)^2$ olup d: ortalamadan belirli bir orandaki sapma (%10), t: ise araştırmada öngörülen %90 güven sınırına göre t tablo değerini (1,645) ifade etmektedir (Newbold, 1995). Bu formüle göre anket yapılacak üretici sayısı 190 bulunmuştur.

TARIMSAL ATIKLAR

İnsanların yaşamsal, kültürel, ekonomik, sosyal faaliyetlerinin neticesinde ihtiyaç duydukları maddelerden arta kalan ve kullanımı artık mümkün olmayan ve yaşanılan ortamdan uzaklaştırılmak istenen, uzaklaştırılmadığı takdirde çevre ve sağlık sorunlarına neden olan tüm maddeler atık olarak nitelendirilmektedir. Herhangi bir sanayi veya tarım ürününün üretilmesi esnasında, ürünün üretilmesinden sonra ve üretilen ürünün kullanım aşamasında ya da kullanıldıktan sonra ortaya çıkan materyaller katı atık olarak adlandırılmaktadır. Katı Atıkların Kontrolü Yönetmeliği (KAKY)'ne göre ise; "Üreticisi tarafından atılmak istenen ve toplumun huzuru ile özellikle çevrenin korunması bakımından, düzenli bir şekilde bertaraf edilmesi gereken katı maddeleri ve arıtma çamurunu ifade eder" olarak ifade edilmektedir (KAKY, 1991).

Tarımsal atıklar diğer katı atıklara göre daha az tehlikeli, çevre ve doğal döngüye daha az zararlı, dönüşümleri kısa süreli olan atıklardır. Tarımsal atıklar doğaya gelişi güzel bırakılmaktan, yok edilmekten ziyade değerlendirilmeli, yeniden ham madde olarak kullanılmalıdır. Tarımsal atıkların yeniden değerlendirilmesi işlemleri belirli bir plan ve teknik çerçevede, uzman kişilerce hazırlanmış ulusal ve uluslararası çevre ve tarım politikalarına uygun şekilde yürütülmelidir. Tarımsal atıkların değerlendirilmesi çevre sorunlarını azaltacak, hammadde rezervlerini koruyacak ve ekonomik açıdan kalkınma sağlayacaktır. Her atık türünde olduğu gibi tarımsal atıkların da çeşidi ve türü farklılık gösterdiğinden değerlendirme işlemleri atık çeşidine göre farklılık gösterecektir (Akırmak, 2010).

Tarımsal atıkların ortaya çıkış şekli ve miktarında diğer atıklar oluşurken geçerli birçok faktör etkilidir. Bunların ilk akla gelenleri ise şu şekilde sıralanabilir:

- Üretimin yapıldığı ve yaşamın sürdürüldüğü yöre,
- Sanayi hammaddesi olarak tarımsal ürünlerin kullanılması,
- Hammaddenin sanayi tesisine olan uzaklığı,

- Toplumların gelir düzeyleri,
- Gelenek ve görenekler,
- Eğitim durumu,
- Beslenme ve diğer tüketim alışkanlıkları,
- İklim koşullarıdır.

Tarımsal atıklar, hayvansal üretim esnasında ya da sonrasında meydana gelen atıklar, bitkisel üretim esnasında ya da sonrasında meydana gelen atıklar, tarım ürünlerinin üretilmesi esnasında ya da sonrasında meydana gelen atıklar olarak 3 gruba ayrılırlar (Akırmak, 2010).

Hayvansal üretim esnasında ya da sonrasında meydana gelen atıklar, hayvansal ürünleri elde etmek amacı ile gerçekleştirilen hayvan bakımı sırasında, üretim gerçekleştirilirken ve hayvansal ürün üretimi sonrasında meydana gelen atıklar bu grup içerisinde yer almaktadır. Bu atıklara verilebilecek örnekler; her türlü hayvan dışkısı, etrafa saçılan ya da üretici tarafından hayvanlar temizlenirken oluşan kıl, tüy vb. atıklar, hayvanların kesimi sırasında oluşan kemik, kan, tırnak, deri, iç organlar gibi atıklardır. Bitkisel üretim esnasında ya da sonrasında meydana gelen atıklar: Sebze ve meyve gibi bitkisel ürün elde edebilmek için toprağın işlenmeye başlanmasından itibaren başlayan, bitkisel üretim için ekim dikimin gerçekleştirilmesi sırasında ve sonrasında meydana gelen atıklardır. Tarım ürünlerinin üretilmesi esnasında ya da sonrasında meydana gelen atıklar: Tarım ürünlerinin üretimi için toprağın işlenmeye başlamadan önce kurutma, öğütme, ayıklama sırasında oluşan sap, saman, çekirdek, vb. ile oluşumu başlayan atıklardır.

Tarımsal atıklar şu şekillerde değerlendirilebilirler (Acaroğlu, 2013; Demirbaş, 2001; Saraçoğlu,2010; Akpınar ve ark, 2010; Aslan, 2008; Karakuş, 2007; Doğan, 2005; Şener, 2015; Şanlı, 2014):

- Yenilenebilir Enerji Kaynağı Olarak Tarımsal Atıklar
 - o Biyokütle, Biyogaz, Pelet
- Kompost Olarak Değerlendirme
- Yonga Levha Olarak Değerlendirme
- Ağır Metal Gideriminde Tarımsal Atık Kullanımı
- Biyobozunur Plastikler Üretilmesinde Tarımsal Atık Kullanımı
- Malç Olarak Değerlendirme
- Mantar Üretiminde Tarımsal Atıkların Kullanılması
- Kağıt Sanayiinde Kullanılması

- Yalıtım ve Yapı Malzemesi Olarak Kullanılması

ARAŞTIRMA BULGULARI

Anket çalışması yüz yüze görüşme yapılarak gerçekleştirilmiş, yapılan görüşmeler neticesinde aşağıdaki bulgular elde edilmiştir.

Üreticilerin yaş aralıkları Çizelge 1' de verilmiştir. En genç üretici 18 yaşında olup, en yaşlı üretici ise 84 yaşındadır. Ankete katılan üreticilerin yaş ortalaması 48'dir.

Çizelge 1. Üreticilerin Yaş Bilgileri

Yaş Aralıkları	%
25 ve altı	0,5
26-35	18,6
36-45	23,3
46-55	26,9
56-65	23,3
66 ve üstü	7,4
Toplam	100

Çizelge 2.'de üreticilerin eğitim bilgileri verilmiştir. Ankete katılan üreticilerin % 52,2'si ilkokul, % 18,9'u ortaokul, % 24,2'si ise lise mezunudur. En düşük paya sahip olan üniversite ve yüksekokulun oranları ise % 4,7' dir.

Çizelge 2. Üreticilerin Eğitim Bilgileri

Eğitim Durumu	%
İlkokul	52,2
Ortaokul	18,9
Lise	24,2
Yüksekokul	2,6
Üniversite	2,1
Toplam	100,0

Çizelge 3'de üreticilerin üretim tipleri ile alakalı bilgiler yer almaktadır. Tablodan da anlaşılacağı gibi araştırmaya katılan üreticilerin %34,7 si bitkisel üretim, %18,9 u hayvansal üretim, %45,3 lük kısmı ise hem bitkisel hem de hayvansal üretim gerçekleştirmektedirler.

Çizelge 3. Üreticilerin Üretim Faaliyetleri

Üretim Tipi	%
Bitkisel	35,3
Hayvansal	18,9
Her İkisi	45,8
Toplam	100,0

Üreticilere tarımsal atıkların değerlendirilmesi ile ilgili eğitim, seminer, toplantı gibi bir etkinliğe katılıp katılmadıkları sorulmuştur. Verdikleri cevaplar Çizelge 8.14.'te yer almaktadır. Ankete katılan üreticilerin %90,5'i konu ile ilgili eğitim almadığını belirtmiştir. Eğitim alan %9,5'lik kesim, aldıkları eğitimi ilçe tarım müdürlüğü ve ziraat odası tarafından edindiklerini belirtmişlerdir.

Çizelge 4. Üreticilerin Tarımsal Atıkların Değerlendirilmesi İle İlgili Eğitime Katılma Durumu

	%
Evet	9,5
Hayır	90,5
Toplam	100,0

Üreticilere tarımsal atıklarını nasıl değerlendirdiklerini ve bildikleri tarımsal atıkların değerlendirme şekillerini sorulmuştur. Çizelge 5'te üreticilerin % kaçının verilen atık değerlendirme şekillerinden hangisini bildiği ya da % kaçının atıkları ne şekilde değerlendirdikleri yer almaktadır.

Çizelge 5. Tarımsal Atıkların Değerlendirilmesi

Üretici tarafından yapılanlar	%	Üretici tarafından bilinenler	%
Biyogaz	-	Biyogaz	51,1
Biyoyakıt	-	Biyoyakıt	33,2
Kompost	-	Kompost	17,9
Gübre (bitkisel üretim)	65,8	Gübre (bitkisel üretim)	89,5
Yalıtım malzemesi	2,1	Yalıtım malzemesi	12,6
Hayvan altlığı	41,8	Hayvan altlığı	75,8
Mantar üretimi	1,5	Mantar üretimi	43,2
Hayvan besleme	53,1	Hayvan besleme	80,5
Yakacak	19,6	Çiftlik inşaat işleri	8,9
Çiftlik inşaat işleri		İlaç sanayii	6,8
Malç		Malç yapımı	4,7
Değerlendirmiyorum	26,3	Kağıt hamuru	18,4
		Paketleme malzemesi	6,8

Çizelge 6. Tarımsal atıkların değerlendirilebileceği tesislere ilişkin görüşler

	Eve t	Hayı r	Kararsı z
	%	%	%
Biyogaz tesisi kurmak için devlet desteğinden haberiniz var mı?	4,2	95,8	
Devlet teşviki verilse, biyogaz tesisi kurmak ister misiniz?	17,4	82,1	0,5
Devlet teşviği verilse, hayvansal atıklarınızı toplama noktasına götür müsünüz?	70	27,9	2,1
Devlet teşviki verilse, bitkisel atıklarınızı toplama noktasına götür müsünüz?	65,3	32,1	2,6
Devlet teşviki verilse, kompost tesisi kurmak ister misiniz?	8,4	75,8	15,8
Devlet teşviki verilse, biyodizel tesisi kurmak ister misiniz?	11,1	74,2	14,7
Ayçiçek saplarını tarladan topluyor musunuz?	16,8	76,8	6,3
Tarımsal atıkların geri dönüşümüyle oluşturulan ürünleri satın almak ister misiniz?	67,4	10,5	22,1
Tarımsal atıkların geri dönüşümüyle oluşturulan ürünleri satın alma konusunda tanıklarınıza tavsiyelerde bulunur musunuz?	67,4	10	22,6

Üreticilere ürettikleri ürünler, üretim sonucunda hangi atıkları elde ettikleri ve meydana gelen atığı ne şekilde değerlendirdikleri sorulmuştur. En fazla üretim payına sahip olan ürünler buğday ve ayçiçeğidir. Buğdaydan arta kalan samanı bitkisel üretimin yanında hayvansal üretim de yapan üreticiler kendi hayvanları için değerlendirmektedirler. Buğday sapları satanların büyük bir çoğunluğu ise biçtikleri ürün masrafı karşılığında biçerdöver sahibine vermektedirler. Değerlendirmeyenler ise genel olarak yakınlarında hayvancılık yapan kişilere kullanmaları için hibe ettiklerini belirtmişlerdir. Büyükbaş hayvan üreticileri, bitkisel üretim de gerçekleştiriyorsa hayvanlardan elde ettikleri gübreleri genellikle tarlalarına, bitkisel üretim yapmıyorlar ise üretim yaptıkları yeri temizlemek için yakınlarda bulunan tarla kenarlarına bıraktıklarını belirttiler. Küçükbaş hayvancılık yapanlar da elde ettikleri gübreleri kendileri ya da başka üreticilere tarlalara gübre olarak dökmek üzere verdiklerini belirttiler. Kırtıkları yapakları ise yılın belirli dönemlerinde köyelerine gelen ve bu ürünü satın almak isteyen kişilere sattıklarını belirttiler.

Üreticilerin atık değerlendirme şekillerine ilişkin bilgiler çizelge 7.'de verilmiştir.

Çizelge 7. Üretilen Ürün Ve Atık Değerlendirme Şekilleri

Üretilen Ürün	Üretici Sayısı	Atık Türü	Değerlendirme Şekli Ve Miktarı
Arpa	23	saman	Yem:% 100
Ayçiçeği	129	Yaprak, sap,	Gübre olarak: %81,9 ;Yakacak:%18,1
Buğday	139	saman	Hayvancılık:%51,8 ; satıyor: %33,1 ; değerlendirmiyor: %15,1
Çeltik	2	Sap, kavuz	Değerlendirmiyor: %100
Macar Fiği	1	Kabuk,sap,yaprak	Yem:% 100
Mısır	2	Sap,yaprak,püskül	Yem: % 100
Silajlık Mısır	18	Sap, yaprak,sömek	Yem: % 100
Şeker Pancarı	6	yaprak	Yem:% 100
Yem Bezelyesi	2	Sap, yaprak	Yem: % 100
Yonca	5	Sap,saman	Yem: % 100
Büyükbaş	96	Gübre	Gübre olarak: %71,9 ; değerlendirmiyor: %28,1
Küçükbaş	32	Kıl, gübre	Kılı satan : %50 ; gübre olarak: %87,5
Kanatlı	3	gübre	Gübre olarak : %100

SONUÇ VE ÖNERİLER

Araştırma sahasından elde edilen sonuçlara göre üreticilerin, tarımsal atıkların ekonomik değeri olan ürünlere dönüştürülmesi yönündeki görüşlerinin pozitif yönde olduğu tespit edilmiştir. Üreticiler tarımsal atıkların değerlendirilmesine ilişkin kurulacak tesislere kendi bütçelerini sarsmayan yönde mali destek verme konusunda da isteklidirler. Üreticilerin tarımsal atıkların değerlendirilmesine olan bakış açıları, üretim yöntemine bağlı olarak elde ettiği atık miktarına ve türüne göre değişmektedir. Üreticilerin atıklar ile ilgili genel görüşleri bertaraf edilmesi üzerine kuruludur.

Karşılaşılan Sorunlar;

- Atıkların toplanabileceği merkezler olmaması ya da üretim alanlarına uzak olması.
- Atıkların Değerlendirilmesine İlişkin eğitim ve bilginin yetersiz oluşu
- Atık yönetimi ve ya verilebilecek teşviklerin değişebileceğine ilişkin endişelerin olması.
- Atıkların değerlendirilmesine ilişkin tesislerin ekonomik getirilerinde ve kurulum aşamasında riskler olduğuna ilişkin görüşlerin olması

Öneriler:

- Tarımsal atıkların değerlendirilmesine ilişkin yapılan çalışmalar ışığında yeni teknolojiler geliştirmeli ve yapılacak çalışmalara destek verilmelidir.
- Doğru ve uygun politikalar ile risk ve belirsizlikler en aza indirgenmelidir.
- Atıkların değerlendirilip ekonomik değere dönüşebilmesi için ilçeler bazında enerji ihtiyacını karşılayacak tesisler kurulmalı ya da kurabilecek girişimcilere devlet tarafından maddi destek ve eğitim verilmelidir.
- Tarımsal atıkların tek bir değerlendirme şekline destek verilmemeli, yapılan değerlendirmeye ve üretim miktarına bağlı değişmekle birlikte tüm üreticiler için destek programları oluşturulmalıdır.
- Evlerinde tarımsal atıklarını değerlendirerek yenilenebilir enerji üretecek konut sahiplerine de kuracakları tesis için düşük faiz ve geri ödeme kolaylığı sağlayacak ödeme planları hazırlanmalıdır

Sonuç olarak; ekonomik koşullarının iyileştirilmesi ve istihdam yaratması açısından tarımsal atıkların değerlendirilmesine yönelik kuruluşlar kırsal nüfusun yaşam standartlarını olumlu yönde etkileyecektir. Girdi maliyetlerinin yüksek, ürettikleri ürünlerin fiyatlarının düşük olduğunu belirten üreticiler için ek gelir sağlayacak bir sektör oluşacaktır.

KAYNAKÇA

- Acarođlu M (2013), "Alternatif Enerji Kaynakları", Ankara: Nobel Akademik Yayıncılık.
- Akırmak E (2010). "Tarımsal Atık Şeker Pancarı K spesti İle S rekli alıřan Dolgulu Kolonda Tekli Ve İekli Boyarmadde Ve Metal Gideriminin İncelenmesi" Hacettepe  niversitesi, Fen Bilimleri Enstit s , Kimya M hendisliđi Anabilim Dalı, Y ksek Lisans Tezi.
- Akpınar , Ortař İ, Demirbas A, řimřek M, Y ksel A (2010), "İki Farklı Yetiřtirme Ortamında Deđiřik Kompost Uygulamalarının  g l Bitkisinin Geliřimi, Besin Elementleri Alımı Ve Mikoriza İnfksiyonu  zerine Etkileri", Ege  niversitesi Ziraat Fak ltesi Dergisi, ss.659-665.
- Arslan MB(2008)." Orman Ve Tarımsal Atıklardan  retilen Kompozit Levhalarda Y zey Kimyasal  zelliklerinin Arařtırılması" S leyman Demirel  niversitesi, Orman End stri M hendisliđi Anabilim Dalı, Y ksek Lisans Tezi.
- Demirbař A (2001). Biomass resource facilities and biomass convesion processing or fuels and chemicals, Energy Conversion and Manegement, Turkey, 1357- 1378.
- Dođan N (2005). Ađır Metal Gideriminde Tarımsal Atık Kullanımı, İn n   niversitesi, Fen Bilimleri Enstit s , Biyoloji Ana Bilim Dalı, Y ksek Lisans Tezi.
- Kaky (1991). Katı Atıkların Kontrol  Y netmeliđi 14.03.1991 tarih, 20814 sayılı Resmi Gazete
- Karakuř B (2007). "eřitli Bitkisel Sera Atıklarının Yonga Levha  retiminde Deđerlendirilmesi" S leyman Demirel  niversitesi, Fen Bilimleri Enstit s , Orman End stri M hendisliđi Anabilim Dalı, Y ksek Lisans Tezi.
- Saraođlu N (2010)." K resel İklimi Deđerimi, Biyoenerji ve Enerji Ormancılıđı". Ankara: Efil Yayınevi.
- řanlı SK (2014). "Farklı Tarımsal Artıkların Pleurotus Eryngii Mantar  retiminde Kullanım Olanakları", Ondokuz Mayıs  niversitesi, Fen Bilimleri Enstit s , Bahe Bitkileri Anabilim Dalı, Y ksek Lisans Tezi.
- řener S (2015)." Nevřehir İli Organik ilek Yetiřtiriciliđinde Kullanılabilecek Farklı G bre Ve Mal Materyallerinin Verim Ve Kalite  zellikleri  zerine Etkileri" ukurova  niversitesi, Fen Bilimleri Enstit s , Bahe Bitkileri Anabilim Dalı, Doktora Tezi.

**SÜRDÜRÜLEBİLİR MAKARNALIK BUĞDAY ÜRETİMİNİN EKONOMİK VE
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ÖZET

Sürdürülebilir Tarım, hızla artan dünya nüfusunun ihtiyacı olan yeterli ve kaliteli gıda maddesinin uygun maliyetlerde üretimini, çevrenin ve doğal tarım kaynaklarının korunmasını geliştirecek sistem ve uygulamalar olarak tanımlanabilir. Trakya bölgesi Türkiye’de üretilen ekmeçlik buğdayın yıllara göre değışmekle birlikte yaklaşık olarak %10’nu üretmektedir. Makarnalık buğday üretimi için de uygun koşullar barındırmaktadır. Bu çalışmada, sürdürülebilir makarnalık buğday üretiminin ekonomik ve çevresel yönden geleneksel makarnalık buğday üretimi ile değerdendirme yapılmıştır. Bu kapsamda 2017-2018 üretim yılında 3 alanda ve 2018-2019 üretim yılında da 4 alanda, sürdürülebilir ve geleneksel üretimin karşılaştırıldığı denemeler kurulmuştur. Deneme alanlarından toplanan teknik ve ekonomik bilgiler ışığında hem sürdürülebilir hem de geleneksel makarnalık buğday üretiminin masrafları, karlılık durumları hesaplanmıştır. Sürdürülebilir üretimin yapıldığı alanlarda makarnalık buğday verimi ortalama 553 kg/da (2017-2018) ve 561.8 kg/da (2018-2019) olarak gerçekleşmiştir. Geleneksel üretimin yapıldığı alanlarda ise ortalama olarak 536,3 kg/da (2017-2018) ile 527.8 kg/da’dır (2018-2019). Geleneksel üretimle karşılaştırıldığında %4 ile %7 arasında daha düşük masraf yapılmıştır. Girdi kullanım miktarlarından yola çıkılarak da her iki üretim yönteminin çevresel etkileri hesaplanmıştır. Çevresel etkilerin değerdendirilmesinde; karbon ayakizi, su ayakizi, ekolojik ayakizi hesaplamalarından yararlanılmıştır. 2018-2019 yılında deneme alanlarındaki makarnalık buğday üretiminin çevresel etkileri karbon ayakizi yönünden değerdendirildiğinde 4 deneme alanında da sürdürülebilir makarnalık buğday üretimi, geleneksel yöntemle göre daha düşük karbon emisyonu sağlamaktadır.

Anahtar Kelimeler: Makarnalık buğday, ekonomik analiz, ekolojik ayakizi, karbon ayakizi

**ECONOMIC AND ENVIRONMENTAL EVALUATION OF SUSTAINABLE DURUM
WHEAT PRODUCTION**

ABSTRACT

Sustainable Agriculture can be defined as a system and practices that improve the production of adequate and quality food at reasonable costs while preserving the environment and natural agricultural resources, which is needed to meet the rapidly increasing world population. The Thrace region produces approximately 10% of the bread wheat produced in Turkey, which varies from year to year. It also provides suitable conditions for the production of durum wheat. This study evaluates the economic and environmental aspects of sustainable durum wheat production compared to traditional durum wheat production. To this end, trials were established comparing sustainable and traditional production in three areas in the 2017-2018 production year and four areas in the 2018-2019 production year. Based on the technical and economic information collected from the trial areas, the costs and profitability of both sustainable and traditional durum wheat production were calculated. The average yield of durum wheat was 553 kg/ha (2017-2018) and 561.8 kg/ha (2018-2019) in the areas where sustainable production was carried out, while it was 536.3 kg/ha (2017-2018) and 527.8 kg/ha (2018-2019) in the areas where traditional production was carried out. The expenses incurred were between 4% and 7% lower than those incurred in traditional production. Based on the amount of inputs used, the environmental impacts of both production methods were calculated. Carbon footprint, water footprint, and ecological footprint calculations were used to evaluate the environmental impacts. In the 2018-2019 production year, when the carbon footprint of durum wheat production in the trial areas was evaluated, sustainable production of durum wheat in all four trial areas resulted in lower carbon emissions compared to traditional production.

Keywords: Durum wheat, economic analysis, ecological footprint, carbon footprint.

GİRİŞ

Toprağı ve tohumu kullanılarak bitkisel ve hayvansal ürünlerin üretilmesi, kalite ve verimlerinin yükseltilmesi, bu ürünlerin uygun koşullarda muhafaza edilmesi, çeşitli alanlarda işlenip değerlendirilmesi anlamlarına gelen tarım en temelde insanların beslenme gibi temel ihtiyaçlarının giderilmesi için gerekli hayvansal ve bitkisel ürünler elde etmek amaçlamaktadır. Bu yönüyle gıda ve sanayiye hammadde üreten tarım sektörü birçok ürün ve üretim için alternatifsiz bir sektördür. Tarım sektörü, gelişmişlik düzeyi her ne olursa olsun, geçmişte olduğu gibi günümüzde de tüm ülkelerin ekonomik hayatlarında önemli bir yere sahip olan stratejik bir sektördür.

Toprak, geriye tekrar kazanılması çok uzun zaman alan ve en değerli doğal kaynaklarımızın başında gelir. Tarım topraklarının sürdürülebilir olarak kullanılması için bugün daha da bilinçli olmalıyız ve alışlagelmiş hatalı tarımsal uygulamalardan kaçınarak, yeni tarımsal yöntem ve uygulamalara geçmeliyiz. Bu konuda atılacak ilk adım ise azaltılmış tarımsal girdi uygulamalı ve bilinçli tarımsal faaliyetlerdir. Sürdürülebilir tarımın oluşturulması ve ileriye dönük tarımsal planlamaların doğru yapılabilmesi için ilk önce toprağın çok iyi tanınması gerekmektedir. Artık toprak verimliliğinin arttırılması zorunluluğunun yanı sıra, verimde sürekliliğinin sağlanması ve korunması da ülkemiz için büyük önem taşımaktadır. Bu da ancak toprakların mevcut fiziksel, kimyasal ve biyolojik özelliklerinin belirlenmesi ve bu özellikler doğrultusunda yapılacak bilinçli gübreleme çalışmaları ile mümkündür (Bellitürk, 2011).

Tarım topraklarının giderek azalması, buna karşın nüfusun artması ile ilgili istatistiksel veriler gün geçtikçe artmaktadır. Bu durum hem dünyada ve hem de ülkemizde var olan bir gerçektir. Nüfus artışı elbette kaçınılmaz, ancak tarım topraklarının amacı doğrultusunda bilimsel bilgiler ışığında kullanılması ise artık bir zorunluluk haline gelmiştir. Türkiye İstatistik Kurumunun (TÜİK) açıkladığı tarım istatistikleri ile ilgili rakamlara baktığımızda 2004 yılında 265 931 780 da olan Türkiye'nin toplam işlenen tarım alanı 2018 yılında 231 999 458 dekara gerilemiştir (TÜİK, 2018).

Türkiye nüfusunun yaklaşık üçte birine yakın bölümü tarımsal ya da kırsal alanda yaşıyor olduğu halde milli gelirde tarımın yeri ancak % 8 – 10 düzeyindedir. Türkiye'de tarım sektöründe göze çarpan eğilimler, toprak dağılımının çok parçalı olması ve verim düşüklüğüdür. Tarım kesiminde nüfus artış hızı ülke ortalamasının üstündedir, bu olgu miras yoluyla toprakların küçülmesine sebep olmakta ve kente olan göçü hızlandırmaktadır. Küçük parçalara bölünmüş yaygın toprak yapısı maliyetleri yükselterek tarım üretiminde verimsizliğe

yol açmaktadır. Tarım sektörü günümüzde artık yeni teknoloji ile ve çağdaş ekonomik normlarla geliştirilen bir sektördür (Arı, 2006).

Torun ve ark. göre (2019); makarnalık buğday (*Triticum durum Desf.*), Türkiye’de ve dünyada gıda üretiminde önemli bir yere sahiptir. Çinko eksikliğinin dünyada tahıl üretilen bölgelerde yaygın olduğu belirtilmektedir (Graham ve Welch, 1996; Alloway, 2008). Türkiye’de tahıl üretilen alanların yaklaşık % 49.8’inin bitkilerce alınabilir Zn konsantrasyonunun (0.5 mg kg^{-1} kritik sınır değerinden düşük olduğu bildirilmiştir (Eyüpoğlu ve ark., 1996). Tarım topraklarımızın organik maddece fakir olduğu herkes tarafından bilinmektedir. Ancak potasyum ve kısmen fosfor bakımından yeterli olan topraklarımızın zaman içinde organik maddede olduğu gibi fosfor ve potasyumca da fakirleşebileceği unutulmamalıdır.

Ülkemizde yaygın olarak ekmeçlik buğday ve makarnalık buğday tarımı yapılmaktadır. Bölgelere göre değişmekle birlikte makarnalık buğday üretimi Orta Anadolu ve Güney Doğu Anadolu bölgesinde daha fazla ekilmektedir. Ekolojik olarak bu bölgelerimizin makarnalık buğday tarımına uygun olması nedeniyle bu bölgelerde makarnalık buğday üretimi diğer bölgelere göre ağırlık kazanmaktadır. Trakya bölgesinde ise makarnalık buğday üretimi ekmeçlik buğday üretimine göre oldukça azdır. Buna karşın bölge ekolojik olarak yüksek verimli makarnalık buğday üretiminin elde edilebileceği bir bölgedir. Ayrıca yapılan çalışmalar bölgenin makarnalık buğday yönünden kalite olarak iyi potansiyele sahip olduğunu göstermektedir (Korkut ve ark., 2004).

Sürdürülebilir tarım, doğal kaynakların korunmasıyla birlikte, çevreye zarar vermeyen tarım teknolojilerinin kullanıldığı bir tarımsal yapının geliştirilmesidir (Turhan, 2015).

Sürdürülebilir tarım uygulamaları ile tarımda; üretken ve karlı sürekli çevre ile dost yöntemler geliştirilmesi, düşük girdi yöntemleri ve deneyimli bir toprak yönetimi, ürünlerin verim ve kalitesinin artırılması, tarımsal uygulamalar ile oluşan çevreye olumsuz etkilerin azaltılması, toprakların verimliliğinin korunarak uzun yıllar korunabilir hale gelmesi, üreticilerin gelirlerinin yükseltilmesi hedeflemektedir. Tüm bunları gerçekleştirebilmek için, kimyasal girdi kullanımının azaltılması, biyolojik mücadele, organik atık kullanımı gibi araçların kullanılması gerekmektedir

Kimyasal (mineral) gübrelerin bilinçsiz bir şekilde kullanımı ile oluşan çevre kirlenmesi sonucunda bozulan doğa dengesinin yeniden kurulması çok güç olduğundan, gerekli önlemlerin alınmasının büyük bir önemi vardır. Bu nedenle tarımsal uygulamalar; kullanılacak mineral

gübrelerin fizyolojik özelliği, bitki ve toprak yapısı gibi parametreler birlikte değerlendirilerek yapılmalı, bu uygulamanın sürdürülebilir olmasına özen gösterilmelidir (Bellitürk, 2005).

Bu çalışmada, sürdürülebilir makarnalık buğday üretiminin çevresel ve ekonomik değerlendirilmesi yapılmıştır. Çalışma kapsamında geleneksel ve sürdürülebilir makarnalık buğday üretiminin karşılaştırılması yapılarak ekonomik ve çevresel kriterler açısından farklılıkları ortaya konmuştur.

MATERYAL VE YÖNTEM

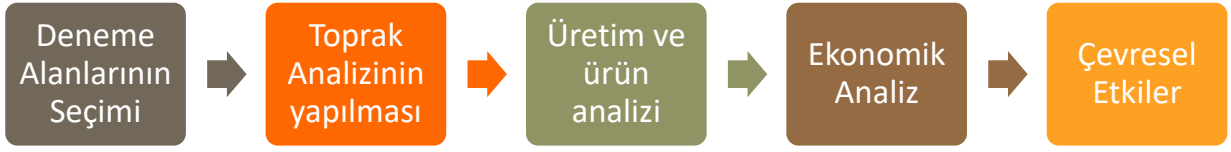
Çalışma kapsamında 2017-2018 üretim yılında 3 alanda ve 2018-2019 üretim yılında da 4 alanda, sürdürülebilir ve geleneksel üretimin karşılaştırıldığı denemeler kurulmuştur. Deneme alanlarından toplanan teknik ve ekonomik bilgiler ışığında hem sürdürülebilir hem de geleneksel makarnalık buğday üretiminin masrafları, karlılık durumları hesaplanmıştır.

“Barilla Sürdürülebilir Tarım” projesi, Tekirdağ Namık Kemal Üniversitesi (TNKÜ) Ziraat Fakültesi ve Barilla Gıda A.Ş. iş birliğinde, 2017-2018 ve 2018-2019 üretim yılları süresince yürütülmüştür. 2019-2020 üretim döneminde üretici sayısı artırılarak devam etmiştir. Sürdürülebilir üretim teknikleri için TNKÜ Ziraat Fakültesinin; Tarla Bitkileri, Toprak Bilimi ve Bitki Besleme, Tarım Ekonomisi bölümlerindeki öğretim üyelerinden oluşan disiplinler arası bir ekibin önerilerinden yararlanılmıştır.

Barilla Sürdürülebilir Tarım Projesi, “Sizin İçin İyi, Gezegen İçin İyi (Good for You, Good For The Planet)”, sloganıyla Barilla A.Ş.’nin üretim faaliyetlerinin ekosistem ve topluluklar açısından tarladan tüketicilere sorumlu bir şekilde yapılması olarak tanımlanmaktadır (Barilla Group, 2023).

Bu projenin amacı; yaygın üretim teknikleri hakkında veri toplamak, en iyi üretim tekniklerini tanımlamak ve saha denemelerini denetlemek, geleneksel tarım tekniklerini önerilen (daha sürdürülebilir) tekniklerle karşılaştırmak, projeye katılan çiftçilere tavsiyelerde bulunmak ve genel olarak sürdürülebilir üretim sisteminin uygulanmasına yardımcı olmaktır.

Çalışmada makarnalık buğdayın tüm üretim süreci kayıt altına alınmıştır. Deneme alanlarından toplanan teknik ve ekonomik bilgiler ışığında hem sürdürülebilir hem de geleneksel makarnalık buğday üretiminin masrafları, karlılık durumları hesaplanmıştır. Girdi kullanım miktarlarından yola çıkılarak da her iki üretim yönteminin çevresel etkileri hesaplanmıştır.



Ekonomik Analiz: Çalışmada makarnalık buğdayın sabit masraf unsurları olarak arazi kirası ve genel idare giderleri; değişken masraf unsurları olarak da tohum, gübre, ilaç, geçici işçilik, makine kiralari ve döner sermaye faiz bedeli alınmıştır (Kıral ve ark., 1999).

Çeki gücü giderleri amortisman, fırsat maliyetini yansıtan faiz, bakım-onarım giderleri, yağ-yakıt vb. birçok masraf kalemini içeren makine sahibi olma giderlerinin belirlenmesi ve bu giderlerinin ürünler arasında dağıtılması gibi doğru ve hatasız yapılması oldukça güç olan işlemleri gerektirdiğinden, makine sahibi işletmeler için alternatif maliyet yöntemi kullanılarak ilgili işler dışarıya yaptırılmış gibi fiyatlandırılmıştır (Alemdar ve ark., 2014). İşgücü giderlerinin hesaplanmasında da, yabancı işgücü için ödenen ücretler, aile işgücü için ise alternatif maliyet olarak bölgede geçerli ortalama işçi ücretleri esas alınmıştır.

Girdi kullanımının analizinde fiilen kullanılan tohum, gübre ve kimyasal ilaç ile bunlar için ödenen bedeller dikkate alınmıştır (Tanrıvermiş, 2000). Cari masrafların hesaplanmasında masrafların yapıldığı andaki geçerli fiyatlar kullanılmıştır (Alemdar ve ark., 2014).

Gider gruplarına göre dekara masraflar, tarımsal işlemler itibariyle işletmelerce kullanılan işgüçlerinin ve çeşitli girdilerin, ana ürün, varsa yan veya ara ürün dekara ortalama miktarları hesaplanarak bulunmuştur (Altıntaş, 2014).

Arazi kirası için, bölgede geçerli olan bedeller dikkate alınmıştır. Kiracılıkla işletilen arazilerde üreticinin ödediği bedel, mülk arazilerde ise alternatif kira bedeli alınmıştır (Açıl, 1976). Genel idare giderleri, değişken masraflar toplamının %3'ü olarak hesaplanmıştır.

Değişken masrafların faizi üretim faaliyetine yatırılan sermayenin fırsat maliyeti olarak tanımlanmaktadır (TEAE, 2001). Söz konusu faiz oranı, üretim dönemi için T.C. Ziraat Bankasının bitkisel üretim kredilerine uyguladığı faiz oranının yarısı (%5) olarak alınmıştır (Kıral ve ark., 1999).

Üretim alanından elde edilen (dekar) ortalama ürün miktarı, ürünün ortalama kg satış fiyatı ile çarpılarak Brüt Üretim Değeri (BÜD) elde edilmiştir. BÜD'den değişken masraflar çıkarılarak brüt kara ulaşılmaktadır. Brüt kardan da sabit masrafların çıkarılması veya BÜD'den üretim

masraflarının çıkarılmasıyla da net kara ulaşılmaktadır (Açıl ve Demirci 1984; Kral ve ark. 1999; Tanrıvermiş 2000, İnan, 2006). Üretim faaliyetine ilişkin brüt ve net karların hesaplanmasında;

- Değişken Masraf = Toplam masraf + Interest on Operating Capital (%5)
- Sabit Masraf = Arazi kirası + Genel İdare Gideri (%3)
- Brüt Üretim Değeri = (Üretim Miktarı x Ürün Fiyatı)+(Yan ürün miktarı x Yan ürün fiyatı)
- Brüt Kar = Gayrisafi (Brüt) Üretim Değeri – Değişken Masraflar,
- Net Kar = Gayrisafi (Brüt) Üretim Değeri – Üretim Masrafları

formülleri kullanılmıştır.

Çevresel Etkilerin Değerlendirilmesi: Çevresel etkilerin değerlendirilmesinde; karbon ayakizi, su ayakizi, ekolojik ayakizi hesaplamalarından yararlanılmıştır. Bu hesaplamalar proje kapsamında, deneme alanlarından toplanan verilerin Barilla A.Ş. tarafından değerlendirilmesi sonucu yapılmıştır.

Karbon Ayakizi, bir ürünün tüm yaşam döngüsü boyunca doğaya saldıgı toplam sera gazı miktarı olarak tanımlanmaktadır (Şahin ve Avcıoğlu, 2016). Su Ayak İzi, yine aynı ürünün tüm yaşam döngüsü boyunca üretilmesi için gereken hem doğrudan hem de dolaylı su miktarıdır. Su ayak izi, yeşil su (suyun buharlaşan miktarının ve bitkiler tarafından kullanılan miktarı), mavi su (doğrudan kullanılan taze yüzey ve yeraltı suyu) ve gri su (kirleticilerin seyreltilmesi için gerekli su hacmi) bileşenlerinden oluşmaktadır (WWF, 2014).

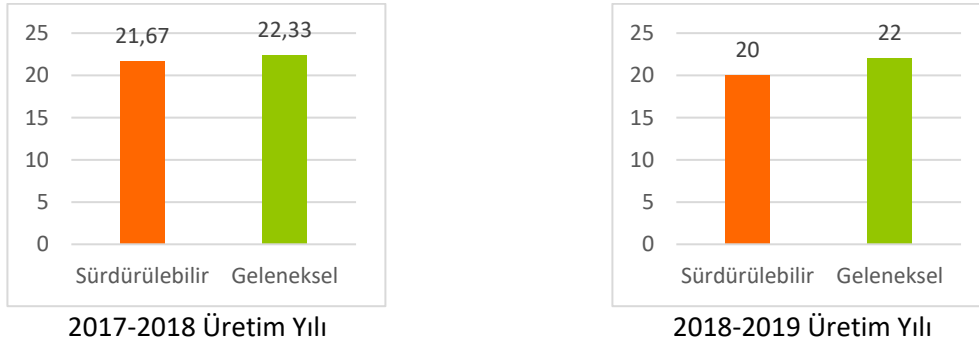
Ekolojik ayak izi ise bir ürün için kullanılan kaynakların üretilmesi ve tüm yaşam döngüsü boyunca üretilen karbondioksit atıklarını emmek için gereken biyolojik olarak verimli toprak ve su alanını ölçmektedir (AÖF, 2019).

Karbon ayakizi, IPCC'nin 5. değerlendirme raporundaki (2013) faktörlerle, Su ayakizi, su ayakizi ağında (Water Footprint Network, <http://waterfootprint.org>) belirtilen yönteme göre, Ekolojik ayak izi de küresel ayakizi ağında (Global Footprint Network, <http://www.footprintnetwork.org>) kullanılan yönteme göre hesaplanmıştır.

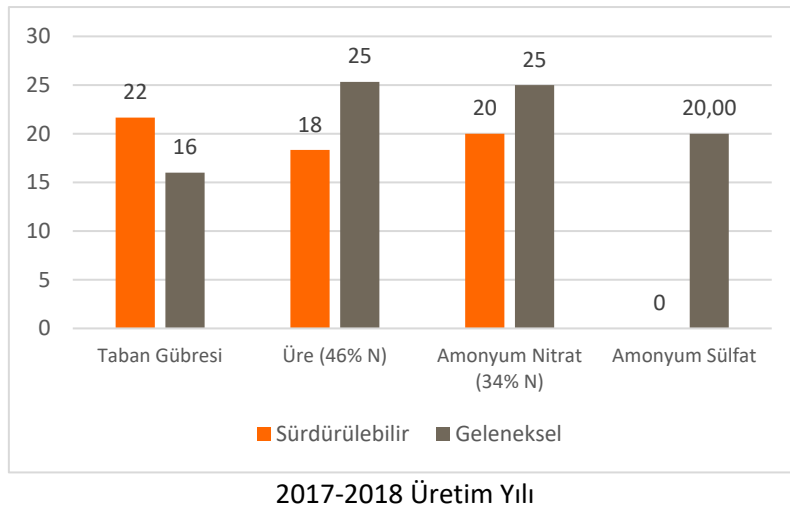
ARAŞTIRMA BULGULARI

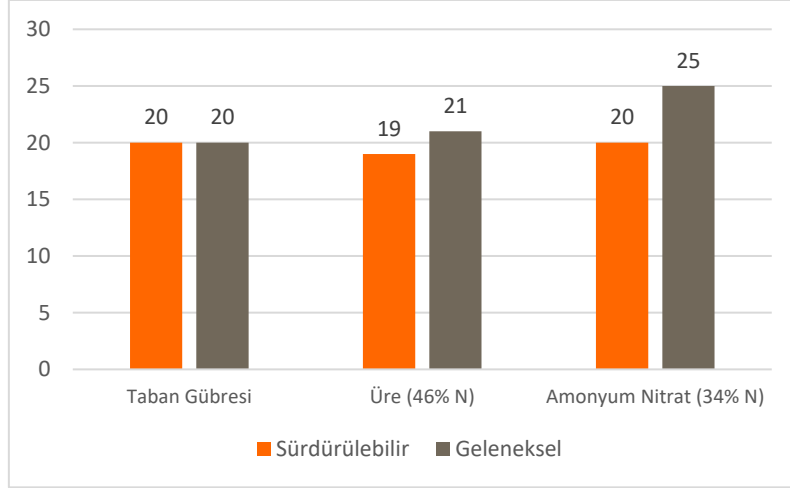
Tarımsal üretimde kullanılan girdiler doğrudan ya da dolaylı olarak doğal kaynaklar üzerinde baskı oluşturmaktadır. Girdiler, bitki, toprak ve kaynaklarına karışarak doğrudan etkide buldukları gibi, söz konusu girdilerin üretilmesi esnasında da doğal çevre olumsuz

etkilenebilmekte, böylece dolaylı bir etkiye de neden olabilmektedir. Sürdürülebilir üretimde girdilerin azaltılması ya da en uygun miktara çekilebilmesi büyük önem taşımaktadır. Uygun tohum çeşidi ve tohum miktarının kullanılması çevresel ve ekonomik anlamda dikkat edilmesi gereken bir konudur. Şekil 1'de deneme alanlarında kullanılan ortalama tohum miktarları görülmektedir. Şekilden de anlaşılacağı üzere sürdürülebilir üretimin yapıldığı alanlarda gerek verim gerekse de çevresel faktörlerden dolayı tohum miktarlarının en uygun seviyede tutulması hedeflenmiştir. 2017-2018 üretim yılında sürdürülebilir alanlarda kullanılan ortalama tohum miktarı dekara 21,7 kg iken, 2018-2019 üretim yılındaki ortalama 20 kg/da'dır. Geleneksel üretimin yapıldığı alanlarda ise ilk yılın ortalaması 22,3 kg/da, ikinci yılın ortalaması ise 22,0 kg/da olarak gerçekleşmiştir.



Şekil 1. Deneme Alanlarında Kullanılan Ortalama Tohum Miktarı (kg/da)



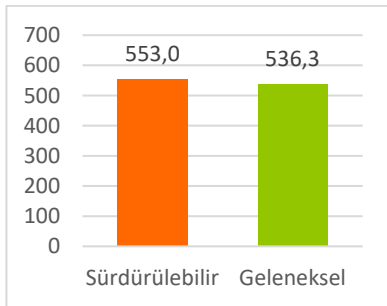


2018-2019 Üretim Yılı

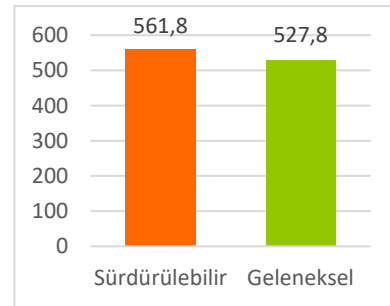
Şekil 2. Deneme Alanlarında Kullanılan Ortalama Gübre Miktarı (kg/da)

Benzer biçimde 2017-2018 ve 2018-2019 üretim yıllarında deneme alanlarında kullanılan gübre miktarları da şekil 2’de verilmiştir. Sürdürülebilir üretimin yapıldığı alanlarda kullanılan gübre miktarları üretim dönemlerinin başında yapılan toprak analizi sonuçlarına göre belirlenmiştir. Geleneksel üretim yapılan alanlarda çiftçiler gübreyi kendi tecrübelerine uygun olarak belirlemişlerdir. Toprağın ihtiyacı olandan daha fazla miktarlarda kullanılan gübre toprak ve su kaynakları açısından önemli bir kirlilik kaynağı haine gelmektedir.

Kullanılan tohum ve gübre miktarı elde edilecek ürün miktarı üzerine doğrudan etki etmektedir. Şekil 3’te üretim yıllarına göre deneme alanlarından elde edilen ortalama verimler yer almaktadır. Sürdürülebilir üretimin yapıldığı alanlarda makarnalık buğday verimi ortalama 553 kg/da ve 561.8 kg/da olarak gerçekleşmiştir. Geleneksel üretimin yapıldığı alanlarda ise ortalama olarak 536.3 kg/da ile 527,8 kg/da’dır. Verim değerleri üzerine uygun miktarda kullanılan tohum ve toprağın ihtiyacı dikkate alınarak yapılan gübrelemenin önemli etkisi bulunmaktadır. Toprak analizinin yapılması bu yönüyle oldukça yararlıdır.



2017-2018 Üretim Yılı



2018-2019 Üretim Yılı

Şekil 3. Deneme Alanlarından Elde Edilen Ortalama Verim (kg/da)

Ekonomik Değerlendirme

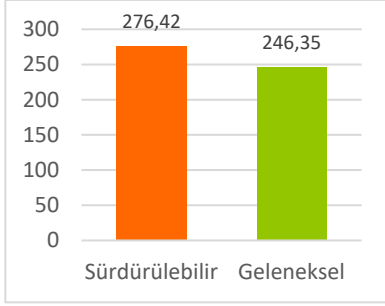
Proje kapsamında sürdürülebilir ve geleneksel üretim ekonomik yönden de karşılaştırılmıştır. Uygun toprak işleme yöntemleri, toprağın, iklimin ve bitkinin ihtiyaçlarını dikkate alan girdi kullanımını üretim masraflarının azalmasına imkan vermektedir. Yüksek masraflarla çok fazla girdi kullanımı durumunda ürün verimi artmasına rağmen üretimin karlılığı aynı oranda artmayabilmektedir. Diğer bir deyişle aşırı girdi kullanımı (tohum, gübre vb) yüksek gelir anlamına gelmemektedir.

Şekil 4'te deneme alanlarında yıllara göre ortalama üretim masraflarının karşılaştırılması yapılmaktadır. Sürdürülebilir üretimin yapıldığı alanlarda üretimin masrafları daha düşüktür. 2017-2018 üretiminde 438.47 TL/da, 2018-2019 üretiminde 610.38 TL/da sürdürülebilir alanlarda yapılan ortalama üretim masrafıdır. Geleneksel üretimle karşılaştırıldığında %4 ile %7 arasında daha düşük masraf yapılmıştır.

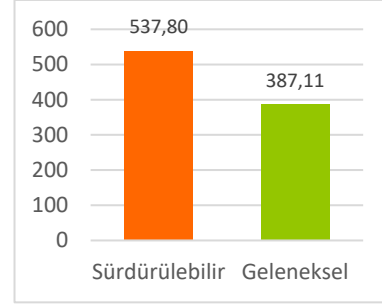


Şekil 4. Deneme Alanlarında Ortalama Üretim Masrafları (TL/da)

Deneme alanlarından elde edilen ortalama net kar Şekil 5'te verilmiştir. Verim yüksekliği, masrafların düşüklüğü nedeniyle sürdürülebilir alanlardaki yapılan üretimin ortalama net karı geleneksel üretimin net karından yüksek çıkmıştır. Şekil 6'da deneme alanları itibariyle daha ayrıntılı net kar rakamları verilmiştir. 2017-2018 üretim yılında 1. deneme alanında geleneksel yöntemlerle üretilen makarnalık buğdayın yan ürün (saman balya) verimi daha yüksek gerçekleşmiştir. Bu nedenle sürdürülebilir ve geleneksel üretim arasındaki net kar farkı negatif değer çıkmıştır. Ancak diğer tüm denemelerde sürdürülebilir üretimin yapıldığı alanlarda net kar daha yüksektir.

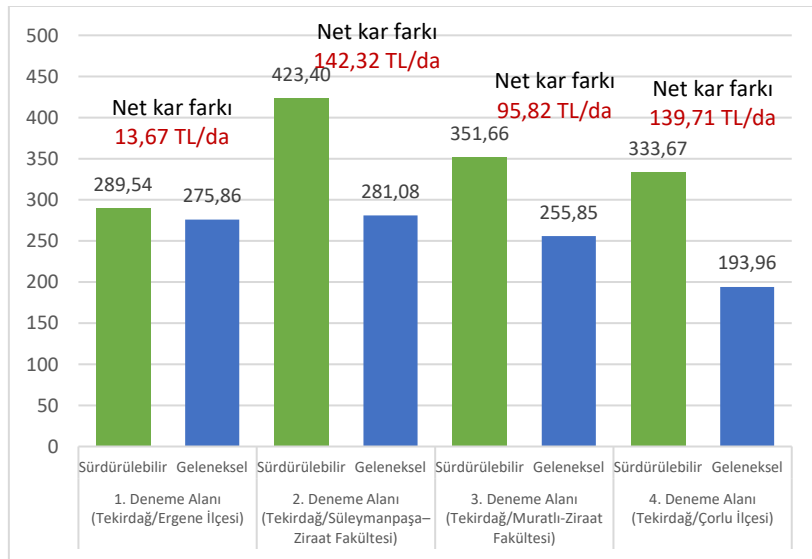
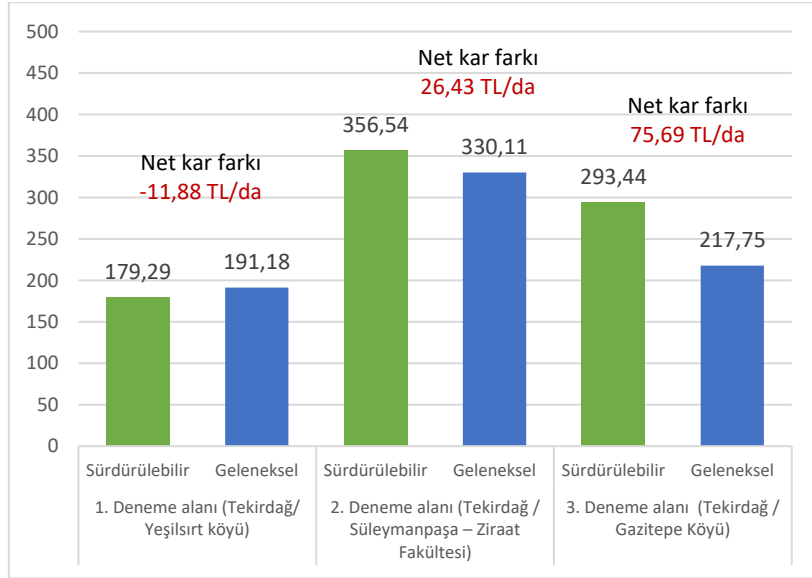


2017-2018 Üretim Yılı



2018-2019 Üretim Yılı

Şekil 5. Deneme Alanlarında Ortalama Net Kar (TL/da)



Şekil 6. Deneme Alanlarına Göre Net Kar

Çevresel Etkilerin Değerlendirilmesi: Çizelge 1’de 2017-2018 yılında deneme alanlarındaki makarnalık buğday üretiminin çevresel etkileri verilmektedir. Çizelge 1’e göre karbon ayakizi yönünden değerlendirildiğinde 3 deneme alanında da sürdürülebilir makarnalık buğday üretimi, geleneksel yöntemle göre daha düşük karbon emisyonu sağlamaktadır. Sürdürülebilir üretim, geleneksel üretime göre 1. deneme alanında %7, 2; deneme alanında %12; 3. deneme alanında ise %8 daha az karbon ayakizi bırakmaktadır.

Bölgede makarnalık buğday üretiminde sulama yapılmadığı için su ayakizi değerleri hesaplanmamıştır. Ekolojik ayakizi bakımından da sürdürülebilir üretim 2. Deneme alanında %5, 3. Deneme alanında %9 daha düşük etkiye sahiptir.

Çizelge 2’de 2018-2019 yılında deneme alanlarındaki makarnalık buğday üretiminin çevresel etkileri verilmektedir. Çizelgeye göre karbon ayakizi yönünden değerlendirildiğinde 4 deneme alanında da sürdürülebilir makarnalık buğday üretimi, geleneksel yöntemle göre daha düşük karbon emisyonu sağlamaktadır. Sürdürülebilir üretim, geleneksel üretime göre 1. Deneme alanında %7; 2. deneme alanında %21; 3. deneme alanında %17; 4.deneme alanında %28 daha az karbon ayakizi bırakmaktadır.

Ekolojik ayakizi bakımından da sürdürülebilir üretim 2. deneme alanında %11; 3.deneme alanında %6 ve 4. deneme alanında %10 daha düşük etkiye sahiptir.

Çizelge 1. 2017-2018 Üretim Yılında Deneme Alanlarındaki Makarnalık Buğday Üretiminin Çevresel Etkileri

	1. Deneme alanı (Tekirdağ/ Yeşilsirt köyü)			2. Deneme alanı (Tekirdağ / Süleymanpaşa – Ziraat Fakültesi)			3. Deneme alanı (Tekirdağ / Gazitepe Köyü)		
	S	G	Fark (%)	S	G	Fark (%)	S	G	Fark (%)
Karbon ayakizi (kg CO ₂ -eq/kg)	0,454	0,486	-7	0,322	0,368	-12	0,367	0,400	-8
Su ayakizi (l su/kg)	2120	2120	-	2120	2120	-	2120	2120	-
Ekolojik ayakizi (global m ² /kg)	5,7	5,7	-	4,2	4,4	-5	4,3	4,7	-9

S: Sürdürülebilir, G: Geleneksel

Çizelge 2. 2018-2019 Üretim Yılında Deneme Alanlarıdaki Makarnalık Buğday Üretiminin Çevresel Etkileri

	1. Deneme Alanı (Ergene)			2. Deneme Alanı (Süleymanpaşa)			3. Deneme Alanı (Muratlı)			4. Deneme Alanı (Çorlu)		
	S	G	Fark (%)	S	G	Fark (%)	S	G	Fark (%)	S	G	Fark (%)
Karbon ayakizi (kg CO ₂ -eq/kg)	0,407	0,379	-7	0,373	0,294	-21	0,382	0,317	-17	0,440	0,316	-28
Su ayakizi (l su/kg)	2108	2106	0	2106	2105	0	2107	2106	0	2108	2106	0
Ekolojik ayakizi (global m ² /kg)	5,0	4,9	0	4,7	4,2	-11	4,8	4,5	-6	5,2	4,6	-10

S: Sürdürülebilir, G: Geleneksel

SONUÇ VE ÖNERİLER

Tarım, gıda zincirinin başlangıç noktasıdır. Bir yanda tarımda verimliliği artırırken toprağı ve doğal tarım kaynaklarını korumak, çiftçinin yaşam kalitesini yükseltmek, ama en önemlisi hızla artan dünya nüfusunun ihtiyacı olan yeterli ve kaliteli gıda maddesini temin ederek gıda ve besin güvenliğini sağlamak, tarımda sürdürülebilirliğin temel kavramlarıdır.

Açlık kapıya dayanmadan, tarım topraklarının birim alanından maksimum ve en kaliteli verimi sağlamak için bilinçli tarım yapmak zorundayız. Bilinçli tarım yapmaya açılan kapılardan ilki ise toprakların bakımı, korunması, verimlilik devamlılığının sağlanmasında toprağın ve bitkinin ihtiyacı olan besin maddelerinin tespit edilmesi gelmektedir. Bunun yanısıra toprak işleme, hastalık ve zararlılarla mücadele gibi konularda da uzmanların tecrübe ve deneyimleri doğrultusunda planlı bir şekilde üretim yapılmalıdır.

Türkiye’de buğday üretiminde sadece kimyasal gübre kullanımı alışkanlığı, günümüzde yavaş yavaş değişmekle birlikte, organomineral ve organik gübreler de bu amaçla kullanılmaya başlamıştır. Ancak toprak analiz sonuçlarına bağlı bir gübreleme alışkanlığı yok denecek kadar az olup, “sürdürülebilir buğday üretimi” için mutlaka toprak analizleri yaptırılmalı ve uygun gübreleme programları hazırlanmalı ve itina ile uygulanmalıdır.

Sürdürülebilir tarımın en önemli ilkesi doğal kaynaklar üzerinde baskı yapan girdilerin tüketimlerinin azaltılmasıdır. Gübre, bu girdilerin başında gelmektedir. Gübre kullanımının ürün verimi üzerinde önemli bir etkisi olduğu aşikardır. Ancak bu etki ürün veriminde, başlangıçta kullanılan gübre miktarı artırıldıkça artan oranda, gübre miktarı artırılmaya devam

ettiğinde azalan oranda olmaktadır. Kullanılan gübre miktarı artırılmaya devam edildiğinde ürün veriminde mutlak bir azalmaya neden olabilmektedir (Azalan verimler kanunu).

Bununla birlikte ürün verimini maksimum yapan gübre miktarı, net kar açısından (ekonomik açıdan) bakıldığında uygun bir miktar olmayabilmektedir. Kullanılan girdi miktarı artıkça üretim masrafları da artacağı için harcanan para, elde edilen gelirden daha fazla olabilmektedir. Bu nedenle girdi kullanımında üreticinin karını maksimum yapan miktarın kullanılmasına özen gösterilmelidir.

“Barilla Sürdürülebilir Tarım Projesi” sonuçlarından da anlaşılacağı üzere daha düşük masrafla yapılan sürdürülebilir üretim denemeleri, verim yönünden de geleneksel yöntemin üzerine çıkmış, ekonomik yönden de üreticinin gelirinde artışa neden olmuştur. Bu üretimin sağladığı bir diğer önemli sonuç da doğal kaynaklar üzerinde daha az baskı yarattığı için gelecek nesiller adına önemli katkılar sağlayacağıdır.

Kimyasal (mineral) gübrelerin bilinçsiz bir şekilde kullanımı ile oluşan çevre kirlenmesi sonucunda bozulan doğa dengesinin yeniden kurulması çok güç olduğundan, gerekli önlemlerin alınmasının büyük bir önemi vardır. Bu nedenle tarımsal uygulamalar; kullanılacak mineral gübrelerin fizyolojik özelliği, bitki ve toprak yapısı gibi parametreler birlikte değerlendirilerek yapılmalı, bu uygulamanın sürdürülebilir olmasına özen gösterilmelidir.

Tarım topraklarımızın organik maddece fakir olduğu herkes tarafından bilinmektedir. Ancak potasyum ve kısmen fosfor bakımından yeterli olan topraklarımızın zaman içinde organik maddede olduğu gibi fosfor ve potasyumca da fakirleşebileceği unutulmamalıdır.

Beslenme ve gıda güvenliği, insanlığın geleceği için anahtar konulardan biridir. Açlık kapıya dayanmadan, tarım topraklarının birim alanından maksimum ve en kaliteli verimi sağlamak için bilinçli tarım yapmak zorundayız. Bilinçli tarım yapmaya açılan kapılardan ilki ise toprakların bakımı, korunması, verimlilik devamlılığının sağlanması ve gübrenmesinde bitki besleme uzmanlarının tecrübe ve deneyimleri doğrultusunda planlı bir şekilde “gübreleme programları” oluşturulmalıdır. Söz konusu akılcı gübreleme programlarına mutlaka organik gübrelerin de gerek ıslah ve gerekse hastalıklara karşı direncin artırılarak daha az kimyasal gübre ve ilaç kullanılmasına geçişin sağlanması açısından yer verilmelidir. Profesyonel olarak üretim yapan her işletmenin kendi tarımsal ve hayvansal atıklarından elde edilen kompostların organik gübre amacıyla kullanması gerekmektedir.

KAYNAKLAR

- Açıl, A.F. 1976. Tarımsal Ürün Maliyetlerinin Hesaplanması ve Memleketimizde Tarımsal Ürün Maliyetlerindeki Gelişmeler, A.Ü. Ziraat Fakültesi Yayınları: 665, II. Baskı, Ankara.
- Açıl, A.F. ve Demirci R. 1984. Tarım Ekonomisi Dersleri, A.Ü. Ziraat Fakültesi Yayınları: 880, Ankara.
- Alemdar, T., Seçer, A., Demirdöğen, A., Öztornacı, B., Aykanat, S., 2014, Çukurova Bölgesinde Başlıca Tarla Ürünlerinin Üretim Maliyetleri ve Pazarlama Yapıları, TEPGE Yayın No: 230 ISBN: 978-605-4672-65-3.
- Alloway, B.J., 2008. Zinc in Soils and Crop Nutrition. 2nd Edition. IZA Brussels, Belgium and IFA, Paris, France.
- Altıntaş, G., 2014, Tokat, Amasya, Yozgat Ve Sivas Yörelerinde Yetiştirilen Bazı Tarım Ürünlerinin 2013 Yılı Üretim Girdileri Ve Maliyetleri, T.C. Gıda Tarım Ve Hayvancılık Bakanlığı Tarımsal Araştırmalar Ve Politikalar Genel Müdürlüğü Orta Karadeniz Geçit Kuşağı Tarımsal Araştırma İstasyonu Müdürlüğü Enstitü Yayın No: 261-P23.
- AÖF, 2019, Doğal Kaynaklar ve Çevre Eknomisi Ders Kitabı, Eskişehir, E-ISBN 978-975-06-3304-1
- Arı, F. A., 2006, Türkiye’de Tarımın Ekonomideki Yeri ve Güncel Sorunları, Çalışma ve Toplum Dergisi, 2006/2 (9).
- Barilla Group, 2023, <https://www.barillagroup.com/en/purpose/>
- Bellitürk, K., 2005. Tekirdağ Koşullarında Buğday Yetiştirilen Toprakların Mikro Besin Elementleri ve Ağır Metal İçeriklerinin Saptanması. Türkiye VI. Tarla Bitkileri Kongresi, 5-9 Eylül, Cilt 2, s: 1211-1215, Antalya.
- Bellitürk, K., 2011. Edirne İli Uzunköprü İlçesi Tarım Topraklarının Beslenme Durumlarının Belirlenmesi. Tekirdağ Ziraat Fakültesi Dergisi (JOTAF), Tekirdağ, 8 (3): 8-15.
- Eyüpoğlu, F., Kurucu, N. ve Talaz, S., 1996. Türkiye Topraklarının Bitkiye Yararışlı Bazı Mikroelementler Bakımından Genel Durumu. Toprak ve Su Kaynakları Araştırma Yıllığı, Yayın No: 98, Ankara.
- Graham, R. D. and Welch, R. M., 1996. Breeding for Staple-food Crops with High Micronutrient Density. Agricultural Strategies for Micronutrients Working Paper No. 3. Washington, D.C: International Food Policy Research Institute, 1-72.
- İnan, İ.H., 2006. Tarım Ekonomisi ve İşletmeciliği, Altıncı Baskı, Tekirdağ.
- Kıral, T., Kasnakoğlu, H. Tatlıdil, F.F., Fidan, H., Gündoğmuş, E. 1999. Tarımsal Ürünler İçin Maliyet Hesaplama Metodolojisi ve Veri Tabanı Rehberi, Tarımsal Ekonomi Araştırma Enstitüsü Yayın No: 37, Ankara.
- Korkut, K. Z., Başer, İ., Dağlıoğlu, O., Bilgin, O., Kahraman, T. ve İ. Öztürk, 2004. Trakya Bölgesi’nde Makarnalık Buğday Üretimi İçin Stabil Yüksek Verimli ve Kaliteli Makarnalık Buğday Genotiplerinin Belirlenmesi. TÜBİTAK Projesi-TOGTAG-2780. Tekirdağ.
- Şahin, G., Avcıoğlu, A.O., 2016, Tarımsal Üretimde Sera Gazları ve Karbon Ayakizi, Tarım Makinaları Bilimi Dergisi (Journal of Agricultural Machinery Science) 2016, 12 (3), 157-162

- Tanrıvermiş, H., 2000. Orta Sakarya Havzasında Domates Üretiminde Tarımsal İlaç Kullanımının Ekonomik Analizi. Tarımsal Ekonomi Araştırma Enstitüsü Yayın No: 42, Ankara.
- TEAE, 2001. Türkiye’de Bazı Bölgeler İçin Önemli Ürünlerde Girdi Kullanımı ve Üretim Maliyetleri, Tarımsal Ekonomisi Araştırma Enstitüsü Proje No: 2001-14, Ankara.
- Torun, A.A., Gülmezoğlu, N., Tolay, İ., Duymuş, E., Aytaç, Z., Cenkseven, Ş. and Torun, B., 2019. Effects of Zinc and NaCl Applications on Dry Matter Yield and Mineral Nutrient Concentrations of Durum Wheat (*Triticum durum* Desf.). Journal of Bahri Dagdas Crop Research 8 (1): 1-10, Konya.
- TÜİK, 2018, Bitkisel Üretim Verileri, Türkiye İstatistik Kurumu, Ankara.
- Turhan, Ş., 2015, Tarımda Sürdürülebilirlik ve Organik Tarım, Tarım Ekonomisi Dergisi, 11-1: 13-24
- WWF, 2014, Türkiye’nin Su Ayakizi Raporu, ISBN: 978-605-86596-7-4, WWF-Türkiye ve Pegasys Strategy and Development

**COMPARATIVE ANALYSIS OF LACTATION CURVE MODELS IN HOLSTEIN
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ABSTRACT

Lactation curves are systems that examine changes in milk yield over time following calving and exhibit a non-linear structure. Various mathematical functions are used in lactation curve modelling to obtain predictive values for significant performance characteristics, such as the postpartum period, time to peak, and yield value at the peak. Within the functional structures, parameters such as maximum milk yield, lactation period, total yield per lactation, and the rate of decrease after the peak yield are defined. In this study, comparison results of various lactation curves in polynomial, exponential, and gamma function structures in Holstein dairy cattle were examined and interpreted to provide the best fit for different problem structures and support biometric interpretations. Comparisons were evaluated using coefficients of determination, mean squared error criteria. The analyses were carried out using the SPSS 26 statistical software and MATLAB R2016a.

Keywords: Lactation curve, nonlinear regression, Holstein, milk yield.

Introduction

Milk yield records are one of the important criteria used to evaluate and monitor the production performance of cows. At the same time, it is an essential indicator for the identification of high and low-yielding cows and the creation of appropriate nutrition programs and indirectly contributes to the development of strategies and decisions to increase the productivity of their enterprises (Gök et al., 2019). This criterion, which also helps breeding studies to ensure the birth of high-yielding offspring in future generations, provides important information that guides breeding strategies. Another important contribution of healthy and regular recording of milk yield records is that it offers business owners the opportunity to monitor potential health problems (Svennersten-Sjaunja et al., 1997). Lactation curves examine the changes in milk yield after calving and provide a graphical representation. Various mathematical functions are used in lactation curve modelling to obtain predictive values for important performance characteristics such as postpartum period, time to peak, and peak yield value. Parameters such as maximum milk yield, lactation period, total yield per lactation, and rate of decline after peak yield are defined in functional structures (Macciotta et al., 2011).

This study examined and interpreted the comparison results of various lactation curves in polynomial, exponential and gamma function structures (Lopez, 2008) in Holstein dairy cattle to provide the most appropriate fit for different problem structures and support biometric interpretations.

Research and Results

The material of the study consists of milk yield records of Holstein Friesian dairy cattle obtained during their first lactation. Recording days less than the 5th day and greater than the 305th day in the milk yield records on the test day were excluded from the analysis. Comparative results of various lactation curves in polynomial, exponential and gamma function structures are included in the results.

Models with polynomial, exponential and gamma function structures are used to model lactation curves in dairy cattle to describe the relationship between time (measured in days of milk) and milk yield and to show how milk production changes over time.

Polynomial equations contain mathematical expressions containing the coefficients of the independent variable raised to different exponents. The coefficients of the polynomial functions provide information about the shape, slope, and intersection of the curve. A linear polynomial function has two coefficients representing slope and intersection, while a quadratic

polynomial function has three coefficients representing curvature, slope, and intersection. These coefficients provide an opportunity to interpret the shape of the lactation curve. In our study, Quadratic Polynomial Model and Ali and Schaffer models were used within the scope of polynomial functions. The mathematical representations of the models examined within the scope of polynomial functions are given in Table 1.

Table 1. Mathematical description of the polynomial functions

Functions	Mathematical Descriptions
Polynomial	Quadratic Model (Dave, 1971) $Y_t = a + bt - ct^2$
	Ali and Schaeffer (Ali and Schaeffer, 1987) $Y_t = a + bt + ct^2 - d\log(t) - k[\log(t)]^2$

Exponential functions are based on exponential equations with a base that can be raised to a power proportional to time. In lactation curve models, exponential functions can be explained by parameters associated with the 'baseline', which indicates how fast the curve grows or declines over time, and the 'baseline', which represents the milk yield at the beginning of lactation and determines the starting point of the curve. Exponential functions can model the initial stage of milk production in lactation curves and then a gradual decline over time. In other words, they are widely used to describe the early stages of lactation in dairy cattle, where milk production is typically high in the initial period and then goes into a decline stage. In our study, Brody Model and Cobby and Le Du model were used within the scope of exponential functions. The mathematical representations of the models examined within the scope of exponential functions are given in Table 2.

Table 2. Mathematical description of the exponential functions

Functions	Mathematical Descriptions
Exponential	Brody (Brody et al., 1923) $Y_t = ae^{-ct}$
	Cobby and Le Du $Y_t = a(1 - e^{-ct}) - bt$

The parameters estimated in the gamma function are related to the shape and scale of the curve. The gamma functions, similar to the exponential function, characterize the gradual decrease following the initial milk production and the milk production after the decrease with various lactation curve models. Lactation curve models in gamma function structure are widely used in research to examine the dynamics of the milk production process and to interpret

lactation biology. In our study, Wood Model and Dhanoa model were used within the scope of Gamma functions.

Table 3. Mathematical description of the gamma functions

Functions	Mathematical Descriptions	
Gamma	Wood (Wood, 1967)	$Y_t = at^b e^{-ct}$
	Dhanoa (Dhanoa, 1981)	$Y_t = at^{kc} e^{-ct}$

Table 4. Statistical criteria for lactation curve models

Criteria	Formula
Adjusted Determination Coefficient	$R_{adj}^2 = 1 - \left[\frac{n-1}{n-p} \right] \times (1 - R^2)$
Mean Square Error	$MSE = \frac{1}{n} \sum (Y - \hat{Y})^2$

The mathematical representations of the models examined within the scope of gamma functions are given in Table 3. Statistical criteria in Table 4 were used in order to comparatively examine the numerical results related to the lactation curve models in our study.

Table 5. Parameters of polynomial function and goodness of fit measurements

Modeller	$a \pm s_a$	$b \pm s_b$	$c \pm s_c$	$d \pm s_d$	$k \pm s_k$	R_{adj}^2	MSE
Quadratic Model	22.219±0.087	-0.009±0.001	0.00006±0.000004	.	.	0.9647	0.2240
Ali and Schaeffer	20,767±1,053	-0,08±0,009	0,00005367±0	1,679±1,765	-2,757±0,825	0.9827	0.1092

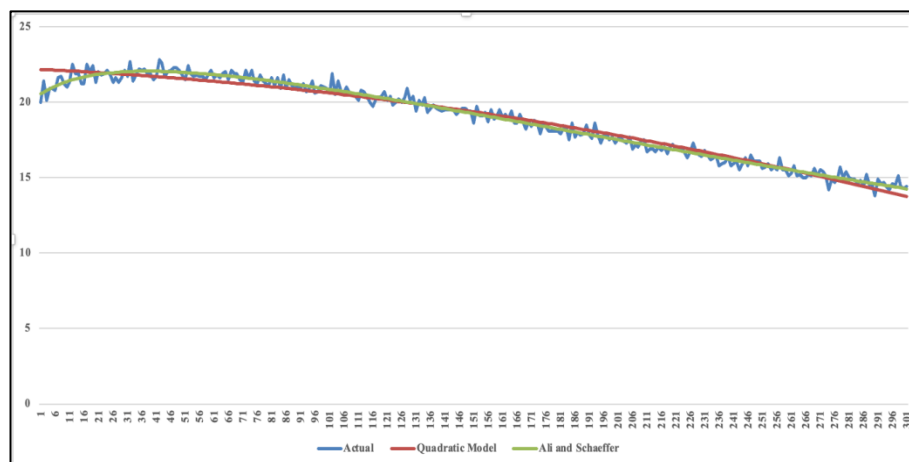


Figure 1. Graphical representation of the results for the Quadratic model and the Ali and Schaeffer model.

For the first lactation of Holstein cattle, the parameters of the models, adjusted R_{adj}^2 and MSE values are given in the Table 5 by using two different lactation curve models in the polynomial function structure according to milk yield (kg) on the test days. It is seen that the high explanatory power of the lactation curve models R_{adj}^2 (ranging between 0.964 and 0.982) MSE values (ranging between 0.2240 and 0.1092) are close to each other at low values.

Table 6. Parameters of exponential function and goodness of fit measurements.

Models	$a \pm s_{\bar{a}}$	$b \pm s_{\bar{b}}$	$c \pm s_{\bar{c}}$	R_{adj}^2	MSE
Brody	23.477±0.097	.	0.001±0.00026	0.9144	0.5393
Cobby and Le Du	23.498±0.067	0.029±0.00003	0.306±0.012	0.9557	0.2807

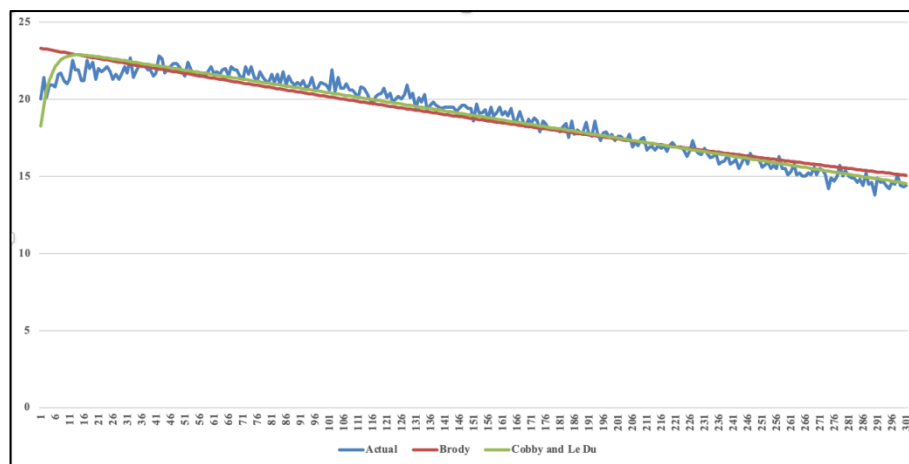


Figure 2. Graphical representation of the results for the Brody model and the Cobby and Le Du model.

The parameters, R_{adj}^2 and MSE values of the models are given in the Table 6 by using two different lactation curve models in the exponential function structure according to the milk yield (kg) on the test days for the first lactations of Holstein cattle. It is seen that the high explanatory power of the lactation curve models R_{adj}^2 (ranging between 0.914 and 0.955) MSE (ranging between 0.5393 and 0.2807) values are close to each other at low values.

Table 7. Parameters of gamma function and goodness of fit measurements

Model	$a \pm s_{\bar{a}}$	$b \pm s_{\bar{b}}$	$c \pm s_{\bar{c}}$	R_{adj}^2	MSE
Wood	17.336±0.170	0.092±0.003	0.002±00003	0.9818	0.1164

The parameters, R_{adj}^2 and MSE values of the models are given in the Table 7 by using two different lactation curve models in the gamma function structure according to milk yield (kg) on the test days for the first lactation of Holstein cattle. It is seen that the explanatory power of the lactation curve models is high R_{adj}^2 (0.9818) MSE values of 0.1164. In the analysis, the expected result could not be obtained with the Dhanoa model.

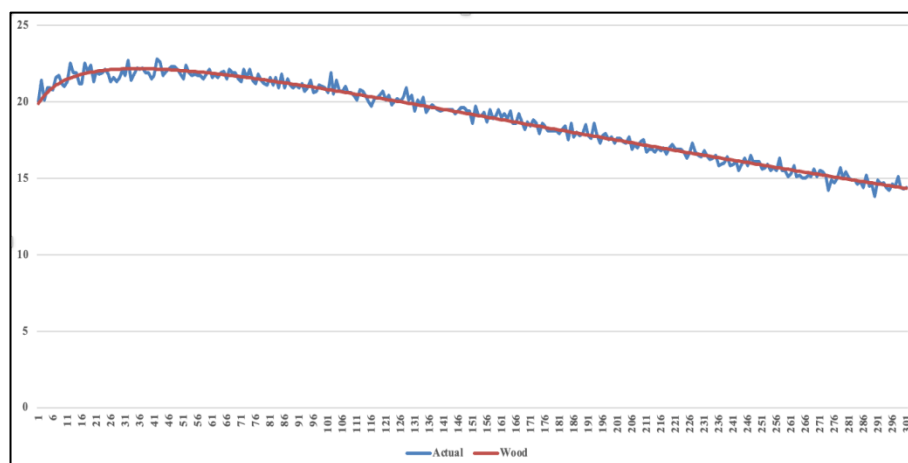


Figure 3. Graphical representation of the results for Wood model

Table 8. Statistical criteria result for all lactation curve models

Lactation Curve Models	R_{adj}^2	MSE
Quadratic Model	0.9647	0.2240
Ali and Schaeffer Model	0.9827	0.1092
Brody Model	0.9144	0.5393
Cobby and Le Du Model	0.9557	0.2807
Wood Model	0.9818	0.1164
Dhanoa Model	.	.

Numerical results on statistical criteria for all lactation curve models are given in Table 8. Accordingly, the model that made the most successful prediction with the highest R and lowest MSE values among the models examined was the Ali and Schaeffer model.

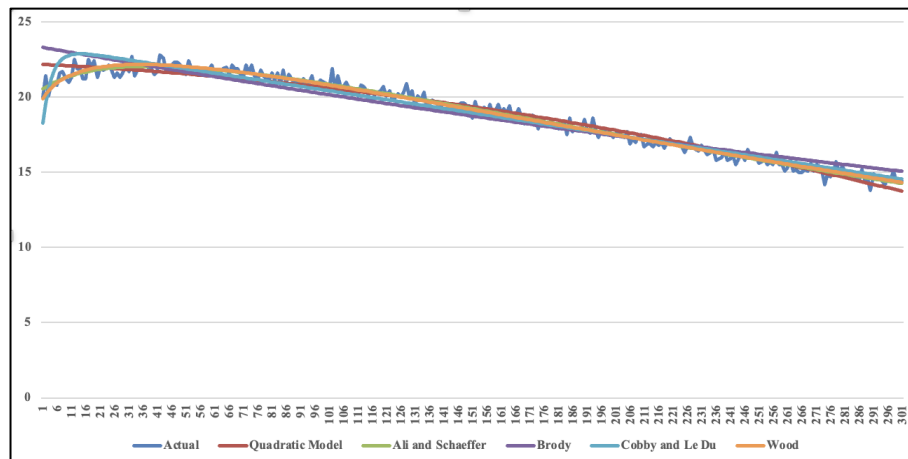


Figure 4. Graphical representation of the results for all lactation curve models

Conclusion

This study examined and interpreted the comparison results of various lactation curves in polynomial, exponential, and gamma function structures in Holstein dairy cattle to provide the most appropriate fit for different problem structures and support biometric interpretations. The results show that the most successful model structure is the 'Ali and Schaeffer model', with the highest coefficient of determination and the lowest mean squared error value. Lactation curve models, which give successful numerical results, can be used for herd management, care-nutrition decisions, health practices, genetic evaluation, and predictions for future periods.

References

- Lopez, S. (2008). Non-linear functions in animal nutrition. In *Mathematical modelling in animal nutrition* (pp. 47-88). Wallingford UK: CABI.
- Turgut, G. Ö. K., Mikail, N., & Akkol, S. (2019). Analysis of the First Lactation Curve in Holstein Cows with Different Mathematical Models. *Kahramanmaraş Sütçü İmam Üniversitesi Tarım ve Doğa Dergisi*, 22(4), 601-608.
- Svennersten-Sjaunja, K., Sjaunja, L. O., Bertilsson, J., & Wiktorsson, H. (1997). Use of regular milking records versus daily records for nutrition and other kinds of management. *Livestock Production Science*, 48(3), 167-174.
- Ali, T. E., & Schaeffer, L. R. (1987). Accounting for covariances among test day milk yields in dairy cows. *Canadian Journal of Animal Science*, 67(3), 637-644.
- Brody, S., Ragsdale, A. C., & Turner, C. W. (1923). The rate of decline of milk secretion with the advance of the period of lactation. *The Journal of General Physiology*, 5(4), 441-444.
- Wood, P. D. P. (1967). Algebraic model of the lactation curve in cattle. *Nature*, 216(5111), 164-165.
- Dhanao, M. S. (1981). A note on an alternative form of the lactation model of Wood. *Animal Science*, 32(3), 349-351.
- Macciotta, N. P., Dimauro, C., Rassu, S. P., Steri, R., & Pulina, G. (2011). The mathematical description of lactation curves in dairy cattle. *Italian Journal of Animal Science*, 10(4), e51.

İNÇİ DARI (*Pennisetum glaucum* (L.) R. Br) POPULASYONLARINDA OT VERİMİ İLE BAZI TARIMSAL ÖZELLİKLER ARASINDAKİ İLİŞKİLERİN KORELASYON VE PATH ANALİZİ İLE SAPTANMASI

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ÖZET

Yem bitkilerinde ot verimi ve verimle ilişkili karakterlerin bilinmesinin yanı sıra, verime doğrudan katkı yapan özelliklerin de bilinmesi ıslah çalışmaları açısından önemlidir. Bu çalışmada, ICRISAT'tan temin edilen 225 adet inci darı (*Pennisetum glaucum* (L.) R. Br) popülasyonunun ot verimi ile bazı tarımsal özellikleri arasındaki ilişkilerin korelasyon ve path analizi ile belirlenmesi amaçlanmıştır. Araştırma ile ilgili tarla denemeleri Adana'da 2021 yılı ikinci ürün yetiştirme döneminde, Alfa Latis (15 x 15) deneme deseninde yürütülmüştür. Çalışma sonucunda; popülasyonların kuru ot verimlerinin 239.31-2425.58 g/bitki, salkım çıkarma gün sayısının 35.8-101.0 gün, bitki boyunun 223.3-383.3 cm, başak uzunluğunun 20.0-55.0 cm, ana saptaki yaprak sayısının 10.0-18.5 adet/bitki, toplam kardeş sayısının 3.67-18.00 adet/bitki, yaş ot verimlerinin 830.7-10247.0 g/bitki arasında değiştiği saptanmıştır. Ayrıca bazı

tarımsal karakterler arasındaki ikili ilişkileri belirlemek için yapılan korelasyon analizi sonucunda; kuru ot verimi ile salkım çıkarma gün sayısı ($r=0.340^{**}$), bitki boyu ($r=0.408^{**}$), başak uzunluğu ($r=0.116^*$), ana saptaki yaprak sayısı ($r=0.303^{**}$), toplam kardeş sayısı ($r=0.746^{**}$) ve yaş ot verimi ($r=0.886^{**}$) arasında olumlu ve önemli ilişkiler saptanmıştır. Path analizi sonuçlarına göre; bitki boyu, toplam kardeş sayısı ve yaş ot veriminin kuru ot verimine doğrudan etkileri olumlu ve önemli; başak uzunluğu ve ana saptaki yaprak sayısının kuru ot verimine doğrudan etkileri olumsuz ve önemli olmuştur. Yürütülen bu çalışmanın sonuçlarına dayanılarak, Adana koşullarında inci darısı bitkisinde kuru ot verimi bakımından yapılacak ıslah çalışmalarında, ot verimine doğrudan katkıda bulunan bitki boyu, toplam kardeş sayısı ve yaş ot veriminin önemli seleksiyon kriterleri olabileceği sonucuna varılmıştır.

Anahtar kelimeler: İnci darı (*Pennisetum glaucum*), popülasyon, Ot verimi, Korelasyon, Path analizi

DETERMINATION OF THE RELATIONS BETWEEN FORAGE YIELD AND SOME AGRICULTURAL CHARACTERISTICS IN PEARL MILLET (*Pennisetum glaucum* (L.) R. Br) POPULATIONS BY CORRELATION AND PATH ANALYSIS

ABSTRACT

In addition to knowing the forage yield and the characteristics related to yield, information on the features that directly contribute to the yield is important in terms of breeding studies. In this study, it was aimed to determine the relationship between forage yield and some agricultural characteristics of 225 pearl millet (*Pennisetum glaucum* (L.) R. Br) populations obtained from ICRISAT by correlation and path analysis. The research was carried out in Adana, during the second crop growing season of 2021. The field experiment was arranged in Alfa Latis (15 x 15) experimental design. Hay yield per plant in the populations varied 239.31-2425.58 g plant⁻¹, the number of days to tassel emerging 35.8-101.0 days, the plant height 223.3-383.3 cm, the spike length 20.0-55 cm, the number of leaves on the main stem 10.0-18.5 leaves/plant, the total number of tillers per plant 3.67-18.00, green herbage yield 830.7-10247.0 g/plant. Correlation analysis showed that between hay yield and number of days to tassel emerging ($r=0.340^{**}$), plant height ($r=0.408^{**}$), spike length ($r=0.116^*$), number of leaves on main stem ($r=0.303^{**}$), total number of tillers per plant ($r=0.746^{**}$) and green herbage yield ($r=0.886^{**}$) were found positive and significant relationships. As a result of path analysis; it was determined that the direct effects of plant height, total number of tillers per plant and green herbage yield on hay yield were significant; The direct effects of spike length and number of leaves on the main stem on hay yield per plant were negatively significant. From the results of this study, it was concluded that plant height, the total number of tillers per plant and green herbage yield, which directly contribute to hay yield, may be important selection criteria in breeding studies of pearl millet under Adana conditions in terms of hay yield.

Keywords: Pearl millet (*Pennisetum glaucum*), population, hay yield, Correlation, Path analysis

GİRİŞ

Darılar, Afrika ve Güney Asya ülkelerinde ağırlıklı olarak dane, ABD ve Avrupa ülkelerinde ise kaba yem bitkisi olarak yetiştirilmektedir. Dünya’da darıların ekim alanının 30.9 milyon ha olduğu ve bunun büyük çoğunluğunun Afrika (18.6 milyon ha) kıtasında bulunduğu, bu kıtayı Asya’nın (11.6 milyon ha) takip ettiği bilinmektedir (FAO, 2021). Darı türlerinin en önemlilerinden olan ve dünyada 6. tahıl olarak kabul edilen İnci darısı (*Pennisetum glaucum* (L.) R. Br.) sulanan ve sıcak bölgelerde yazlık ekimlerde yüksek verim potansiyeline sahiptir. Dünya tarımında gerek insan beslenmesinde gerekse hayvan beslemede önemli bir yere sahip olan inci darısı ile ülkemizde yapılan araştırmalar yok denecek kadar azdır. Ülkemizde yeni yeni tanınan bu bitkiden geliştirilmiş bir çeşidimiz bulunmamaktadır. Küresel ısınmaya bağlı olarak dünyamızı etkilemeye başlayan iklim değişimleri sulama olanakları kısıtlı olan veya marjinal alanlarda yetiştirilecek alternatif bitkilerin geliştirilmesini zaruri hale getirmiştir.

İnci darısı (*Pennisetum glaucum*; Poaceace familyası, Panicoideae alt familyası *Penicillarium* bölümü içerisinde yer alan diploid ($2n = 14$) kromozomlu ve yabancı tozlanan, yüksek oranda heterosis gösteren C4 buğdaygil bitkisidir (Andrews ve Kumar, 1992; Upadhyaya ve ark., 2008). Dik gelişen 3-5 metreye kadar boylanabilen, bol kardeşlenen bir bitkidir. İnci darı, kuraklığa dayanıklı tahılların başında yer almaktadır (Taylor ve ark., 2006; Lee ve ark., 2012), ancak susuz koşullarda yetiştirilmesi mümkün değildir. Diğer tahıllarla karşılaştırıldığında daha az hastalık ve zararlı sorunu olması nedeniyle farklı üretim sistemlerine uygun olabileceği bildirilmektedir (Jukanti ve ark., 2016). Yarı kurak koşullarda yağışın çok düşük (≤ 300 mm) veya düzensiz olduğu ekolojilerde yetiştirebildiği, sorgum ve mısırın sorun yaşadığı alanlarda hayatta kalabileceği bildirilmektedir (Dendy, 1995). Ancak 2000-2700 m yüksekliğinde olduğu ekolojilerde gelişiminde sorunlar ortaya çıkabilmektedir (Hannaway ve Larson, 2004). Söz konusu tür, çok sıcak ve kurak koşullarda yetişen sorguma göre de nispeten daha az su tüketmektedir (Singh ve Singh, 1995). İnci darısı, kumlu ve hafif yapılı verimli olmayan ve pH 6.2-7.7 arasında değişen topraklarda yetiştirilebilen, düşük girdilere iyi cevap veren, optimum büyüme sıcaklığının 33 °C ($12 - 45$ °C) olduğu bir bitkidir (Kumar, 1989; Andrews ve Kumar, 1992; Fribourg, 1995). Son çalışmalarda, inci darısının düşük yağış rejimi altında, geleneksel ürün olan mısır ve sorguma göre daha yüksek kuru madde verimi ve bürüt enerji ürettiği saptanmıştır (Hernández ve ark., 2007).

İnci darının sıcaklığa kuraklığa ve tuzluluğa diğer ürünlere göre daha toleranslı olması, özellikle marjinal alanlarda yetiştirilebilmesinin yanı sıra, tarımının düşük girdilerle yapılması, hastalık

ve zararlılar bakımından daha avantajlı olması nedeniyle önemli bir tür olarak önümüzdeki yıllarda karşımıza çıkacaktır (Yücel ve Yücel, 2022).

Bu çalışma ile iklim değişiklikleri ile birlikte Çukurova Bölgesinde değişecek ürün deseni içerisinde özellikle ikinci ürün tarımı içerisinde üretimi yapılacak önemli türlerin başında gelecektir. İnci darının birim alandaki yüksek biyokütle potansiyeli nedeniyle tarımının yaygınlaşması ile yazlık dönemde yüksek yeşil ot verimi sağlanmasının yanı sıra silaj yapılarak kaliteli kaba yem açığının kapatılmasında önemli rol alacağı düşünülmektedir.

ARAŞTIRMA VE BULGULAR

Araştırma, denizden 12 m yükseklikte 36° 51' kuzey enlemi ile 35° 20' doğu boylamları arasında yer alan Doğu Akdeniz Tarımsal Araştırma Enstitüsü (Doğankent/ADANA) arazilerinde 2021 yılında yürütülmüştür. Tarla denemeleri, 15 x 15 Alfa Latis deneme deseninde iki tekerrürlü olarak kurulmuştur. Her popülasyon, uzunluğu 4 m olan sıralara, 70 cm x 25 cm ekim normunda, 2 sıra olarak elle ekilmiştir.

Araştırmada, her popülasyona ait parsellerde, bitkilerin çiçeklenme döneminde salkım çıkarma gün sayısı (gün), bitki boyu (cm), başak uzunluğu (cm), ana saptaki yaprak sayısı (adet/bitki), toplam kardeş sayısı (adet/bitki), yaş ot ağırlığı (g/bitki) ve kuru ot ağırlığı (g/bitki) özellikler, Upadhyaya ve ark., (2008), Upadhyaya ve Gowda (2009) ve Rao ve Bramel (2000) tarafından açıklanan yöntemlere göre incelenmiştir.

Çalışma sonucunda; popülasyonlarda salkım çıkarma gün sayısının 35.8-101.0 gün, bitki boyunun 223.33-383.33 cm, başak uzunluğunun 20.0-55.0 cm, ana saptaki yaprak sayısının 10.0-18.5 adet/bitki, kardeş sayısının 3.67-18.00 adet/bitki, yaş ot verimlerinin 830.67-10247.0 g/bitki ve kuru ot verimlerinin 239.31-2425.58 g/bitki arasında değiştiği saptanmıştır (Çizelge 1). Söz konusu değerlerin başka araştırmacılar tarafından sırasıyla 49-129 gün, 129-377 cm, 17-89 cm, 0.55-6.40 adet/bitki arasında değiştiği saptanmıştır (Pucher ve ark., 2015, Angarawai ve ark., 2016; Athoni ve ark., 2016).

Çizelge 1. Popülasyonlar, hat ve çeşitlerin minimum, maksimum, ortalama, varyans, standart sapma Sx ve Cv değerleri

Değişken Adı	Min.	Mak.	Ortalama	Varyans	Standart Sapma	Sx	CV
%50 Salkım Çıkarma Süresi (gün)	35.83	101.00	67.76	82.44	9.08	0.61	13.40
Bitki Boyu (cm)	223.33	383.33	306.39	784.50	28.01	1.87	9.14
Başak Uzunluğu (cm)	20.00	55.00	29.76	22.00	4.69	0.31	15.76
Ana Saptaki Yaprak Sayısı (adet)	10.00	18.50	13.41	2.13	1.46	0.10	10.88
Bitkide Toplam Kardeş Sayısı (adet)	3.67	18.00	7.141	4.99	2.23	0.15	31.28
Yaş Ot Verimi (g/bitki)	830.67	10247.00	2628.652	1620275.75	1272.90	84.86	48.42
Kuru Ot Verimi (g/bitki)	239.31	2425.58	683.158	98972.40	314.60	20.97	46.05

İnci darı populasyonlarında ölçümü yapılan karakterleri arasındaki ikili ilişkileri belirlemek için yapılan korelasyon analizi sonucunda; kuru ot verimi ile salkım çıkarma gün sayısı ($r=0.340^{**}$), bitki boyu ($r=0.408^{**}$), başak uzunluğu ($r=0.116^*$), ana saptaki yaprak sayısı ($r=0.303^{**}$), toplam kardeş sayısı ($r=0.746^{**}$) ve yaş ot verimi ($r=0.886^{**}$) arasında olumlu ve önemli ilişkiler saptanmıştır (Çizelge 2).

Verimi etkileyen karakterler arasındaki ikili ilişkilerin belirlenmesinin yanı sıra bu karakterlerin etkilerinin doğrudan mı dolaylı mı, olumlu mu olumsuz mu olduğunu tespit etmek ıslah çalışmalarında başarının artırılmasında önemlidir. Bu amaçla path analizi yapılmıştır. Çalışmamızda kuru ot verimi bağımlı değişken olarak ele alınırken salkım çıkarma gün sayısı, bitki boyu, başak uzunluğu, ana saptaki yaprak sayısı, toplam kardeş sayısı ve yeşil ot verimi bağımsız değişken olarak alınmıştır.

Çizelge 2- İnci Darı’da Bazı Özellikler Arası İlişkiler (Korelasyon Analizi)

	Kuru Ot Verimi	%50 Salkım Çıkarma	Bitki Boyu	Başak Uzunluğu	Ana Saptaki Yaprak Sayısı	Toplam Kardeş Sayısı	Yaş Ot Verimi
Kuru Ot Verimi	1						
%50 Salkım Çıkarma Süresi	0.340**	1					
Bitki Boyu	0.408**	0.476**	1				
Başak Uzunluğu	0.116*	0.032	0.197**	1			
Ana Saptaki Yaprak Sayısı	0.303**	0.462**	0.820**	-0.029	1		
Toplam Kardeş Sayısı	0.746**	0.281**	0.204**	0.068	0.159**	1	
Yaş Ot Verimi	0.886**	0.412**	0.465**	0.113	0.406**	0.812**	1

*: 0.05 Düzeyinde Önemli **: 0.01 Düzeyinde Önemli ÖD: Önemli Değil

Path analizi sonucunda; bitki boyu ve yaş ot veriminin kuru ot verimine doğrudan etkileri olumlu (sırasıyla 0.1511 ve 0.8351) ve çok yüksek (sırasıyla %21.63 ve %80.54), toplam kardeş sayısının kuru ot verimine doğrudan etkisi olumlu (0.0688) ve yüksek (%8.49) olmuştur. Ana saptaki yaprak sayısının kuru ot verimine doğrudan etkisi olumsuz (-0.162) ve çok yüksek

Çizelge 3- İnci Darı’da Kuru Ot Verimine Farklı Karakterlerin Path Katsayıları ile Doğrudan ve Dolaylı İlişkileri

			%50 Salkım Çıkarma Süresi	Bitki Boyu	Başak Uzunluğu	Ana Saptaki Yaprak Sayısı	Toplam Kardeş Sayısı	Yaş Ot Verimi
Dolaylı Etkiler	%50 Salkım Çıkarma	P	-0.0197*	0.0719	-0.0005	-0.0748	0.0193	0.3439
		%	3.72	13.57	0.1	14.1	3.64	64.86
	Bitki Boyu	P	-0.009	0.1511	-0.003	-0.133	0.014	0.3881
		%	1.35	21.63	0.48	18.99	2.01	55.55
	Başak Uzunluğu	P	-0.0006	0.0297	-0.0169	0.0047	0.0047	0.094
		%	0.42	19.73	11.23	3.13	3.12	62.37
	Ana Saptaki Yaprak Sayısı	P	-0.009	0.124	0.0005	-0.162	0.011	0.3387
		%	1.41	19.22	0.08	25.07	1.7	52.52
	Toplam Kardeş Sayısı	P	-0.006	0.0308	-0.001	-0.026	0.0688	0.6785
		%	0.68	3.8	0.14	3.18	8.49	83.71
	Yaş Ot Verimi	P	-0.008	0.0702	-0.002	-0.066	0.0559	0.8351
		%	0.78	6.77	0.18	6.33	5.39	80.54

*: Doğrudan Etkiler koyu renk ve altı çizili olarak verilmiştir

(%25.07) olmuştur. Başak uzunluğunun kuru ot verimine doğrudan etkisi olumsuz (-0.0169) yüksek (%11.23) olmuştur (Çizelge 3).

SONUÇ

Yürütülen bu çalışmanın sonuçlarına dayanılarak, Adana koşullarında inci darısında kuru ot verimi bakımından yapılacak ıslah çalışmalarında, ot verimine doğrudan katkıda bulunan bitki boyu, toplam kardeş sayısı ve yaş ot veriminin önemli seleksiyon kriterleri olabileceği sonucuna varılmıştır.

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KAYNAKÇA

- Andrews, D.J., Kumar, K.A. 1992. Pearl millet for food, feed, and forage. *Advances in Agronomy*, 48:89-139
- Angarawai, I.I., Aladele, S., Dawud, M.A., Turaki, Z.G.S., Yakub, Y. 2016. Genetic diversity among Nigeria maiwa type of pearl millet germplasm. *The Global Journal of Science Frontier Research*, 16 (3):1-6.
- Athoni, B.K., Ishwar, B., Pattanashetty, S.K. & Guggari, A.K. (2016). Genetic diversity for yield and its component traits in Pearl millet [*Pennisetum glaucum* (L.) R.Br.]. *International Journal of Science and Nature*, 7 (4):795-798.
- Dendy, D.A.V. 1995. "Sorghum and the millets: Production and importance". Pages 11-26 in: *Sorghum and Millets: Chemistry and Technology*. D. A. V. Dendy, ed. AACC International: St. Paul, MN
- FAOSTAT, 2021. Crops and Livestock products, www.fao.org/faostat/data. Erişim tarihi; 04.05.2023.
- Fribourg, H.A. 1995. Summer annual grasses. pp 463-472 in R. Barnes, C. J. Nelson, M. Collins, and K. Moore, eds. *Forages an introduction to grassland agriculture*. Vol.1. 5th ed. Iowa State Press:Ames, Iowa.
- Hannaway, D.B., Larson C. 2004. "Forage fact sheet: pear lmillet (*Pennisetum americanum*)". Oregon State University, Corvallis, OR. http://forages.oregonstate.edu/php/fact_sheet_print_grass.php?SpecID=34&use=Forage
- Hernández, A.J.A., Zavala, G.F., Martínez, G.M.A., Jasso, C.H.C., Ventura, R.E., Durán, L.K. 2007. "Tecnología para producir forraje de mijo perla en San Luis Potosí". Folleto para Productores No 3. Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias. Campo Experimental San Luis. México.
- Jukanti, A.K., Laxmipathi Gowda, C.L., Rai, K. N., Manga, V. K., Bhatt, R. K. 2016. Crops that feed the world 11. Pearl Millet (*Pennisetum glaucum* L.): an important source of food security, nutrition and health in the arid and semi-arid tropics. *Food Security*, 8,(2), 307-329.
- Kumar, K.A. 1989. Pearl millet: Current status and future potential. *Outlook on Agriculture* 18:46-53.
- Lee, D., Hanna, W., Buntin, G.D, Dozier, W., Timper, P., Wilson, J.P. 2012. "Pearl millet for grain". College of Ag.and Env. Sci., Univ. of Georgia Cooperative Extension. Bulletin #B 1216. <http://extension.uga.edu/publications/detail.cfm?number=B1216> (accessed 30 Jul. 2014).
- Mengesha, M.H., Sharma, D. 1985. Collection and evaluation of pearl millet (*Pennisetum americanum*) germplasm from Ghana. *Economic Botany*, 39(1):25-38.
- Pucher, A., Sy, O., Angarawai, I.I., Gondah, J., Zangre, R., Ouedraogo, M., Sanogo, M.D., Boureima, S., Hash, C.T., Haussmann, B.I.G. 2015. Agro-morphological characterization of West and Central African pearl millet accessions. *Crop Science*, 55:737-748.

- Rao N.K., Bramel, P.J. 2000.” Manual of Genebank Operations and Procedures”. Technical Manual no. 6. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics Rao, S.A.,
- Singh, B.R., Singh D.P. 1995. “Agronomic and physiological responses of sorghum, maize and pearl millet to irrigation”. *Field Crops Research*, 42, 57-67.
- Taylor, J.R, Schober, T.J Bean, S. 2006. “Novel and non-food uses for sorghum and millets”. *Journal of Cereal Science*, 44, 252-271.
- Upadhyaya H.D., Reddy, K.N., Sastry, D.V.S.S.R. 2008. “Regeneration guidelines: pearl millet”. In: Dulloo ME, Thormann I, Jorge MA and Hanson J, editors. *Crop specific regeneration guidelines [CD-ROM]*. CGIAR System-wide Genetic Resource Programme, Rome, Italy. 9 pp.
- Upadhyaya, H.D., Gowda, C.L.L. 2009. *Managing and enhancing the use of germplasm-strategies and methodologies*. Technical Manual no.10. ICRISAT, Patancheru, Andhra Pradesh, India. 236 p.
- Yücel, C., Yücel, D. 2022. *Tarımda deęişen yapılar ve beklentiler. İnci darı (Pennisetum glaucum (L.) R.Br.)*. Ed. Serap Doęan ve Nazlı Kalender. İksad publishing house, ISBN: 978-625-8323-16- 0, S: 3-46.

**ÇİMENTO/AGREGA ORANININ GEÇİRİMLİ BETONLARIN MEKANİK VE
HİDROLİK ÖZELLİKLERİ ÜZERİNDEKİ ETKİSİ**

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Özet

Yüksek boşluklu yapısı nedeniyle geçirimli betonların hava ve suyun kolayca bir alt tabakaya aktarılması, ses ve sıcaklığın azaltılması, toz ve yollardaki kirleticilerin kontrol edilebilmesi ve özellikle yağmurlu havalarda daha güvenli bir sürüş imkânı sağlaması gibi birçok avantajı bulunmaktadır. Ancak yüksek geçirimliliğe neden olan boşluk yapısı, geçirimli betonda aynı zamanda düşük mekanik ve durabilite performansına neden olmaktadır. Ayrıca düzgün bir karışım tasarımı yapılmayan geçirimli betonların hem istenen mekanik özellikleri karşılayamadığı hem de yerine yerleştirilmesinde sorunlarla karşılaşıldığı görülmektedir. Bu çalışmada farklı gradasyona sahip (15-25 mm ve 5-15 mm) iki farklı kireçtaşı agregası ile geçirimli beton karışımlar üretilmiştir. Ayrıca çimento/agrega (Ç/A) oranının etkisi incelemek amacıyla üç farklı (0.20, 0.25 ve 0.30) ç/a oranında karışımlar üretilmiştir. Elde edilen sonuçlar bu çalışmada kullanılan ç/a oranları arasında geçirimli beton tasarımında kullanmak için en ideal ç/a oranının 0.25 olduğunu göstermiştir.

Anahtar kelimeler: Geçirimli beton, çimento/agrega oranı, mekanik özellikler

**EFFECT OF CEMENT/AGGREGATE RATIO ON MECHANICAL AND
HYDRAULIC PROPERTIES OF PERVIOUS CONCRETE**

Abstract

Pervious concretes because of their high void content have many advantages such as transferring air and water to subgrade, decreasing noise and temperature, controlling dusts and any other pollutants on the roads, and providing a safe driving environment especially on rainy days. But high porous structure while providing high permeability also causes low mechanic and durability performance. Besides, pervious concretes without proper design cannot reach desired mechanical properties and, cannot be placed appropriately. In this study, limestone aggregates with two different gradations (15-25 mm and 5-15 mm) were used to produce pervious concrete. Also, three different cement to aggregate ratio (0.20, 0.25 and 0.30) was considered to investigate the effect of cement/aggregate ratio (c/a) on pervious concrete. Results showed that among the c/a ratios that were considered in this study the best suited one for pervious concrete design is 0.25.

Keywords: Pervious concrete, cement/aggregate ratio, mechanical properties

Giriş

Geçirimli beton yaklaşık sıfır slump değerine sahip, ince agregalar kullanılmadan ya da oldukça az kullanılarak üretilen fazlaca boşluklu bir beton türüdür. Yüksek iri agregalar oranı nedeniyle geçirimli beton içerisinde boyutları 2-8 mm arasında değişen birbiriyle bağlantılı boşluklar oluşturulmakta ve böylece su bu boşluklardan kolayca geçebilmektedir. Geçirimli betonda minimum boşluk oranı %15 iken bu değer %35'e kadar çıkabilmekte ve herhangi bir ek mineral/kimyasal katkı kullanılmadan üretilen geçirimli betonların basınç dayanımları ise 2.8 ile 28 MPa arasında değişmektedir. Geçirimli betonların su geçirimsizlik miktarları, karışım hesabında belirlenen boşluk miktarı ve agregalar boyutlarına göre farklılık göstermekle beraber genellikle 0.14-1.22 cm/sn arasında değişmektedir [1].

Geçirimli beton üretiminde genellikle normal Portland çimentosu, iri agregalar ve su kullanılır. Böylece iri agregalar yığınları ince bir çimento hamuruyla sarmalanmış olur. Bahsedilen malzemelerin kullanılmasıyla geçirimli betonda genellikle boyutları 1-5 mm arasında değişen birbiriyle bağlantılı boşluklar oluşturulmuş olur. Bu sayede bünyesindeki boşluklar yardımıyla geleneksel betona kıyasla çok daha hızlı bir şekilde suyun tabakalar arasında iletilmesi sağlanmış olur. Geçirimli betonda kullanılan agregalar gradasyonu genellikle 9.5 mm ile 19.0 mm arasında değişmektedir. Doğal veya kırma taş agregalarının her ikisi de geçirimli betonda sıklıkla kullanılmaktadır. İnce agregalar kullanımından, boşlukları doldurarak boşlukların birbiriyle olan bağlantısını kestiği için kaçınılmaktadır. İnce agregalar kullanımı geçirimli betonun yoğunluğunu ve basınç dayanımını artırırken su geçirimsizliğini azaltmaktadır. Ek olarak, geleneksel betonda olduğu gibi, uçucu kül, cüruf, silis dumanı gibi mineral katkıları geçirimli betonda da kullanılabilir [1-5].

Geçirimli betonda kısmen yüksek basınç dayanımları elde etmek mümkündür ancak bunun için boşluk oranını azaltmak gerekmektedir, bu da betonun geçirimsizliğinin azalmasına neden olmaktadır. Sıkıştırma aralığı 0.086 mm'den 0.127 mm'ye düşürüldüğünde geçirimli betonun basınç dayanımının %11 azaldığı raporlanmıştır [6]. Agregalar boyutu arttıkça basınç dayanımının azaldığı gözlenirken aynı agregalar boyutu için polimer ve mineral katkı kullanımının basınç dayanımını arttırdığı söylenmiştir [7]. Agregaların incelik modülü arttıkça basınç dayanımının azaldığı [2] ve sahada elde edilen basınç dayanımları ile laboratuvar ortamında üretilen numunelerin dayanımlarının birbirlerinden farklı olabileceği [8] tarafından raporlanmıştır.

Bu çalışmada iki farklı tane aralığına sahip (15-25 mm ve 5-15 mm) kireçtaşı agregaları ve üç farklı çimento/agregalar (ç/a) oranında geçirimli betonlar üretilmiştir. Böylelikle agregalar

gradasyonu ve ç/a oranının geçirimli betonların basınç, yarmada çekme, eğilme dayanımları ile su geçirimliliği katsayısı üzerindeki etkisi incelenmiştir.

Deneysel Çalışma

1.1. Malzemeler

Bu çalışma kapsamında 15-25 mm ve 5-15 mm tane aralığındaki kireçtaşları kullanılmış olup agregaların fiziksel özellikleri Tablo 1’de verilmiştir. Yerel bir firmadan temin edilen CEM I 42.5 R tip normal portland çimentosu kullanılmıştır.

Tablo Hata! Belgede belirtilen stilde metne rastlanmadı..2. Agregaların özellikleri

Fiziksel özellikler	Kireçtaşı agregası	
	15-25 mm	5-15 mm
Sıkışık birim hacim ağırlık (kg/m ³)	1527	1387
Gevşek birim hacim ağırlık (kg/m ³)	1442	1534
Özgül ağırlık	2.71	2.67
Su emme (%)	0.23	0.30

2.2 Yöntem

Çalışma kapsamında geçirimli betonlar standart su kürüne maruz bırakılmışlardır. Standart su küründe 28 gün boyunca kürlendikten sonra geçirimli betonlar üzerinde basınç, yarmada çekme, eğilme dayanımları ve su geçirimliliği katsayıları belirlenmiştir. Basınç dayanımları için 150x150x150 mm boyutlarındaki küp numuneler, yarmada çekme dayanımı için 100x200 mm ebatlarında silindir örnekler ve eğilme dayanımı için ise 100x100x400 mm prizmatik örnekler kullanılmıştır. Ayrıca su geçirimliliği katsayısı da 100x200 mm silindir örnekler üzerinden belirlenmiştir. Basınç, yarmada çekme ve eğilme dayanımları sırasıyla TS EN 12390-3, TS EN 12390-6 ve TS EN 12390-5 standartları kullanılarak elde edilmiştir [9-11]. Su geçirimliliği katsayısı aşağıdaki eşitlik kullanılarak elde edilmiştir:

$$\text{Su geçirimliliği katsayısı} = (Q \times L) / (H \times A \times t)$$

Q: Beslenen su miktarı (mm³)

L: Numunenin uzunluğu (mm)

A: Numunenin yüzey alanı (mm²)

t: Zaman (sn)

H: Numune yüksekliği (mm)

Çalışma kapsamında belirlenen üç farklı ç/a (0.20, 0.25 ve 0.30) oranlarındaki beton karışım oranları Tablo 2’de verilmiştir.

Tablo Hata! Belgede belirtilen stilde metne rastlanmadı.. Geçirimli beton karışım oranları (1 m³)

Karışım	Çimento	Su	Kireçtaşı agregası		Çimento/Agrega oranı
			15-25 mm	5-15 mm	
Kireçtaşı 15-25	350	94	1750	-	0.20
Kireçtaşı 5-15	350	84	-	1750	
Kireçtaşı 15-25	400	134	1600	-	0.25
Kireçtaşı 5-15	400	125	-	1600	
Kireçtaşı 15-25	450	155	1500	-	0.30
Kireçtaşı 5-15	450	147	-	1500	

Bulgular ve Tartışma

Basınç, yarmada çekme ve eğilme dayanımları Tablo 3’de listelenmiştir. Tablo 3’den de anlaşılacağı üzere bu çalışma kapsamında göz önüne alınan çimento/agrega (ç/a) oranları içerisinde, mekanik özellikler dikkate alındığında, en yüksek performansı 0.25 ç/a oranının gösterdiği görülmektedir. En yüksek basınç dayanımı değeri 0.25 ç/a oranı ve 15-25 mm tane aralığında kireçtaşı agregası kullanılarak elde edilmiştir. Basınç dayanımı değerleri 15-25 mm gradasyonlu kireçtaşı agregası kullanılarak elde edilen geçirimli betonlar için 19.40 ile 14.48 MPa arasında değişirken, 5-15 mm tane aralığındaki agregalar kullanıldığında ise 14.66 ile 11.52 MPa arasında değişmiştir. Bütün karışımlarda 10 MPa basınç dayanımından fazla değerler elde edilmiştir. Yarmada çekme dayanımı sonuçları 0.76-1.52 MPa arasında değişmiştir. Geleneksel betonda olduğu gibi yarmada çekme dayanımları basınç dayanımına kıyasla oldukça düşük olmuştur. Mekanik özellikler dikkate alındığında 15-25 mm tane aralığındaki agregaların 5-15 mm tane aralığına kıyasla daha üstün olduğu sonucuna ulaşılmıştır. 5-15 mm tane aralığındaki kireçtaşı agregaları ile elde edilen geçirimli betonların en yüksek eğilme dayanımı 1.52 MPa olurken, bu değer 15-25 mm agreg gradasyonu kullanılan geçirimli betonlarda 2.37 MPa olmuştur.

Tablo Hata! Belgede belirtilen stilde metne rastlanmadı.. Basınç, yarmada çekme ve eğilme dayanımı sonuçları

Karışım	Basınç dayanımı (MPa)	Yarmada çekme dayanımı (MPa)	Eğilme dayanımı (MPa)	Çimento/Agrega oranı
Kireçtaşı 15-25	17.34	1.37	2.37	0.20
Kireçtaşı 5-15	13.77	0.83	1.72	
Kireçtaşı 15-25	19.40	1.52	2.32	0.25
Kireçtaşı 5-15	14.66	0.96	1.85	
Kireçtaşı 15-25	14.48	1.13	1.84	0.30
Kireçtaşı 5-15	11.52	0.76	1.52	

Su geçirirnililiđi katsayısı sonuçları Tablo 4’de listelenmiştir. Mekanik özelliklerde olduđu gibi 0.25 ç/a oranına sahip olan geçirimli betonlar daha yüksek geçirirnililik katsayısına sahip olmuştur. 15-25 mm agrega gradasyonlu ve 0.25 ç/a oranı ile elde edilen geçirimli betonlar 1.52 cm/s ile en yüksek su geçirirnililiđi katsayısı deđerine sahip olmuştur. En düşük su geçirirnililiđi katsayısı deđeri ise 0.30 ç/a oranı ve 5-15 mm agrega gradasyonu kullanılarak üretilen geçirimli betonlarda 0.59 cm/s ile elde edilmiştir.

Tablo 4. Geçirimli betonların su geçirirnililiđi katsayıları

Agrega tipi	Agrega gradasyonu	Su geçirirnililiđi katsayısı (cm/sn)	Çimento/Agrega oranı
Kireçtaşı agregası	15/25 mm	1.34	0.20
	5/15 mm	1.04	
	15/25 mm	1.52	0.25
	5/15 mm	1.40	
	15/25 mm	0.99	0.30
	5/15 mm	0.59	

Sonuçlar

Bu deneysel çalışmadan aşağıda listelenen sonuçlar elde edilmiştir:

- 15-25 mm tane aralığı 5-15 mm tane aralığına kıyasla hem mekanik hem de hidrolik özellikler bakımından daha iyi sonuç vermiştir.
- Bu çalışma kapsamında dikkate alınan ç/a oranları arasından 0.25 ç/a oranı ile en yüksek basınç, yarmada çekme ve eğilme dayanımları elde edilmiştir.
- 0.30 ç/a oranı ile üretilen geçirimli betonlar en düşük basınç dayanımına sahip olmuştur.

Teşekkür

Bu çalışma Ege Üniversitesi Bilimsel Araştırma Projeleri Koordinatörlüğü tarafından 22751 No’lu proje ile desteklenmiştir.

KAYNAKLAR

- [1] American Concrete Institute (ACI) Pervious Concrete, ACI 522 Committee Report, Farmington Hills, MI: ACI, 2006.
- [2] Crouch, L. K., Sparkman, A., Dunn, T. R., Hewitt, R., Mittlesteadt, W., Byard, B., & Pitt, J. (2006). Estimating pervious PCC pavement design inputs with compressive strength and effective void content. Maryland: Silver, 15.
- [3] Dai, Z., Li, H., Zhao, W., Wang, X., Wang, H., Zhou, H., & Yang, B. (2020). Multi-modified effects of varying admixtures on the mechanical properties of pervious concrete based on optimum design of gradation and cement-aggregate ratio. *Construction and Building Materials*, 233, 117178.
- [4] Delatte, N., Miller, D., and Mrkajic, M. "Portland Cement Pervious Concrete: Field Performance Investigation on Parking Lot and Roadway Pavements." Final Report of the RMC Research and Education Foundation, Silver Springs, MD, 2007.
- [5] Dullien, F.A.L. (1992) "Porous Media-Fluid Transport and Pore Structure" Department of Chemical Engineering, Univeristy of Waterloo, Ontario, Canada.
- [6] Suleiman, M. T., Kevern, J., Schaefer, V. R., & Wang, K. (2006, May). Effect of compaction energy on pervious concrete properties. In Submitted to Concrete Technology Forum-Focus on Pervious Concrete, National Ready Mix Concrete Association, Nashville, TN, May (pp. 23-25).
- [7] Yang, J., & Jiang, G. (2003). Experimental study on properties of pervious concrete pavement materials. *Cement and Concrete Research*, 33(3), 381-386
- [8] Mahboub, K. C., Canler, J., Rathbone, R., Robl, T., & Davis, B. (2008). Pervious concrete: Compaction and aggregate gradation. *ACI Materials Journal*, 106(6), 523.
- [9] TS EN 12390-3, Testing hardened concrete - Part 3: Compressive strength of test specimens, 2019.
- [10] TS EN 12390-6, Testing hardened concrete - Part 6: Tensile splitting strength of test specimens, 2010.
- [11] TS EN 12390-5, Testing hardened concrete - Part 5: Flexural strength of test specimens, 2019.

**NAR ÜRETİMİNDE GİRDİ KULLANIMI VE BRÜT KAR ANALİZİ (SİİRT İLİ
ÖRNEĞİ)**

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ÖZET

Bu çalışmada, Siirt ili Zivzik narı üretiminde girdi kullanımı brüt kar analizinin belirlenmesi amaçlanmıştır. Çalışmanın ana materyalini Siirt il ve ilçelerinde nar üretimi yapan 186 üreticiden anket yöntemiyle elde edilen veriler oluşturmuştur. Araştırma alanında toplam nar bahçesi alanı 98,80 ha ve ortalama nar üretim alanı 0,53 ha olarak hesaplanmıştır. Toplam ağaç sayısı 62.889 adet ve ortalama ağaç sayısı 635 adet/ha olarak bulunmuştur. Toplam üretim miktarı 3.445,50 ton olarak belirlenmiş, ortalama nar verimi 34.856,37 kg/ha, ağaç başına verim ortalama 55,25 kg olarak bulunmuştur. Gayri safi üretim değeri 278.850,96 TL/ha, değişken masraflar 73.245,88 TL/ha ve brüt kâr 205.605,08 TL/ha olarak bulunmuştur. Enerji kullanım etkinliği 1'den yüksek olduğu için girdilerin etkin kullanıldığını söylemek mümkündür ancak daha etkin girdi kullanımıyla bu oranın artması sağlanabilir.

Anahtar Kelimeler: Brüt kâr, girdi kullanımı, nar üretimi, Siirt

**INPUT USAGE AND GROSS PROFIT ANALYSIS IN POMEGRANATE
PRODUCTION (SIİRT PROVINCE EXAMPLE)**

ABSTRACT

In this study, it was aimed to determine the energy use and greenhouse gas emission in Zivzik pomegranate production in Siirt province. The main material of the study was the data obtained from 186 pomegranate producers in Siirt province and its districts by survey method. The total pomegranate orchard area in the research area was calculated as 98.80 ha and the average pomegranate production area was calculated as 0.53 ha. The total number of trees was 62,889 and the average number of trees per hectare was 635. The total production amount was determined as 3,445.50 tons, the average pomegranate yield was 34,856.37 kg ha⁻¹ and average yield per tree was 55.25 kg. Gross production value, variable costs and gross profit were found as 278,850.96 TL ha⁻¹, 73,245.88 TL ha⁻¹ and 205,605.08 TL ha⁻¹, respectively. Since the energy use efficiency is higher than 1, it is possible to say that the inputs are used efficiently, but this ratio can be increased by using more efficient inputs.

Keywords: Gross profit, input use, pomegranate production, Siirt

Not: Bu çalışma Siirt Üniversitesi BAP tarafından 2022-SİÜZİR-029 nolu proje ile desteklenmiştir.

GİRİŞ

Tarım sektörü, besin maddeleri ihtiyacının karşılanması, tarıma dayalı sanayinin hammadde kaynağını oluşturması, insanlara istihdam imkânı sağlaması, dışa bağımlılığın azaltılması ve ödemeler dengesine olumlu etkilerinin olması nedeniyle, ülke ekonomileri için önemli bir sektördür (Er, 2016). Bu bağlamda, Türkiye’de de tarım, gayri safi yurt içi hasılaya katkıda bulunması ve istihdam yaratması açısından önemini korumaya devam etmektedir. Türkiye’nin ekonomisine bakıldığında tarımın payı, sanayi ve hizmetler sektöründeki büyümeden dolayı giderek düşmesine rağmen toplam üretim ve istihdamdaki payı birçok ülkeye göre daha fazladır (Anonim, 2013).

Dünyada giderek büyüyen açlık sorunu, Türkiye’de ise hızla artan nüfusun yeterli beslenememesi ve tarımın ekonomiye olan katkısını artırma gereği, üretim artışı konusunda tarım uzmanlarının daha çok çaba harcamaları sonucunu ortaya çıkarmaktadır. Üretim artışı için yeni tarım alanları elde etme olanağı bulunmadığından, verimi yükseltmek, üretimi artırmanın tek yolu olarak görülmektedir. Tarımda girdi kullanımı, üretim miktarının artmasında ve kalitenin yükseltilebilmesinde en önemli unsurdur. Toprak, işgücü ve sermayeyi etkin hale getiren unsur tarımsal girdilerdir. Bitkisel üretim faaliyetinde kullanılan girdiler; tohum, gübre, tarım ilacı, tarım alet ve makineleri, sulama ve tarımsal kredilerdir. Gereğinden fazla ve hatalı biçimde kullanılan girdilerin, ürün kalitesi yanında toprak ve su kirlenmesine yol açabilen olumsuz etkileri de bulunmaktadır (Çelik, 2000).

Tarımsal üretimin temel amacı, tarım işletmelerinin kendi koşullarına göre toprak, iklim, su, bitki ve insan gücü kaynaklarının en verimli ve en uyumlu bir şekilde kullanılmasını sağlamak suretiyle işletmenin üretim miktarını, verimliliğini arttırmak ve çiftçinin harcanabilir gelir düzeyini yükselterek tarım işletmelerini güçlendirmek ve ulusal gelire katkılarına arttırmaktır. Her üretim faaliyetinde, üretim faktörlerinin en uygun fiyat ile temin edilmesi ve optimum düzeyde kullanımı, hem verimi artırıcı, hem de maliyetleri düşürücü yönde etki yapmaktadır. Üreticiler, gerek işletme sermayelerindeki yetersizlikler ve gerekse teknik bilgi eksikliği nedeniyle tarımsal üretim faktörlerini optimum düzeyde kullanamamakta ve bu durum ürün verimini ve dolayısıyla çiftçi gelirini olumsuz etkilemektedir (Gündoğmuş, 1997).

Verimlilik kavramı 1830’lu yıllarda ortaya çıkmış bir kavram olup, bu kavramın kalitatif nitelikten ayrılıp kantitatif bir hale gelmesi 19. yüzyılın sonları ve 20. yüzyılın başlarında mümkün olmuştur (Pirinçioğlu,1988). Genel olarak verimlilik kıt kaynakların etkin kullanımıyla yakından ilgili bir kavramdır (İnan, 2016). Üretimde “verimlilik”, üretilen çıktı

miktarının kullanılan girdi miktarına oranıdır. Tarımsal üretimde verimlilik, birim alandan elde edilen ürün miktarı ya da birim alandan elde edilen tarımsal üretim değeri olarak anlaşılmaktadır (Şahin ve ark., 2010).

Tarım sektörünün diğer sektörlerle sermaye ve işgücü transfer etmesi, hammadde ve ürün ihtiyacını karşılaması açısından ekonomik kalkınmaya önemli katkıları vardır. Günümüzde küresel ısınmanın giderek artması ve su kaynaklarının giderek azalması tarım sektörünün önemini daha da arttırmaktadır. Uluslararası rekabet ve gıda alanında kendi kendine yeten ülkeler arasında olabilmek için tarım sektörünün etkinliğinin ve verimliliğinin artırılması gerektiği ortaya çıkmaktadır (Avcı ve Kaya, 2008). Artan nüfusun gıda talebinin karşılanabilmesi, çiftçilerin yaşam standartlarının artırılabilmesi, tarımın daha etkin hale getirilebilmesi ve tarımsal kalkınmanın sağlanabilmesi bakımından yeni teknolojilerin adaptasyonu ile birlikte üretim faktörlerinin verimli ve etkin kullanılması büyük önem taşımaktadır. Nar güzelliğın, bolluk ve bereketin simgesi olan, milattan önce yetiştirilmeye başlayan ve günümüze kadar önemini koruyan kırmızı taneli meyve olarak bilinir. Punicaceae ailesinde yer alan ve latince ismi *Punica Granatum L* olan narın anavatanı Asya olup, kullanım çeşitliliği olarak oldukça geniş bir yelpazeye sahiptir (Şenocak, 2016). Tropik ve subtropik iklim meyvesi olarak bilinmekle birlikte sıcak ve ılıman iklim bölgelerinde de sınırlı bir şekilde yetişebilen narın dünyada ve Türkiye'deki üretim ve tüketim miktarı her geçen gün artmaktadır (Şahin, 2013).

Yıllar boyu nar meyvesi gerek sanayi gerek ilaç gerekse gıda alanlarında kullanılarak insan yaşamındaki öncülüğünü korumuştur. B1, B2, C vitamini, fosfor, potasyum, demir, karbonhidrat ve protein açısından oldukça zengindir (Şenocak, 2016). Meyvenin kabuğundan ve çekirdeğinden farklı çeşitlerde faydalanılmakta, kan şekeri seviyesini düzenleyici, tansiyon dengeleyici, ishal, dizanteri, mide iltihabı gibi birçok hastalığı önleyici ve tedavi edici özelliği bulunmaktadır (Gündoğdu ve Yılmaz, 2013). Nar meyvesi ülkemizde genelde taze olarak tüketilmesinin yanında nar suyu, şurup, nar ekşisi, reçel, nar tane kurusu, konserve, şarap, likör vb. şekillerde tüketilmektedir. Salatalara ve yemeklere renk ve tatlandırıcı olarak genellikle nar ekşisi kullanılmaktadır. Yemek sektörü dışında ilaç, kozmetik, kimya sanayinde mürekkep, boya, sirke, sitrik asit, kolonya üretiminde faydalanılmaktadır. Narın dallarından örme sepet, çekirdeklerinden ise baharat üretilmektedir (Güler, 2016)

Nar, insan sağlığına faydalarının yanında ülke ekonomileri açısından da oldukça önemli bir üründür. Tüketiciler açısından geniş ürün yelpazesıyla zevk ve alışkanlıklara uygun olarak mayhoş, tatlı ya da çekirdeksiz gibi türevlere sahip olan nar, üreticiler açısından uygun koşullar

sağlandığında uzun süre depolanabildiği için gerek iç pazarda, gerekse ihracattaki önemiyle de dikkat çekmektedir (Anonim, 2011). Birleşmiş Milletler Gıda ve Tarım Teşkilatı (FAO) 2022 yılı verilerine göre, dünyada toplam 126.441 ton nar üretimi yapılmaktadır. Nar tarımı, Hindistan, İran, Çin ve Türkiye başta olmak üzere dünyanın birçok bölgesinde yapılmaktadır (FAO, 2022). Türkiye’de 2022 yılında 29.069,70 ha toplam nar üretim alanı, 16.170.063 adet toplam ağaç sayısı bulunmakta olup, 681.460 ton nar elde edilmiş ve ağaç başına verim ortalama 48 kg’dır. Bölgelere göre nar üretim miktarı incelendiğinde 402.635 ton ile Akdeniz Bölgesi birinci, 162.601 ton ile Ege Bölgesi ikinci ve 97.865 ton ile Güneydoğu Anadolu Bölgesi üçüncü sırada yer almaktadır. Çizelge 1’e baktığımızda nar üretiminde ilk beş sırada yer alan iller sırasıyla Antalya (173.058 ton), Mersin (102.690 ton), Adana (88.231 ton), Muğla (71.374 ton), ve Denizli (52.450 ton)’dir (TÜİK, 2022a).

Çizelge 1. Bölgeler itibariyle nar üretimi

Bölgeler	Meyve veren yaşta ağaç sayısı	Meyve vermeyen yaşta ağaç sayısı	Toplu meyvelik alanı (ha)	Üretim miktarı (ton)	Verim (kg/ağaç)
Akdeniz-TR6	6.993.842	595.063	14.352,10	402.65	58
Batı Anadolu-TR5	74.226	49.750	208,30	2.332	31
Batı Karadeniz-TR8	31.977	7.285	6,20	798	25
Batı Marmara-TR2	107.937	36.138	184,10	2.987	28
Doğu Karadeniz-TR9	17.544	10.178	-	293	17
Doğu Marmara-TR4	282.001	25.821	444,50	10.775	38
Ege-TR3	3.865.027	466.315	6.492,8	162.61	42
Güneydoğu Anadolu-TRC	2.694.391	808.539	7.326,2	97.865	36
Kuzeydoğu Anadolu-TRA	355	30	-	12	34
Ortadoğu Anadolu-TRB	63.892	37.427	53,00	1.141	18
İstanbul-TR1	1.985	340	2,50	21	11
TÜRKİYE	14.133.177	2.036.886	29.069,70	681.460	48

Güneydoğu Anadolu Bölgesi’nin bütün illerinde nar yetiştiriciliği yapılmaktadır. Zivzik narı, Hicaz narı, Katırbaşı, Dicle narı, Bori, Şekerek, Mayhoş, Barut, Urfa narı, Karaköprü narı, Seyfi narı, Katina narı, Derik narı ve Oğuzeli narı önemli yerel veya standart çeşitlerdir. Zivzik narı meşhur olanların başında yer almaktadır. Zivzik narı ismini yetiştigi bölge olan Siirt ili Şirvan ilçesine bağlı Zivzik (Dişlinar) köyünden alan bol sulu, eşsiz aromalı, iç pazarda tüketiciler tarafından çok tercih edilen, depolama ömrü uzun, şifa kaynağı bir meyvedir. Bir

Zivzik narı ortalama 200 ile 800 gram arasında olup, meyve taneleri nohut büyüklüğünde, çekirdeği küçük ve yumuşaktır. Asit oranı düşük ve tadı mayhoş olup uzun süre bozulmamakta ve tüketiciler tarafından pazarda tercih edilmektedir (Şimşek ve Yücel, 2015)

Siirt'in iklim özellikleri incelendiğinde nar yetiştiriciliğine çoğunlukla uygun bir il olduğu görülmektedir. Siirt'te 2022 yılında toplam 6.143 ton nar üretimi gerçekleşmiş olup, üretim miktarı bakımından Siirt, Türkiye'de 14., Güneydoğu Anadolu Bölgesi'nde ise 3. sırada yer almaktadır. En fazla nar üretimi Pervari ilçesinde (3.612 ton) gerçekleşmiş olup, bunu sırasıyla Eruh (899 ton), Tillo (772 ton), Şirvan (444 ton), Baykan (218 ton) ve Merkez (169 ton) ilçeleri takip etmektedir. İlde ağaç başına ortalama nar verimi 32 kg'dır. Toplu meyvelik alanı 1.005,40 ha, toplam nar ağaç sayısı 229.108 adet olup bunun 192.793 adedi meyve veren yaşta, 36.315 adedi ise meyve vermeyen yaştaki ağaçlardan oluşmaktadır (TÜİK, 2022a)

Bu çalışmada, Siirt ili Zivzik narı üretiminde uygulanan işlemler ve kullanılan girdiler incelenmiştir. Kullanılan girdilerin ve elde edilen çıktılarının kullanımı ve brüt kar analizi yapılmıştır. Çalışma sonucunda belirlenen bulgu ve etkinlik göstergelerine bağlı olarak, mevcut üretimin iyileştirilmesine yönelik çözüm önerileri verilmiştir.

MATERYAL VE METOT

Materyal

Araştırmanın ana materyalini Siirt il ve ilçelerinde nar üretimi yapan üreticilerden anket yöntemiyle elde edilen veriler oluşturmuştur. Bunların dışında, İl Tarım ve Orman Müdürlüğü kayıtları, Çevre, Şehircilik ve İklim Değişikliği İl Müdürlüğü kayıtları, Türkiye İstatistik Kurumu (TÜİK), Birleşmiş Milletler Tarım ve Gıda Örgütü (FAO) istatistiki verilerden yararlanılmıştır. Ayrıca konuyla ilgili olarak Türkiye'de ve diğer ülkelerde daha önce yapılan araştırmalardan elde edilen bilgilerden de yararlanılmıştır.

Siirt ilinin coğrafi yapısı

Güneydoğu Anadolu Bölgesi'nde yer alan Siirt ili kuzeyden Batman ve Bitlis, batıdan Batman, güneyden Mardin ve Şırnak, doğudan Şırnak ve Van illeri ile çevrilidir. Siirt ili 41° 57' doğu boylamı ve 37° 55' kuzey enlemi üzerinde bulunur. Siirt ili topraklarının büyük bir bölümü dağlarla kaplıdır; kuzeyde Muş Güneyi Dağları, doğuda Siirt Doğusu Dağları ilin doğal sınırlarını oluşturan sıradağlardır. Ova benzeri düzlüklerin Kurtalan ilçesinde yer aldığı Siirt'te doğuya doğru gidildikçe yükselen dağlardan, Pervari ilçesinin Yazlıca (Herekol) Dağı 2943 m,

Körkandil Dağı 2821 m, Şirvan Bekravi Dağı 2650 m, Hastelli Dağı 2700 m, Çıraf Dağı 2268 m'lik belli başlı yükseltilerindedir (Özyazıcı ve ark., 2014).

Siirt, dört mevsimin en belirgin özellikleriyle yaşandığı bir ildir. Genel olarak karasal iklim hüküm sürmektedir. Yazları sıcak ve kuraktır. Haziran ve Ekim ayları arasında pek yağış görülmez. İlin doğu ve kuzey bölgelerinde kışlar daha sert ve yağışlı, güney ve güneybatı bölgelerinde ise ılık geçer. Gece ile gündüz arasındaki sıcaklık farkı fazladır. Rüzgârlar geceleri doğu ve kuzeydoğudan, gündüzleri güney ve güneybatıdan, kışın ise genellikle kuzey ve kuzeybatıdan eser (Anonim, 2005).

Siirt ilinin arazi kullanım durumu Çizelge 2'de verilmiştir. Siirt ilinde tarımsal alanın toplam alan içindeki payı %18,29, ormanlık alanın payı %55,02, çayır-mera alanlarının payı %5,19, tarım dışı alanların payı %21,50 olarak bulunmuştur (Anonim, 2017).

Çizelge 2. Siirt ilinde arazi kullanım durumu

Arazi kullanımı	Alan (ha)	%
Tarımsal alan	102.894	18,29
Ormanlık alan	309.603	55,02
Çayır-Mera	29.233	5,19
Tarım dışı alan	120.975	21,50
Toplam	562.705	100,00

Siirt ilinin tarımsal yapısı

Siirt ilinde tarım arazilerinin kullanım durumu Çizelge 3'te verilmiştir. İlde toplam 102.894 hektar alanda tarımsal üretim yapılmaktadır. Bu alanın 39.650 hektarını hububat ekim alanı, 15.965 hektarını nadas ve kıraç araziler, 31.745 hektarını bağ-bahçe, 6.865 hektarını yem bitkileri, 6.200 hektarını yemelik tane baklagiller, 2.469 hektarını endüstri bitkileri alanı oluşturmaktadır (Anonim, 2017).

Çizelge 3. Siirt ilinde tarım arazilerinin kullanım durumu

Tarımsal araziler (ha)	Merkez	Tillo	Baykan	Eruh	Kurtalan	Pervari	Şirvan	Toplam
Hububat Alanı	4.175	160	2.200	3.100	27.500	1.400	1.115	39.650
Nadas ve Ekim Yapılmayan Araziler	2.100	1.000	2.315	150	8.000	800	1.600	15.965
Kıraç Araziler	400	10	200	500	1.000	100	90	2.300
Sebze Alanı (Örtü Altı Dâhil)	400	10	200	500	1.000	100	90	2.300
Meyve Alanı	9.500	2.800	1.900	3.150	5.000	1.100	3.000	26.450
Bağ Alanı	200	125	550	650	1.100	70	300	2.995
Baklagil Ekim Alanı	300	---	250	130	5.500	10	10	6.200
Endüstri Bitkileri	275	---	---	10	2.150	34	---	2.469
Yem Bitkileri Ekim Alanı	400	15	75	700	150	5.250	275	6.865
Toplam Tarım Alanı	17.350	4.110	7.490	8.390	50.400	8.764	6.390	102.894

Metot

Örnekleme aşamasında kullanılan metot

Anket çalışması Siirt'te nar üretiminin yoğun olduğu ilçe ve köylerindeki tarımsal işletmelerde yürütülmüştür. Tarım ve Orman İl Müdürlüğü'nden Çiftçi Kayıt Sistemine kayıtlı nar üretimi yapan toplam üretici sayılarına ilişkin bilgiler elde edilmiştir. Çiftçi Kayıt Sistemine kayıtlı nar üretimi yapan toplam üretici sayısının 186 olduğu saptanmıştır. Ana kitle sayısının az olması nedeniyle tam sayım yöntemi kullanılmış olup 186 üretici ile anket çalışması gerçekleştirilmiştir.

Verilerin toplanması aşamasında kullanılan metot

Araştırma verileri belirlenen ilçelerdeki üreticilerle yüz yüze görüşmek suretiyle anket yapılarak toplanmıştır. Anket, nar üretiminde uygulanan işlemler, tarımsal mekanizasyon uygulamalarının işlem sayıları ve süreleri, kullanılan ekipmanlar, her bir üretim faaliyetinde kullanılan işgücü miktarı, diğer tarımsal girdilerin miktar ve bedelleri, ürün verimi, satış fiyatı, ekim alanı gibi verileri kapsamaktadır.

Ekonomik analiz

Ekonomik analiz kapsamında nar üretiminden elde edilen verim, brüt üretim değeri, yapılan değişken masraflar ve brüt kâr belirlenmiştir. Değişken masraflar; işgücü, çeki gücü, gübre, zirai mücadele masrafları, elektrik ve su ücretleri, pazarlama ve taşıma masraflarının yanında değişken masraflar faizinden oluşmaktadır. Döner sermaye faizinin hesaplanmasında

T.C. Ziraat Bankasının bitkisel üretim kredilerine uyguladığı faiz oranı dikkate alınmıştır. Gayrisafi üretim değerini hesaplanmasında, çiftçi eline geçen ürünün satış fiyatı dikkate alınmıştır. Brüt kar, gayrisafi üretim değerinden değişken masraflar çıkarılarak hesaplanmıştır (Kıral ve ark., 1999).

BULGULAR VE TARTIŞMA

Siirt ilinde, 186 adet nar üreticisi ile yapılan anketlerden elde edilen veriler, yöntem bölümünde verilen sıralama esas alınarak ilgili eşitliklerin kullanılmasıyla değerlendirilmiştir. Elde edilen bulgular ilerleyen bölümlerde verilmiştir.

Nar Üretiminde Girdi Kullanımı

Nar üretimi ile ilgili istatistiki bilgiler Çizelge 4'te verilmiştir. Araştırma alanında 186 üreticinin toplam nar bahçesi alanı 98,80 ha ve ortalama nar üretim alanı 0,53 ha olarak hesaplanmıştır. Toplam ağaç sayısı 62.889 adet ve ortalama ağaç sayısı 635 adet/ha olarak bulunmuştur. Toplam üretim miktarı 3.445,50 ton olarak belirlenmiş, ortalama nar verimi 34.856,37 kg/ha, ağaç başına verim ortalama 55,25 kg olarak bulunmuştur. Nar ile ilgili yapılan önceki çalışmalarda, Akcaöz ve ark. (2009) ortalama nar verimini 23.350 kg/ha, ortalama ağaç sayısını 616,5 adet/ha olarak bulmuşlardır. Çanakçı (2010) nar verimini 35.118,67 kg/ha, Houshyar ve ark. (2017) 17.308,10 kg/ha olarak belirlemişlerdir. Özalp ve Yılmaz (2013) ortalama nar verimini 19.698,80 kg/ha, ağaç başına ortalama nar verimini 45,53 kg olarak belirlemişlerdir. Araştırma sonucunda elde edilen verim değerleri Akcaöz ve ark. (2009), Özalp ve Yılmaz (2013) ve Houshyar ve ark. (2017) tarafından elde edilen değerlerden yüksek olarak bulunurken, Çanakçı (2010) tarafından elde edilen sonuçla benzerlik göstermiştir. Türkiye'de 2022 yılında ağaç başına ortalama nar verimi 48 kg olarak belirlenmiştir (TÜİK, 2022a). Araştırma sonucu elde edilen ağaç başına ortalama nar verimi Türkiye ortalamasından daha yüksek bulunmuştur.

Çizelge 4.Nar üretimi ile ilgili istatistikler

Nar üretim verileri	Ortalama
İşletme sayısı (adet)	186,00
Toplam nar üretim alanı (ha)	98,80
Ortalama nar üretim alanı (ha)	0,53
Toplam ağaç sayısı	62.889
Ortalama ağaç sayısı (adet/ha)	635,00
Toplam üretim miktarı (ton)	3.445,50
Verim (kg/ha)	34.856,37
Ağaç başına ortalama verim (kg)	55,25

Nar üretiminde uygulanan tarımsal işlemlere ait bilgiler Çizelge 5’te verilmiştir. Nar üretim işlemleri, toprak işleme, sulama, gübreleme, ilaçlama, budama ve hasat işlemlerinden oluşmaktadır. Toprak işleme uygulamaları Kasım ve Haziran ayları arasında ortalama 3 defa yapılmış ve traktör, kazayağı, kültivatör, tırmık ve çapalama makinesi kullanılmıştır. Sulama işlemleri Nisan ve Eylül ayları arasında ortalama 40 kez yapılmış ve pompa ve insan iş gücünden yararlanılmıştır. Gübreleme uygulamaları Eylül ve Temmuz ayları arasında ortalama 4 kez yapılmış ve insan işgücü ve gübreleme makinesi kullanılmıştır. İlaçlama işlemleri Eylül ve Temmuz ayları arasında ortalama 3 kez yapılmış ve işlemlerde pülverizatör ve insan işgücü kullanılmıştır. Budama işlemleri Aralık ve Şubat ayları arasında ortalama 2 kez yapılmış ve insan iş gücü kullanılmıştır. Hasat işlemleri Ekim ve Kasım ayları arasında insan işgücü kullanılarak yapılmış ve taşımada traktör kullanılmıştır.

Çizelge 5 Nar üretiminde tarımsal işlemler ve kullanılan ekipmanlar

Tarımsal işlem	Kullanılan ekipman	İşlem sayısı	İşlem dönemi
Toprak İşleme	Kazayağı, kültivatör, tırmık, çapalama makinesi	3	Kasım-Haziran
Sulama	İnsan işgücü, pompa	40	Nisan-Eylül
Gübreleme	İnsan işgücü, Gübreleme makinesi	4	Eylül-Temmuz
İlaçlama	İnsan işgücü, Pülverizatör	3	Eylül-Temmuz
Budama	İnsan işgücü	2	Aralık-Şubat
Hasat	İnsan işgücü, traktör	1	Ekim-Kasım

Nar üretiminde tarımsal işlemlere göre kullanılan girdiler ve miktarları Çizelge 6'da verilmiştir. Toprak işleme, içerisinde insan işgücü girdi değeri ortalama 14,91 h/ha, çeki gücü girdi değeri ortalama 14,91 h/ha hesaplanmıştır. Toprak işleme, 1. sürüm, 2. sürüm ve çapalama tarımsal uygulamalarından oluşmakta olup, bu faaliyetler esnasında harcanan yakıt miktarı 74,60 l/ha olarak belirlenmiştir. Gübreleme girdileri içerisinde insan işgücü, çeki gücü, azot, fosfor, potasyum, kükürt, çiftlik gübresi ve yakıt yer almaktadır. Gübreleme işleminde insan işgücü girdi değeri ortalama 27,07 h/ha, çeki gücü değeri 11,37 h/ha, azot miktarı 284,19 kg/ha, fosfor miktarı 320,92 kg/ha, potasyum miktarı 113,56 kg/ha, kükürt miktarı 113,56 kg/ha, çiftlik gübresi 14.089,54 kg/ha ve harcanan yakıt miktarı 52,13 kg/ha olarak bulunmuştur. İlaçlama işlemlerinde insan işgücü kullanımı 19,38 h/ha, çeki gücü kullanımı 10,30 h/ha, İnsektisit kullanımı 30,34 kg/ha, fungusit kullanımı 24,63 kg/ha ve yakıt kullanımı 50,52 l/ha olarak belirlenmiştir. Sulama işlemleri içerisinde insan işgücü, su ve elektrik girdileri yer almakta olup, insan işgücü girdi değeri 553,33 h/ha, sulama suyu miktarı m³/ha ve harcanan elektrik 576,80 kWh/ha olarak bulunmuştur. Budama işlemleri çoğunlukla insan işgücü ile yapılmakta olup insan işgücü girdi değeri 67,89 h/ha olarak hesaplanmıştır. Hasat-taşıma işlemleri insan işgücü kullanımı 409,95 h/ha, çeki gücü kullanımı 6,72 h/ha ve yakıt tüketimi 35,11 l/ha olarak bulunmuştur.

Çizelge 6. Nar üretiminde tarımsal işlemlere göre kullanılan girdi miktarları

Girdi	Birim	Ortalama (birim/ha)
Toprak İşleme		
İnsan işgücü	h/ha	14,91
Çeki gücü	h/ha	14,91
Yakıt	l/ha	74,60
Gübreleme		
İnsan işgücü	h/ha	27,07
Çeki gücü	h/ha	11,37
Azot (N)	kg/ha	284,19
Fosfor (P ₂ O ₅)	kg/ha	320,92
Potasyum (K ₂ O)	kg/ha	113,56
Kükürt (S)	kg/ha	244,82
Çiftlik gübresi	kg/ha	14.089,54
Yakıt	l/ha	52,13
İlaçlama		
İnsan işgücü	h/ha	19,38
Çeki gücü	h/ha	10,30
İnsektisit	kg/ha	30,34
Fungusit	kg/ha	24,63
Yakıt	l/ha	50,52
Sulama		
İnsan işgücü	h/ha	553,33
Sulama suyu	m ³ /ha	630,94
Elektrik	kWh/ha	576,80
Budama		
İnsan işgücü	h/ha	67,89
Hasat		
İnsan işgücü	h/ha	409,95
Çeki gücü	h/ha	6,72
Yakıt	l/ha	35,11

Brüt Kâr Analizi

İncelenen işletmelerde nar üretim faaliyetine ilişkin değişken masraflar Çizelge 7’de verilmiştir. Değişken masraflar 73.245,88 TL/ha olarak bulunmuş olup, masraflar içinde %36,71 ile gübre masrafları ilk sırada yer almaktadır. Bunu %29,83 ile işgücü masrafları,

%13,58 ile ilaç masrafları, %7,41 ile döner sermaye faizi, %5,22 ile çeki gücü masrafları, %4,13 ile su masrafları, %1,71 ile pazarlama masrafları ve %1,42 ile elektrik masrafları izlemektedir. Gayri safi üretim değeri 278.850,96 TL/ha ve brüt kâr 205.605,08 TL/ha olarak bulunmuştur. Çanakçı (2010) araştırmasında nar üretiminde değişken masraflar içinde en yüksek payı alan girdilerin işgücü ve gübre masrafları olduğunu belirlemiştir. Özalp ve Yılmaz (2013) Antalya ilinde nar üretimi üzerine yaptıkları çalışmada gübre ve işgücü masraflarının değişken masraflar içinde en yüksek payı alan girdiler olduğunu belirlemişlerdir. Troujeni ve ark. (2018) araştırmalarında nar üretiminde değişken masraflar içinde en yüksek payı işgücü masraflarının aldığını bulmuşlardır. Araştırma sonucunda elde edilen bulgular Çanakçı (2010), Özalp ve Yılmaz (2013) ve Troujeni ve ark. (2018) literatürleriyle benzerlik göstermektedir.

Çizelge 7. Nar üretiminde değişken masraflar ve brüt kâr

Masraf kalemleri	TL/ha	%
İşgücü Masrafları	21.850,60	29,83
Çeki Gücü Masrafları	3.822,48	5,22
Gübre	26.884,98	36,71
İlaç	9.945,45	13,58
Su	3.028,51	4,13
Elektrik	1.038,24	1,42
Pazarlama	1.250,00	1,71
Döner Sermaye Faizi	5.425,62	7,41
Değişken Masraflar	73.245,88	100,00
Verim (kg/ha)	34.856,37	
Satış Fiyatı (TL/kg)	8,00	
Gayri Safi Üretim Değeri (TL/ha)	278.850,96	
Brüt Kâr (TL/ha)	205.605,08	

SONUÇ VE ÖNERİLER

Yapılan çalışma kapsamında Siirt ilinde nar üretimi yapan 186 üretici ile yapılan anketler ile elde edilen veriler değerlendirilerek nar üretiminde girdi kullanımı belirlenmiş, enerji analizi yapılmış ve brüt kar analizi hesaplanmıştır. Araştırmada elde edilen sonuçlar özetlenmiş ve maddeler halinde aşağıda verilmiştir.

- ✓ Araştırma alanında toplam nar bahçesi alanı 98,80 ha ve ortalama nar üretim alanı 0,53 ha olarak hesaplanmıştır.
- ✓ Toplam ağaç sayısı 62.889 adet ve ortalama ağaç sayısı 635 adet/ha olarak bulunmuştur.
- ✓ Toplam üretim miktarı 3.445,50 ton olarak belirlenmiş, ortalama nar verimi 34.856,37 kg/ha, ağaç başına verim ortalama 55,25 kg olarak bulunmuştur.
- ✓ Nar üretim işlemleri, toprak işleme, sulama, gübreleme, ilaçlama, budama ve hasat işlemlerinden oluşmaktadır.
- ✓ Araştırma alanında incelenen işletmelerde bir hektar nar bahçesinde 1.092,53 saat işgücü kullanılmıştır. Nar üretiminde harcanan işgücünün %50,65'i sulamada, %37,52'si hasatta, %6,21'i budamada, %2,48'i gübrelemede, %1,77'si ilaçlamada, %1,36'sı toprak işlemede kullanılmıştır.
- ✓ Bir hektar nar bahçesinde ortalama traktör kullanımı 43,30 saat olarak bulunmuştur. Nar üretiminde harcanan çeki gücünün %34,43'ü toprak işlemede, %26,26'sı gübrelemede, %23,79'u ilaçlamada, %15,52'si hasatta kullanılmıştır.
- ✓ Bir hektar nar bahçesinde ortalama 212,36 l mazot kullanıldığı tespit edilmiştir.
- ✓ Bir hektar nar bahçesinde ortalama 14.089,54 kg çiftlik gübresi kullanıldığı tespit edilmiştir. Söz konusu işletmelerde gübre kullanımında ilk sırayı amonyum sülfat (Şeker) gübresi almakta olup, diğer gübreler ise DAP (18-46) ve potasyum sülfat gübreleridir.
- ✓ İşletmeler ortalaması olarak bir hektar nar bahçesinde 284,19 kg azot, 320,92 kg fosfor, 113,56 kg potasyum, 244,82 kg kükürt uygulaması yapılmıştır.
- ✓ Bir hektar nar bahçesinde ortalama 30,34 kg/ha insektisit, 24,63 kg/ha fungusit kullanılmıştır.
- ✓ Araştırma bölgesinde bir hektar nar bahçesinde ortalama 630,94 m³/ha sulama suyu, 576,80 kWh elektrik kullanılmıştır.
- ✓ Gayri safi üretim değeri 278.850,96 TL/ha, değişken masraflar 73.245,88 TL/ha ve brüt kâr 205.605,08 TL/ha olarak bulunmuştur.

Öneriler

Çalışmada elde edilen bulgular doğrultusunda aşağıda yer alan önerilerde bulunmak mümkündür.

- ✓ Enerji kullanım etkinliği 1'den yüksek olduğu için girdilerin etkin kullanıldığını söylemek mümkündür ancak daha etkin girdi kullanımıyla bu oranın artması

sağlanabilir. Bölgede nar üretiminde yüksek verime sahip nar çeşitlerinin yaygınlaştırılması, enerji kullanım etkinliğinin artmasına katkı sağlayacaktır.

- ✓ Hem enerji kaynakları hem sera gazı emisyonu içinde en yüksek payı gübre girdisinin aldığı görülmüştür. Gübre uygulamaları en fazla çevre kirleticiler oldukları için, toprak analizleri iyi yapılmalı, gübre uygulamalarını (özellikle azotlu gübre) azaltıcı önlemler alınmalıdır. Ayrıca yenilenebilir enerji kaynaklarının artırılabilmesi için kimyasal gübre kullanım oranının azaltılması ve çiftlik gübresi veya organik gübre kullanımının arttırılması sağlanmalıdır.
- ✓ Kaynakların korunumu ve fosil yakıtların doğrudan veya dolaylı kullanımıyla ortaya çıkan çevresel sorunların etkin bir şekilde önlenmesi açısından yenilenebilir enerji kaynaklarının tarımda kullanımını yaygınlaştırmak önemlidir. Dünya genelinde önemli bir pazar haline gelen organik tarımsal üretim ile araştırma bölgesinde nar üretiminde fosil kaynaklı yakıtların tarımsal amaçlı olarak kullanımı azaltılabilir.
- ✓ Yenilenemeyen enerji kaynaklarının neden olduğu etkiler ve çevre ile uyumlu sürdürülebilir tarım konularında çiftçilerin bilinçlendirilmesi önemlidir.
- ✓ Kimyasal gübre, toprak analizi ve ilaç kullanımı konularında eğitim yayım faaliyetlerinin arttırılması önem arz etmektedir.
- ✓ Oluşabilecek çevresel riskleri azaltmak için üreticiler tarım sigortaları konusunda bilinçlendirilmelidir.
- ✓ Üreticiler daha yüksek verim ve kalite sağlayacak dikim şekilleri konusunda bilgilendirilmelidir.
- ✓ İşletmelerin verimliliği, ucuz girdi temini, kredi kullanımı ve pazarlama olanaklarının sağlanması için nar üretici birliklerinin yaygınlaştırılması ve üreticilerin daha organize bir şekilde pazara girebilmesi önemlidir.
- ✓ İyi tarım uygulamaları ile ilaç, gübre ve sulama suyu uygulamaları kontrollü bir şekilde yapılmaktadır. Bilinçli ilaç ve gübre kullanımı hem çevrenin zarar görmesinin hem de girdi israfının önüne geçmektedir. Bu bağlamda iyi tarım uygulamalarının nar üreticileri tarafından benimsenmesi sağlanmalıdır.

Kaynaklar

- Akcaoz, H., Ozcatalbas, O., Kizilay, H., 2009. Analysis of energy use for pomegranate production in Turkey. *Journal of Food, Agriculture and Environment*, 7 (2), 475-480.
- Anonim, 2005. Siirt Tarım Master Planı, Tarım ve Köyişleri Bakanlığı, Siirt İl Müdürlüğü, Siirt.
- Anonim, 2011. Nar Yetiştiriciliği. Milli Eğitim Bakanlığı Yayınları, Ankara, 45s.
- Anonim, 2013. Türkiye Tarım Sektörü Raporu. Türkiye Odalar ve Borsalar Birliği Yayınları, ISBN: 978-605-137-388-1, Ankara.
- Anonim, 2017. T.C. Siirt Valiliği, Gıda Tarım ve Hayvancılık İl Müdürlüğü, Faaliyet Raporu (2013-2017). <http://siirt.tarim.gov.tr/Lists/SolMenu/Attachments/23/2013-2017%20Faaliyet%20Raporu.pdf>
- Avcı, M.A., Kaya, A., 2008. Geçiş ekonomileri ve Türk tarım sektöründe etkinlik ve toplam faktör verimliliği analizi (1992-2004), *Ege Akademik Bakış*, 8 (2), 843-860.
- Çanakçı, M., 2010. Energy use pattern and economic analyses of pomegranate cultivation in Turkey, *African Journal of Agricultural Research*, 5 (7), 491-499. <https://doi.org/10.5897/AJAR10.039>.
- Çelik, N., 2000. Tarımda Girdi Kullanımı ve Verimliliğe Etkileri, Devlet Planlama Teşkilatı Uzmanlık Tezi, İktisadi Sektörler ve Koordinasyonlar Genel Müdürlüğü, Ankara.
- Er, İ., 2016. Türkiye’de Tarım Sektörünün Avrupa Birliği Ortak Tarım Politikasına Uyumu Üzerine Bir İnceleme Yüksek Lisans Tezi, Trakya Üniversitesi Sosyal Bilimler Enstitüsü, Edirne.
- FAO, 2022. <https://www.fao.org/faostat/en/#data> [Ziyaret Tarihi: 15 Şubat 2023].
- Güler, A., 2016. Farklı Bölgelerde Yetişen Hicaznar (*Punicagranatum*) Nar Çeşidi Meyvelerinin Bazı Fiziksel ve Biyokimyasal İçeriklerinin Karşılaştırılması, Yüksek Lisans Tezi, Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü, Isparta.
- Gündoğdu, M., Yılmaz, H., 2013. Bazı standart nar (*Punica granatum L.*) çeşitleri ve genotiplerine ait meyvelerin C vitamini, şeker ve besin elementleri içeriklerinin belirlenmesi, *Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi*, 23 (3), 242-248.
- Gündoğmuş, E., 1997. İç Anadolu Bölgesi Tarım İşletmelerinde Şeker Pancarı Üretiminin Simülasyon Yöntemiyle Fonksiyonel Analizi, Doktora Tezi, Ankara Üniversitesi Fen Bilimleri Enstitüsü, Ankara.
- Houshyar, E., Mahmoodi-Eshkaftaki, M., Azadi, H., 2017. Impacts of technological change on energy use efficiency and GHG mitigation of pomegranate: Application of dynamic data envelopment analysis models, *Journal of Cleaner Production*, 162, 1180-1191. <https://doi.org/10.1016/j.jclepro.2017.06.152>
- İnan, H., 2016. Tarım Ekonomisi ve İşletmeciliği, Güncellenmiş 8. Baskı, İdeal Kültür Yayıncılık, İstanbul.
- Kıral, T., Kasnakoğlu, H., Tatlıdil, F.F., Fidan, H., Gündoğmuş, E., 1999. Tarımsal Ürünler İçin Maliyet Hesaplama Metodolojisi ve Veri Tabanı Rehberi. Proje Raporu 1999-13, Yayın No:37, Ankara.

- Özalp, A., Yılmaz, İ., 2013. Antalya ili nar üretiminde girdi kullanımı, kârlılık ve verimlilik analizi, Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 26 (1), 19-26.
- Özyazıcı, M.A., Dengiz, O., İmamoğlu, A., 2014. Siirt ili bazı arazi ve toprak özelliklerinin coğrafi bilgi sistem analizleriyle değerlendirilmesi, Türkiye Tarımsal Araştırmalar Dergisi, 1 (2), 128-137. <https://doi.org/10.19159/tutad.67391>
- Pirinççioğlu, N., 1988. Tarım Sektöründe Verimlilik (1970-1985 Dönemi), MPM Yayınları, Yayın No:365, Ankara.
- Şahin, İ., Semerci, A., Kaya, Y., Çıtak, N., 2010. Ayçiçeği Tarımında Verimlilik ve Destekleme Politikalarının Etkinliğinin Belirlenmesi, Tarım ve Köyişleri Bakanlığı AR-GE Destekleri Projesi, Proje No: TAGEM 08/AR-GE/6, Edirne.
- Şahin, A., 2013. Nar Yetiştiriciliği, BATEM (Batı Akdeniz Tarımsal Araştırma Enstitüsü Müdürlüğü) Yayınları, Antalya.
- Şenocak, E., 2016. Halk anlatı ve inanışlarında mitolojik bir meyve: Nar, Avrasya Uluslararası Araştırmalar Dergisi, 4 (8), 228-251. <https://doi.org/10.33692/avrasyad.509344>
- Şimşek M., Yücel, B., 2015. Çevre dostu meyve üretim tekniği açısından Güneydoğu Anadolu Bölgesi, Güneydoğu Anadolu Bölgesi Çevre Sempozyumu, Diyarbakır, 227-234.
- Troujeni, M.E., Khojastehpour, M., Vahedi, A., Emadi, B., 2018. Sensitivity analysis of energy inputs and economic evaluation of pomegranate production in Iran, Information Processing in Agriculture, 5 (1), 114-123. <https://doi.org/10.1016/j.inpa.2017.10.002>
- TÜİK, 2022a. Bitkisel Üretim İstatistikleri. <http://biruni.tuik.gov.tr/medas/?kn=92&locale=tr> [Ziyaret Tarihi: 10 Mart 2023].

ŞIRNAK İLİNDE YETİŞTİRİLEN BAZI TAHIL SAP ATIKLARININ ENERJİ DEĞERLERİNİN ANALİZİ

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ÖZET

Bu çalışmada, Şırnak ilinin tahıl sap atık potansiyelinin belirlenmesinde, Şırnak, Tarım ve İl Müdürlüğü' nün 2022 yılı bitkisel üretim istatistiklerinden (İVA), yararlanılmıştır. Şırnak ili 2022 yılına ait kullanılabilir bazı tahıl (buğday, mısır, mercimek, arpa ve yonca) sap atık değerlerinden elde edilebilecek organik atık miktarı (ton/yıl), organik atıklardan elde edilebilecek kuru madde miktarı (ton/yıl), kuru maddeden temin edilebilecek uçucu kuru madde miktarı, toplam metan miktarı (m³/yıl) ve metan gazından elde edilebilecek enerji potansiyel değerleri belirlenmiştir. Yapılan hesaplamalar sonucunda tahıl sap atık miktarı 43.16,797 ton/yıl, ortalama kuru madde miktarı 3798,779 ton/yıl, uçucu kuru madde miktarı 3755,611ton/yıl, toplam metan üretim potansiyeli 938,904 m³/yıl ve enerji potansiyeli ise 33.800,509 MJ/yıl olarak belirlenmiştir.

Anahtar Kelimeler: Tarımsal Atık, Tahıl Sapı, Metan Potansiyeli, Enerji Potansiyeli, Şırnak

**ANALYSIS OF SOME ENERGY VALUES OF GRAIN STEM WASTES GROWN IN
ŞIRNAK PROVINCE**

ABSTRACT

In this study, 2022 plant production statistics (IVA) of Şırnak, Agriculture and Provincial Directorate were used to determine the grain straw waste potential of Şırnak province. The amount of organic waste that can be obtained from the straw waste values of some usable grains (corn, oats, wheat, barley, lentils and alfalfa) for 2022 in Şırnak province, the amount of dry matter that can be obtained from organic wastes (tons / year), dry matter The amount of volatile dry matter that can be supplied, the total amount of methane (m³/year) and the energy potential values that can be obtained from methane gas were determined. As a result of the calculations, the amount of grain straw waste is 43,16,797 tons/year, the average dry matter amount is 3798,779 tons/year, the amount of volatile dry matter is 3755,611 tons/year, the total methane production potential is 938,904 m³/year, and the energy potential is 33,800,509. Determined as MJ/year.

Keywords: Agricultural Waste, Grain Stalk, Methane Potential, Energy Potential, Şırnak.

GİRİŞ

Dünyada enerji kaynaklarına olan ihtiyaç her geçen gün artarak devam etmektedir. Özellikle gelişmekte olan ülkelerde nüfus artışı, sanayileşme, insanların refah seviyesinin yükselmesi ve teknolojik gelişmelere paralel olarak önümüzdeki yıllarda enerji talebi daha da yoğun olacaktır. Fosil enerji kaynaklarının dünyada ciddi çevre sorunlarına yol açması, rezervlerinin yakın gelecekte tükenecek olması, kaynak ülkelere bağımlılığın çeşitli siyasi ve ekonomik sorunlara yol açması ve fiyat istikrarsızlıkları gibi nedenlerden dolayı yenilenebilir enerji kaynaklarına olan ilgi artmıştır. Özellikle gelişmiş ülkelerde yenilenebilir enerji kaynakları olan hidrolik, rüzgar, jeotermal, güneş, biyokütle, dalga, hidrojen vb. enerji kaynaklarından başta elektrik üretimi olmak üzere çeşitli yollarla yararlanılmaktadır. Tüm bu gelişmelere rağmen fosil enerji kaynaklarının dünya birincil enerji kaynakları tüketimindeki üstünlüğü tartışmasız bir şekilde devam etmektedir ve kısa vadede bu üstünlüğünü korumaya devam edecektir. Gelişmekte olan bir ülke olan Türkiye'nin de artan nüfus ve büyüyen ekonomisine paralel olarak enerji kaynakları tüketimi yükselerek devam etmektedir. Mevcut enerji yapısı % 72 oranında dışa bağımlı olan Türkiye, bu oranı azaltabilmek için bir yandan sınırları içinde fosil enerji kaynakları hammaddesi arama çalışmaları yürütürken, diğer yandan da yenilenebilir enerji kaynaklarının potansiyelinin belirlenmesi ve kullanımı konusunda çalışmalar yapmaktadır. Bu şekilde ithal enerji kaynaklarına olan bağımlılık azalırken, enerji kaynakları da çeşitlendirilecektir.

Türkiye sahip olduğu coğrafi yapısı ve ekolojik koşulları sayesinde, ürün çeşitliliği ve miktarı yönünden tarımsal üretimde büyük bir potansiyele sahiptir. Tarımsal üretim ile birlikte budama, bakım ve hasat işlemleri sırasında fazla miktarda tarımsal artık meydana gelmektedir. Tarımsal artıklar arazide büyük sorunlar yaratmaktadır. Bu yüzden etkili çözüm yolları ile artıkların yararlı hale getirilebilmesi üretimde önemli ölçüde avantaj sağlayacaktır. Bitkisel orijinli artıklar toprak ıslahı ve verimliliği açısından önemli derecede organik madde kaynağı olmasının yanı sıra içerdikleri bitki besin maddeleri yönünden de önemli bir potansiyele sahiptirler (Çıtak vd., 2006). Bu yüzden bağ ve bahçe ürünlerinin yetiştirilmesi sırasında meydana gelen özellikle budama sürgünleri ve diğer bitkisel artıklar geri dönüşüm sağlanarak başarılı bir artık yönetimi ile yeniden üretime kazandırılmalıdır. Bitkisel içerikli artıklar; farklı amaçlar için işlenerek değerlendirilme olanaklarına sahiptirler. Örneğin yenilenebilir enerji kaynağı olarak kullanılabilmesinin yanı sıra kompost, kâğıt endsütrisi ve yonga levha kullanımı

gibi birçok yerde değerlendirilmesi nedeniyle çevre dostu ve ekonomik bir üretim için etkili olabilmektedir (Çolakoğlu, 2018)

Bitkisel atıklar kullanılarak bölge, yöre ve işletme bazında biyogaz enerjisinin üretim potansiyeli konusunda yapılan çalışmalar incelendiğinde: Enerji ihtiyacımızın kendi öz kaynaklarımız (yenilenemiyen ve yenilenebilen) ile karşılanması durumunda hem ülke ekonomimizin dışa bağımlılığının azaltılması hem de maliyetlerin azaltılması sağlanabilecektir. Türkiye bulunduğu coğrafya ve iklimden dolayı önemli miktarda yenilenebilir enerji kaynaklarına sahiptir (Başçetinçelik, 2006; Gürel, 2020).

Biyokütle genel olarak bitki veya hayvan kaynaklı hidrokarbon içeren maddelerdir ve çoğunlukla organik içeriklidir (Demirel ve Gürdil, 2018). Külcü (2016) tarımsal biyokütle potansiyelini incelediği bir çalışmada, Afyonkarahisar ilinde bir yılda açığa çıkan 2 838 954 ton bitkisel atıktan (%20 nem içeriğinde) 1 490 451 ton kompost üretilmesinin mümkün olduğunu belirtmiştir.

Karaca (2017), Antalya’ da yaptığı bir araştırmada toplamda en fazla atığın 165.3 bin ton ile domates bitkisi, bunu da 27.35 bin ton atık miktarı ile biber ve yaklaşık 10 bin ton atık miktarı ile patlıcan bitkisi üretiminden kaynaklandığını belirtmiştir. Bu üç bitkinin sera üretiminde oluşturdukları bitkisel atık miktarı ise kuru bazda toplam 202.65 bin ton olarak belirlenmiştir.

Sümer ve ark. (2016), Çanakkale ilinde bulunan zeytin üretimi esnasında oluşan atıklardan elde edilebilecek toplam metan gazı üretim potansiyel değerinin 8.803.909 m³/yıl olduğunu tespit etmişlerdir.

Baran ve ark., (2021), Adıyaman İlinin bitkisel üretimden kaynaklanan kullanılabilir tarımsal atık miktarı ve bu atıkların enerji potansiyeli biyokütle açısından teorik olarak değerlendirilmişlerdir. Adıyaman’da 11 farklı meyve ağacı için budama atıklarının kuru biyokütle potansiyeli 39.325.858,11 ton/yıl ve toplam ısıl kapasitesi 786.517.162,20 GJ/yıl olarak hesaplanmışlardır.

Baran (2021), Batman ilinde bazı tahıl (buğday, arpa, mercimek, nohut ve mısır) sap atık değerlerinden elde edilebilecek organik atık miktarı (ton/yıl), organik atıklardan elde edilebilecek kuru madde miktarı (ton/yıl), kuru maddeden temin edilebilecek uçucu kuru madde miktarı, toplam metan miktarı (m³/yıl) ve metan gazından elde edilebilecek enerji potansiyel

değerleri belirlemiştir. Yapılan hesaplamalar sonucunda tahıl sap atık miktarı 5318,41 ton/yıl, ortalama kuru madde miktarı 4680,20 ton/yıl, uçucu kuru madde miktarı 4627,02 ton/yıl, toplam metan üretim potansiyeli 1156,75 m³/yıl ve enerji potansiyeli 41643,15 MJ/yıl olarak belirlemiştir.

Bu çalışmada, Şırnak ili 2022 yılına ait kullanılabilir bazı tahıl (mısır,yulaf, buğday, arpa, mercimek ve nohut) sap atık değerlerinden elde edilebilecek organik atık miktarı (ton/yıl), organik atıklardan elde edilebilecek kuru madde miktarı (ton/yıl), kuru maddeden temin edilebilecek uçucu kuru madde miktarı, toplam metan miktarı (m³/yıl) ve metan gazından elde edilebilecek enerji potansiyel değerleri belirlenmiştir.

MATERYAL VE METOT

Çalışma Alanı

Şırnak ili, 37°31' kuzey enlemleri ve 42°28' doğu boylamları arasında yer almaktadır. İlin toplam alanı 7.151, 57 km² dir. Şırnak İli yüzölçümünün ¾'ünü kaplayan batı kesimi, Güneydoğu Anadolu Bölgesinde yer alırken, geri kalan yüzölçümünün ¼'ü ise Doğu Anadolu Bölgesi içinde kalır. İl batıda Mardin, kuzeyde Siirt ve Van, doğuda Hakkari illeri ile güneyde Irak ve Suriye devletleriyle çevrilidir. İlin yer aldığı Güneydoğu Anadolu Bölgesi jeolojik olarak kenar kıvrımları kuşağı olarak adlandırılan kuşak içinde yer alır. Bu kuşaktaki jeolojik özellikler ülkemizde yer alan diğer kuşaklardan farklı bir özellik taşır. Anadoludaki Alpin Jeosenklinealinin ön çukuru durumunda olan bölge, jura tipinde gelişmiş kıvrım şeritleri içerir. Burası Eo-Kambriyenden (birinci zaman) başlayarak Pliyosen (üçüncü zaman) dahil, bütün devirler boyunca devamlı bir sedimantasyon (tortulanma) havzası olarak gelişmiştir. Kambriyenden itibaren bütün formasyonlar sığ deniz (kıta kenarı, şelf) fasiyesinde gelişmiş, metamorfizme (başkalaşım) ve magma yer kabuğu içindeki tabakalar arasına sokularak şekil oluşturmuştur.

İlin güneyinde Suriye ve Irak sınırına yakın kesimleri hariç hemen hemen tamamı dağlarla kaplıdır. Dağlık kesimlerde Güneydoğu Toroslar sistemine bağlı yüksek kütleler vardır. İlin önemli dağları; Cudi dağı (2114 mt), Küpeli Dağı, Kelmehmet dağı (3231 mt.), Tanintanın dağı (3055 mt), Namaz dağı (1990 mt.) ve Altın dağlarıdır. İlimizin en önemli akarsuyu, Kızılsu, Hezil ve Habur çaylarının beslediği Dicle nehridir.Şırnak için en yüksek sıcaklık 40.3° C derece ile Ağustos ayı, en düşük sıcaklık -12.2° C ile Ocak ayıdır. Şırnak ilinde ortalama yıllık yağış miktarı 857.1 mm. dir. En az yağışlı ay Ağustos 1.4 mm., en çok yağış

alan ay ise Mart 143.3 mm.'dir. Günlük en çok yağış miktarı Nisan (95.8 mm. dir.) Yağışlar \geq 10 mm. dolayında olup, yağış alan gün sayısı, ortalama 31.2 gündür.

Tarım Alanlarının Yapısal Özellikleri

Şırnak ilinin 7.152 kilometrekare arazi varlığının 2.796.630 dekarı ormandır. Bu da Şırnak arazi varlığının %39'sına tekabül etmektedir. Ancak bu ormanın % 30' u normal nitelikte, geriye kalan kısmı yani % 70 i bozuk ve çok bozuk nitelikte ormanlardır. Baltalık ormanlarının tamamen tabii mescere, genelde ağaç türleri meşe palamut, mazı vb. olup görülen diğer ağaç türleri ise badem, erguvan, yabani incir, karaçam, menengiç, mahlep, alıç, çitlenbik, akçağaç, fıstık, nadir olarak da zeytin ağaçlarıdır. Bölgede hali hazırda armut, elma, kayısı, antep fıstığı, ceviz ağaçları gibi ağaçlar da yetiştirilmektedir. Mevcut arazilerin kullanım özelliklerinin belirlenmesi, arazi kullanım değişiminin ortaya konması ve değişimin devam edeceği düşünülerek tahmin hesaplarının yapılmasıyla hangi arazinin hangi kullanım için uygun olabileceği tarımsal üretim teknolojileri ve ekonomisi açısından önemli bir olgudur (Çelik ve Baran, 2018). Şırnak ili arazi varlığı ve kullanışlarına göre dağılımı Çizelge 1'de gösterilmiştir.

Çizelge1. Şırnak İli Arazi Varlığı ve Dağılımı (2022)

Diğer Alanlar (da)	Ormanlık Alanlar (da)	Çayır-Mera Alanı (da)	Tarım Alanı (da)
498.572,2	904.247,3	217.640,20	197.609,80

Şırnak ilinin arazi niteliklerine göre mevcut dağılımı Çizelge 2'de verilmiştir. İl'de tarım arazisi kullanım alanı 197.609,80ha, sebze alanı 12.664 ha, meyvelik 49.638 ha, nadas alanı 293.665ha ve süsü bitkileri alanı ise 28ha'dır. Kullanılan 97.228 ha alanın %88.65'i kuru, geri kalan %11.34'ünde ise sulu tarım yapılmaktadır. Kayıtlı çiftçi sayısı 45896 kişidir (TUIK, 2022).

Çizelge 2. Şırnak İli Tarımsal Arazilerin Niteliklerine Göre Mevcut Dağılımı (TUIK ,2022)

Cinsi	Tarım Alanı (ha)
Sebze Arazisi	12.634
Meyve Arazisi	49.654
Tahıllar ve Diğer Bitkisel Ürün Alanı	900.821
Nadas	101.906
Toplam	1,065.015

2022 yılında, Şırnak iline ait yetiştirilen bazı tahıl ürünlerinin ekim alanı ve Ülke üretimdeki payları Çizelge 3’te verilmiştir.

Çizelge 3. Çalışma Alanında Yetiştirilen Bazı Tahıl Ürünlerinin Ekim Alanı ve Üretim Miktarları (TUIK, 2022)

Ürün Adı	Ekilen Alan (da)	Üretim(ton)	Verim(kg/da)
Buğday	496.401	100.647	400
Mısır	20.301	14.299	704
Kırmızı Mercimek	112.401	7.972	71
Arpa	105.673	15.708	149
Yonca	43.025	66.246	1540

Atık ve Enerji Potansiyellerinin Hesaplanması

Verilen ekim alanı değerleri kullanılarak 2022 yılına ait ortalama atık potansiyeli belirlenirken, toplanabilirlik oranları dane buğday, arpa, kırmızı mercimek ve yonca için % 15, mısır için ise; % 60 olduğu ifade edilmektedir (Öztürk ve Başçetinçelik, 2006). Atıklardan elde edilebilecek kuru madde, uçucu kuru madde potansiyeli ve toplam metan potansiyel değerleri Sharma ve ark. (1988) tarafından kullanılan yöntemle göre belirlenmiştir. Uçucu kuru madde hesaplamasında gerekli parametreler literatür verileri kullanılmıştır. Bu ürünlerin atıklarından elde edilebilecek metan gazının enerji miktarı ise Aybek ve ark. (2015) tarafından kullanılan yöntemle göre belirlenmiştir. Belirtilen tahıl ürünleri tahıl atıklarından elde edilebilecek metan gazının enerji ise Aybek ve ark. (2015); Taşova ve Polatçı (2019) ve Baran (2021) yöntemine göre belirlenmiştir.

Hesaplama kullanılan eşitlikler aşağıda verilmiştir;

$$AP = ((EA \times 37 \times 15)/100)1000 \quad (1)$$

Burada;

AP: Ürün atık miktarı potansiyeli (ton/yıl);

EA: buğday ekim alanı (da).

$$KM = ((AP \times 88)/100) \quad (2)$$

Burada;

KM: Elde edilebilir kuru madde potansiyeli (ton/yıl).

$$UKM = ((AP \times 87)/100) \quad (3)$$

Burada;

UKM: Ucu kuru madde potansiyeli (ton/yıl).

$$\mathbf{\ddot{O}MO = UKM \times 0.25} \quad (4)$$

Burada;

ÖMO: Özgül metan oranı (CH₄ kg).

$$\mathbf{ME = \ddot{O}MO \times 36} \quad (5)$$

Burada;

ME: Elde edilebilir metan gazının enerji değeri (MJ).

ARAŞTIRMA ve BULGULARI

Şırnak ili 2022 yılına ait üretimi yapılan bazı tahıl bitkilerinin atık ve kuru madde potansiyeli, uçucu kuru madde, metan potansiyeli ve enerji potansiyeli hesaplanarak aşağıda Çizelge 4'te detaylandırılmıştır. Çizelge 4'e göre Şırnak ili 2022 yılına ait toplam tahıl atık potansiyel değerinin ortalama 43.16,797 ton/yıl ve bu değerden elde edilebilecek kuru madde potansiyel değerinin ise ortalama 3798,779 ton/yıl olduğu belirlenmiştir. Şırnak ili 2022 yılına ait toplam uçucu kuru madde potansiyel değerinin ortalama 3755,611 ton/ yıl ve elde edilebilecek toplam metan oranı 938,904 m³/yıl olduğu belirlenmiştir. Şırnak ili 2022 yılına ait bazı tahıl ürünleri atıklarından elde edilebilecek toplam enerji potansiyel değerinin ortalama 33.800,509 MJ/yıl olarak saptanmıştır.

Çizelge 4. Şırnak İline ait bazı tahıl ürünlerinin kullanılabilir atık ve kuru madde potansiyeli, uçucu kuru madde, özgül metan oranı ve enerji potansiyeli

Ürünler	Atık Potansiyeli (ton/yıl)	Kuru Madde Potansiyeli (ton/yıl)	Uçucu Madde(ton/yıl)	Kuru Metan Potansiyeli (m ³ /yıl)	Enerji Potansiyeli (MJ/yıl)
Buğday	2755,026	2424,422	2396,872	599,218	21571,850
Mısır	112,671	99,150	98,023	24,506	882,210
Kırmızı Mercimek	623,826	548,966	542,728	135,682	4884,554
Arpa	586,485	516,107	510,242	127,561	4592,179
Yonca	238,789	210,134	207,746	51,937	1869,716
Toplam	4316,796	3798,780	3755,612	938,903	33800,509

SONUÇ VE ÖNERİLER

Çalışmada, güncel verilere göre hesaplanan yanma enerji değerlerine bakıldığında; son yıllardaki yakılarak kullanılması enerji üretimi açısından iyi bir alternatif olan biyokütle atıkların potansiyeli ve enerji değerinin yüksek olduğu görülmektedir. Şırnak ilinde üretimi yapılan bazı tarımsal ürünlerin sap atıklarına göre, elde edilebilecek yıllık bazdaki ortalama atık, kuru madde, uçucu kuru madde, metan ve enerji potansiyelleri araştırılmıştır. Belirlenen

bulgular dođrultusunda Őırnak ilinde ortalama **4316,796** ton/yıl tahıl sap atıđının olduđu grlmŕtr. Bu atıklardan elde edilebilecek ortalama enerji potansiyeli ise yıllık **33800,509** MJ olduđu belirlenmiŕtir. Enerji aıđının kapatılması iin lkemizde mevcut tahıl sap atıklardan elde edilebilecek enerji potansiyellerinin uygulamaya aktarılmasının nemli olacađı dŕnlmektedir.

Kaynaklar

- Anonim , (2022) Şırnak ili bitkisel üretim verileri erişim
linki:https://www.tarimorman.gov.tr/SGB/TARYAT/Belgeler/il_yatirim_rehberleri/sirnak.pdf
- Anonim, (2022) Tarımsal atıklar Erişim
linki<http://www.derim.com.tr/tr/pub/issue/4560/62578>
- Anonim,(2022) TUIK veriler erişim linki: <https://www.tuik.gov.tr/>
- Aybek, A., Üçok, S., İspir, M.A., Bilgili, M.E., (2015). Türkiye’de kullanılabilir Hayvansal Gübre ve Tahıl Sap Atıklarının Biyogaz ve Enerji Potansiyelinin Belirlenerek Sayısal Haritalarının Oluşturulması. Tekirdağ Ziraat Fakültesi Dergisi. 12 (03). 111-120.
- Baran, M.F., Çelik, A, Bellitürk, K., (2021). Some Agricultural Product Analysis Of The Energy Values Of Stalk Waste (A Case Study Of Adıyaman Province), 3rd International Conference on Food, Agriculture and Veterinary, 9-10 October 2021, Adana, Turkey, Conference Proceedings Book volume:1, Pages:648-647, ISBN: 978-625-7720-43-4
- Baran, M.F., (2021). Batman İlinde Bulunan Tahıl Sap Atıklarının Bazı Enerji Değerlerinin Analizi, 3rd International Conference on Food, Agriculture and Veterinary, 19 - 20 June 2021, Ege University, İzmir, Turkey, Conference Proceedings Book volume:1, Pages:648-647, ISBN: 978-625-7720-43-4
- Baran, M.F., Küçükler, E., (2021). Bitkisel Atıkların Enerji Potansiyelinin Teorik Analizi (Tokat İli Örneği) MAS Journal of Applied Sciences 6(2): 358–364, 2021
- Başçetinçelik, A., Öztürk, H.H., Karaca, C., Kaçıra, M., Ekinci, K., Kaya, D., Baban, A., Güneş, K., Komitti, N., Barnes, I., Nieminen, M., (2006). A Guide on Exploitation of Agricultural Residues in Turkey. Final Report Annex XIV, LIFE 03 TCY/ TR /000061, Adana
- Çelik, A, Baran, M.F. (2018). Adıyaman İli Toprak Yapısı ve Tarımsal Mekanizasyon Durumu. Gece Kitaplığı, Ziraat, Orman ve Su Ürünleri Alanında Akademik çalışmalar, Birinci Basım, sayfa: 61-75, ISBN • 978-605-288-617-5
- Çıtak, S., Sönmez, S., Öktüren, F. (2006). Bitkisel Kökenli Atıkların Tarımda Kullanılabilme Olanakları. Derim, 23(1), 40-53.
- Çolakoğlu, B., (2019). “Tarımsal Atıkların Alternatif Kullanım Alanları Konusunda Üretici Eğilimleri”, Namık Kemal Üniversitesi, Fen Bilimler Enstitüsü, Tarım Ekonomisi Anabilim Dalı, Uluslararası İlişkiler Bilim Dalı, Yüksek Lisans Tezi.
- Demirel, B, Gürdil, G.A.K. (2018). Fındık zürufu atığından yakıt briketi elde edilmesi ve brikete ait bazı özelliklerin belirlenmesi, Anadolu Tarım Bilim. Derg./Anadolu J Agr Sci, 33 (2018) ISSN: 1308-8750 (Print) 1308-8769 (Online) doi: 10.7161/omuanajas.302527
- Gürel, B., (2020). Türkiye’deki Güncel Biyokütle Potansiyelinin Belirlenmesi ve Yakılmasıyla Enerji Üretimi İyi Bir Alternatif Olan Biyokütle Atıklar İçin Sektörel Açından ve Toplam Yanma Enerji Değerlerinin Hesaplanması, Mühendislik Bilimleri ve Tasarım Dergisi, 8(2), 407-416.

- Karaca, C. (2017). Antalya'da seracılık biyokütle artıklarının potansiyelinin haritalanması ve enerji üretim amacıyla değerlendirilmesi. *Mediterranean Agricultural Sciences*, 30(1): 21-25.
- Külcü, R. (2016). Afyonkarahisar ilinin tarımsal biyokütle potansiyelinin incelenmesi. *Akademia Mühendislik ve Fen Bilimleri Dergisi*, 1(2): 1-9
- Öztürk, H.H., Başçetinçelik, A., (2006). Energy exploitation of agricultural biomass potential in Turkey. *Energy Exploration and Exploitation Dergisi*, 24 (5), syf: 313-330.
- Sharma, S.K., Mishra, I.M., Sharma, M.P., Saini, J.S. (1988). Effect of particle size on biogas generation from biomass residues. *Biomass* 17 (4): 251–263.
- Sümer, S.K., Çiçek, G., Say, S.M. (2016). Tarım Makinaları Bilimi Dergisi. Çanakkale İlinde Zeytin Üretimi Artık Potansiyelinin Belirlenmesi ve Değerlendirme Olanaklarının Araştırılması. 12 (2). 103-111.
- Taşova, M., Polatçı, H. (2019). Tokat İlinde Bulunan Tahıl Sap Atıklarının Metan Gazı ve Enerji Değerlerinin Teorik Analizi. *Gaziosmanpaşa Bilimsel Araştırma Dergisi* , 8 (3) , 59-69 . Retrieved from <https://dergipark.org.tr/tr/pub/gbad/issue/50458/618860>

**ARONYA (*Aronia melanocarpa*) YETİŞTİRİCİLİĞİNDE UYGULANAN
MEKANİZASYON**

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ÖZET

Ülkemizin coğrafi yapısı, zengin ve verimli bir tarımsal üretim için büyük avantajlar sunarken agrostratejik konumu da dünya tarımı için önemli bir köprü işlevi görmektedir. Tüm bu hususlar dikkate alındığında tarım sektörüne yapılacak yatırımlar ülkemiz ekonomisi ve ihtiyaçlarının karşılanması bağlamında öncelik taşımaktadır. Bu sebeple Aronya tarım ve gıda sektörü açısından büyük önem arz etmektedir. Aronya, gerek birim alandaki getirisi gerekse sağlık açısından sahip olduğu yararlarından dolayı dünya çapında çok aranan meyve türlerinden biri olup Türkiye için yeni bir üzümse meyvedir. Bu çalışmada ülkemizde yaygınlaşan mucize bitki aronya yetiştiriciliği ve uygulanan tarımsal mekanizasyon bahsedilmiş ve değerlendirmeler yapılmıştır. Ülkemizde aronya üretimine yönelik yapılacak yatırımların arz talep dengesi yönünden değerlendirildiğinde arz tarafında gerekliliğin oldukça yüksek düzeyde olduğu görülmektedir.

Anahtar Kelimeler: Aronya, meyve, tarımsal mekanizasyon , hasat

MECHANIZATION APPLIED IN ARONIA (*Aronia melanocarpa*) CULTURE

ABSTRACT

While the geographical structure of our country offers great advantages for a rich and productive agricultural production, its agrostrategic location also serves as an important bridge for world agriculture. Considering all these issues, investments to be made in the agricultural sector have priority in terms of meeting our country's economy and needs. For this reason, Aronya is of great importance in terms of agriculture and food sector. Aronia is one of the most sought after fruit species around the world due to its yield per unit area and its health benefits, and it is a new berry fruit for Turkey. In this study, the cultivation of the miracle plant aronia, which is widespread in our country, and the applied agricultural mechanization are mentioned and evaluations are made. When the investments to be made for aronia production in our country are evaluated in terms of supply and demand balance, it is seen that the necessity on the supply side is quite high.

Keywords: Aronia, fruit, agricultural mechanization, harvest.

GİRİŞ

Türkiye sahip olduğu farklı iklim koşulları nedeniyle birçok meyve türünün yetişmesine imkân sağlamaktadır. Bu meyveler arasında yer alan üzüksü meyveler son yıllarda dünyada ve ülkemizde yüksek talep gören meyve türleridir. Üzüksü meyveler taze olarak tüketimlerinin yanında, işlenerek de değerlendirilebilmeleri nedeni ile sanayide giderek önem kazanmaktadır. Türkiye İstatistik Kurumu (2019) verilerine göre ülkemizin dünya üzüksü meyve üretimindeki payı %8'dir. Bunun %24,92'sini çilek, %25,18'ini diğer üzüksü meyve türleri oluşturmaktadır (Poyraz ve ark. 2018; Poyraz Engin ve Boz, 2019). Ülkemizin polikültür tarımı uygulanan birçok bölgesinde üzüksü meyvelerin önemi ve yetiştiriciliği gittikçe önem kazanmaktadır. Son yıllarda ihracat imkânlarının artması nedeniyle bu gibi ürünlere olan talep her geçen yıl artmaktadır. Aronya tarım ve gıda sektörü açısından büyük önem arz etmektedir. Aronya, gerek birim alandaki getirisi gerekse sağlık açısından sahip olduğu yararlarından dolayı dünya çapında çok aranan meyve türlerinden biri olup Türkiye için yeni bir üzüksü meyvedir.

Botanik olarak bakıldığında aronya; Angiosperms (Kapalı tohumlular) Bölümü, Eudicolydon (İki çenekliler) Alt Bölümü, Meloideae Sınıfı, Rosales Takımını Rosaceae (Gülgiller) Familyasının Amygdaloideae Altfamilya yapısından Maleae Cinsinden Aronya şeklinde tanımlanmıştır. Bu cins içerisinde Aronia melanocarpa (Michx) Elliot (Black chokeberrey), Aronia prunifolia (Marsh) (Purple chokeberry) ve Aronia arbutifolia (L.) Elliot (Red chokeberry) olmak üzere bilinen üç tür mevcuttur. Avrupa'da en yaygın aronya çeşitleri arasında 'Aron' (Danimarka), 'Nero'(Çek Cumhuriyeti), 'Viking' (Finlandiya), 'Rubin' (Rusya), 'Kurkumachki' (Finlandiya), 'Hugin' (İsveç), 'Fertödi' (Macaristan) 'Albigowa', 'Dabrowice', 'Egerta', 'Kutno' 'Nova' 'Wies', 'Hakkija', 'Ahonnen', 'Serina', 'Autum Magic', 'McKenzie', 'Morton', 'Galicjanka' (Polonya) yer almaktadır (Poyraz Engin 2016, Özder, 2020). Aronya, Avrupa'da doğallaştırılmış olup; inter generik hibrit bir form olarak yetiştirilmektedir. En yaygın olarak Kuzey Amerika'da ağaç altlarında ve bataklıklarda yetiştirilmektedir. Aronya üzüksü meyveler içerisinde oldukça yüksek bir antioksidan kapasitesine sahip olması nedeni ile dünyada taze meyve olarak tüketilebildiği gibi işlenerek gıda sanayinde ve eczacılıkta da kullanılmaktadır (Poyraz Engin, 2018, Özder, 2020).

Üzüksü meyveler içerisinde yer alan aronyanın (Aronia melanocarpa (Michx) Elliot) insan sağlığı üzerine etkisi konusunda yapılan çalışmalar sonucunda, meyvelerinin antioksidan kapasitesi ve antosiyanin miktarı bakımından diğer üzüksü meyvelere göre daha yüksek değere sahip olduğu ortaya konmuştur. Bu meyve türünün düzenli tüketimi ile kardiyovasküler

hastalıklar, sindirim sistemi hastalıkları ve bazı kanser hastalıklarına karşı koruma sağladığı tespit edilmiştir (Kulling ve Rawel 2008). Antioksidan açısından oldukça zengindir. En çok Antioksidan içeren meyvedir. Ayrıca vitamin ve mineral kaynağıdır. B12 ve D vitamini hariç tüm vitaminleri içermektedir. Bu yüzden aronya ya ‘Süper Meyve’ denilmektedir. Güller sınıfına dâhil olan meyve Aronya Berry ve Black Chokeberry isimleriyle de anılmaktadır (Tokusoglu, 2017a- 2017b; Özder, 2020).

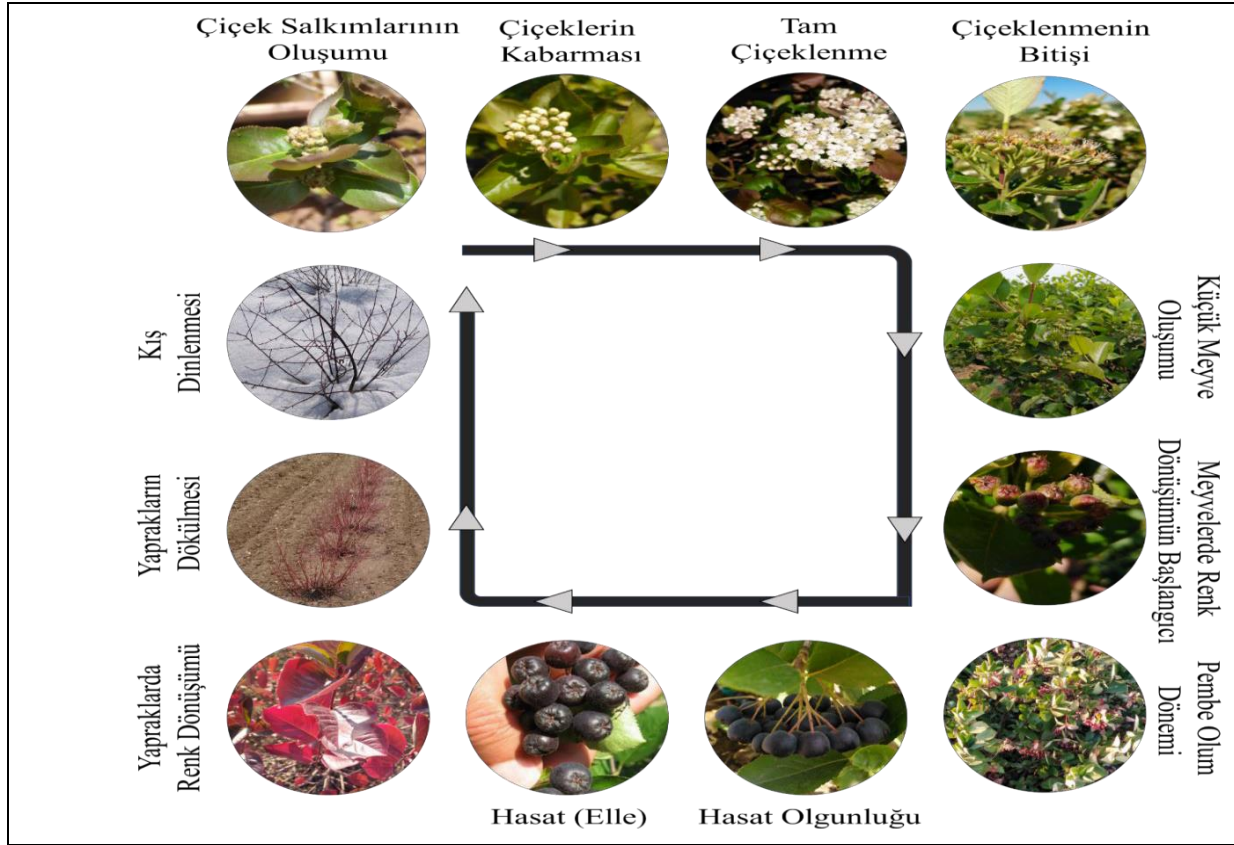
Aronya zaman zaman süs bitkisi olarak da yetiştirilmektedir. Çalı formunda bir bitkidir. Bahçe tesisinde 1 m x 4 m mesafeyle dikilirler. Sonbaharda yaprakları çok güzel bir şekilde kırmızılaşır. Güzel yaprakları sayesinde süs bitkisi olarak da kullanılmaktadırlar. Kış döneminde yapraklarını dökerler. İlkbaharda çiçek açarlar. Meyveleri Ağustos ayında olgunlaşmakta ve uzun süre üzerinde kalabilmektedir. Ekşi meyveler, çalılıktan çiğ olarak yenabilir olduğu kadar işlenerek tüketilmesi de tercih edilmektedir. Aronya meyveleri antosiyaninler gibi polifenik bileşiklerce zengin olması sebebiyle, meyveler büzme özelliği kazanarak ağız içerisinde büzüştüren bir his yarattığı için chokeberry ismiyle de anılmaktadır(Özder, 2020). Ülkemizde bu meyve çok geç fark edilmiştir. Halen üretimi yaygınlaşmamıştır. Aronyayı ülkemizle ilk tanıştıranların başında iş adamı Osman Nuri Günay gelmektedir. Aronyanın ülkemizde yetiştirilmesi ve yaygınlaşması adına çalışmalar yapmış ve hala yapmaktadır. 2008 yılında Tataristan’ ın başkenti Kazan’ dan 30 adet fidan alıp Ankara’ da yetiştirdiklerini, aronyadan istedikleri verimi alınca meyvenin anavatanının Amerika olduğu için buradan yeni çeşitleri getirmek için çalışmalarda bulunmuşlar(Özder, 2020).

Ülkemizde aronya yetiştiriciliği ile ilgili ilk çalışmalar 2012 yılında Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü’nde fidan üretimi ile başlamış ve deneme alanında plantasyon oluşturulmuştur. 2017 yılında ilk hasat şenliği düzenlenmiş ve meyvenin tanıtım ve yayım çalışmalarına başlanmıştır. Ayrıca Yalova, Sakarya, Kayseri ve Zonguldak’ta İl Tarım Orman Müdürlükleri tarafından yayım projeleri hazırlanmıştır (Poyraz Engin ve Boz, 2019, Özder, 2020). Ülkemizde halen 19 ilde toplam 777 dekar alanta aronya üretimi yapılmaktadır (Çizelge 1).

Çizelge 1. İllere göre aronya üretimi

İLLER	FİDAN SAYISI(ADET)	ÜRETİM ALANI(da)
Kırklareli	52.000	240
Bursa	23.000	141
Manisa	15.000	90
Kırşehir	8.000	48
Yalova	8.000	48
Çanakkale	7.000	42
Samsun	6.000	36
İzmir	5.000	30
Ordu	3.000	18
Antalya	3.000	18
İstanbul	3.000	18
Bolu	2.000	12
Ankara	2.000	12
Sakarya	1.500	9
Giresun	1.000	6
Çorum	500	3
Amasya	500	3
Tekirdağ	500	2
Trabzon	300	1
Toplam	129.800	777

Aronya, çalı formunda, 80-140 cm'ye kadar boylanabilen, yaklaşık 6 mm çapında mor-siyah meyveleri olan Kuzey Amerika menşeli çok yıllık bir bitkidir. Bitkinin yaprakları 3–7 cm uzunluğunda olup parlak ve tüsüzdür. Beyaz-pembe çiçekleri mayıs ayında açmaktadır (Hardin 1973, Scott ve Skirvin 2007). Aronya çiçekleri erselik yapıdadır. Bir salkımda 20-25 adet çiçek bulunmaktadır. Bu çiçeklerden 8-14 adet meyve oluşmaktadır. Çiçekleri Rosaceae'nin karakteristik özelliği olan 5 adet çanak yaprak, 5 adet taç yaprak ve 10-30 adet erkek organ bulundurmaktadır. Aronyanın bazı bitkisel özellikleri ve vejetasyon döngüsü Şekil 1'de gösterilmiştir(Yılmaz ve ark.2021). Çiçeklenme periyodu 20-25 gün sürmektedir. Aronya kendine verimli bir bitki olup tozlayıcıya ihtiyaç duymamaktadır (Poyraz Engin, 2018; Yılmaz ve ark.2021). Aronya'nın yıllık vejetasyon döngüsü Şekil 1'de verilmiştir (Yılmaz ve ark.2021).



Şekil 1 . Aronya'nın yıllık vejetasyon döngüsü

KÜLTÜREL İŞLEMLER

Toprak İsteği: Aronya bitkisi adaptasyon kapasitesinin yüksek olması nedeniyle çok geniş toprak tipi ve pH aralığında yetiştirilebilen, çok yıllık, çalı formunda gelişen üzüksü meyve türüdür. Yetiştiricilik için drenajı iyi, orta bünyeli, organik maddece zengin, 6-6,5 pH değerine sahip topraklar önerilmektedir. Organik maddesi toprağa besin maddesi ve nem kattığı gibi havalanmasını ve drenajının iyi olmasını sağlamaktadır. Eğer aronya dikilecek olan alanlardaki topraklara organik madde ilave edilir ve dikimden en az bir yıl önce bu maddeler toprakla karıştırılırsa aronya bitkilerinin adaptasyonları daha iyi olur, daha kuvvetli bir gelişme göstererek verimlilikleri artar. Organik madde kaynağı olarak torf, kompost, iyi yanmış ahır gübresi kullanılabilir. Bu arada, yeşil gübre olabilecek bazı bitkilerin ekilmesi ve C/N oranının en iyi olduğu dönemde toprak altına verilmeleri de toprak organik maddesini artırır (Anonim 2023 a).

Toprak işleme :

Aronya bitkisi yüzlek köklüdür. Bu nedenle toprak işleme yüzeysel olarak yapılmalıdır. İlkbahar dönemindeki toprak işleme toprağın havalandırılması yanında yabancı ot kontrolünün sağlanması bakımından da çok önemlidir. Bu yüzden sıra aralarına ilkbahar aylarında toprak işleme yapılmalıdır. Ayrıca yaz ayında da toprağın sık sık kabartılması ve sonbaharda da son bir derin sürüm yapılması önerilir. Aronya için arazi hazırlığı en az bir yıl önceden yapılmalıdır. Ilıman iklim bölgelerinde ilkbahar öncesi dikim yapılabilse de sonbahar dikimleri özellikle kar yükünün olmadığı yerlerde daha uygundur. Dikim öncesi arazideki çalı, taş, ağaçcık v.s temizlenerek arazi 50 cm derinlikten işlenmelidir. Sürümde derin toprak işleme aletleri (kültüvator, çizel , tırmık ve tesviye) ile zemin düzeltilmelidir. Toprak şartları ve hasat şekillerine dikim aralıkları planlanmalıdır. Dizlişleri, birbirine gölgeleme yapmayacak, bol ışık alacak şekilde olup, iş genişliğini de dikkate almak gerekmektedir. Genellikle 2 x 4 m veya 1.5 x 3 m kullanılır (Kask, 1987). 120-160 cm X 300 cm (Knudson, 2005). En sık dikim 1.25 m x 2.5 m. Aronya bitkisi bakımı çok zor değildir. Çalı formunda bir bitki olduğu için yetiştiricilerini çok zorlamaz. Yüksek verim elde edilebilmesi için iki yılda bir defa olacak şekilde gübre verme işlemi önerilmektedir.

Dikim: Aronya, tozlaşmaya ihtiyaç duymayan bitkilerden biridir. Üretimi kendi çekirdeklerinden bile yapılabilir. Toprak yeterince ufalanmış ve gerekli neme sahipse dikim işlemlerine başlanabilir. Dikim sıraları 1,5 metrede bir olacak şekilde işaretlendikten sonra sıraların üzerine 30 santimetre çapında ve 20 santimetre derinliğinde çukurlar açılır. Dikim işlemi bu çukurlara yapılır. Dikim işlemlerinden sonra kök sisteminin üstüne atılan toprak, ayakla bastırılmak sureti ile sıkıştırılır. Fakat bu işlem gerçekleştirilirken kök boynundan çıkan, fundanın oluşmaya başladığı filizler olan yan dallara zarar verilmemesi konusunda son derece hassas olunmalıdır (Anonim 2023 b). Fidan dikiminde kullanılan makine Şekil 2 'de verilmiştir.



Şekil 2. Fidan Dikim Makinası

Gübreleme: Aronya bitkisi çiçek açmadan 2-3 ay evvel organik gübreyle ve çiçek açmaya yakın bir dönemde çinko bor ağırlıklı olarak gübreleme yapılırsa verim yüksek olacaktır. Aynı zamanda dikimden önce dekara 2-3 ton yanmış çiftlik gübresi kullanılabilir. Meyve oluşumu ortaya çıkmaya başladığı zaman ise fosfor potasyum ağırlıklı gübreleme yapılması önerilir (Anonim 2023 a).



Şekil 3. Çiftlik gübresi

Sulama: Yıllık 500-600 mm aralığında yağış, bitki gelişimi için yeterlidir. Ancak yağışın vegetasyon döneminde yağması önemlidir. Verimi etkileyen su kıtlığı, yalnızca temmuz

ve ağustos kuraklıklarında, dinamik meyve büyümesi sırasında ortaya çıkabilir. Sulama mevcut imkânlarla göre damla (Şekil 4) veya yağmurlama yöntemlerinden birisiyle yapılabilir.



Şekil 4. Aronya bitkisinde damla sulama

Hasat : Aronya meyveleri salkım şeklinde oluşur ve bir salkımda genelde 5-15 tane meyve bulunmaktadır. Aronya meyveleri çeşide, budamada bırakılan dal tipine ve iklime bağlı olarak 90-110 gün içinde olgunlaşırlar. Meyveler, ağustos sonu veya eylül başında olgunlaştıktan sonra hasat edilir. Olgunlaşma sırasında meyveler yumuşar, renklenme artar, tatlanma meydana gelir ve taneler irileşir. İsveç'te yapılan bir çalışmada, 22 Ağustos'ta maksimum verime ulaşıldığı, ancak bu tarihte antosiyanin birikiminin devam ettiği ve maksimum antosiyanin birikiminin 8 Eylül tarihinde gerçekleştiğini bildirmişlerdir. Ayrıca meyvelerde kararın olayı da bir hafta önceki hasatta en az seviyede bulunmuş olmasına rağmen, 1 hafta önce hasat edilseydi kararın %32 azalırken, antosiyaninlerde %20 azalmıştır. Sonuç olarak en yüksek antosiyanin içeriğine sahip meyve eldesi ve meyvelerde burukluk oranının da azaltılması için ekolojilere göre değişmekle birlikte Eylül'ün ikinci haftası gerçekleştirilmelidir. Ancak tam olgunlaşmadan toplanan meyvelerin kaliteleri sürgünler üzerinde olgunlaşanlara göre daha düşüktür. Aronya meyveleri elle veya mekanik hasat makinalarıyla hasat edilebilir (Şekil 5). Amerika Birleşik Devletleri ve Avrupa'da aronya genellikle mavi yemiş hasat makinelerine benzer bir makina ile hasat edilmektedir. Hasat, yağışsız ve kuru havalarda yapılmalıdır. Elle hasatta ham meyveler ve yeşil meyveler hasat edilmemelidir (Şekil 6). Hasadı yapan kişi mümkün mertebe en az taneyi avucunda biriktirmelidir. Böylece meyveler ezilmez, bozulmaz ve tanelere çekici, sağlıklı görüntü veren

pus tabakası silinmez. Taze olarak tüketilecek aronya meyveleri bir örnek, koyu renkli, dolgun, sert, hasarsız ve temiz olmalıdır. Düz veya teraslanmış alanlarda hasat makineleri kullanılabilir. Hasat makinesinin ekonomik olması için bahçenin en az 50 da olması gerekir. İlk iki yıl el ile hasat yapılması uygun olmakta iken 3. yıldan itibaren makineli hasat yapılabilmektedir (Anonim 2023 a; Anonim 2023b).



Şekil 5. Hasat makinası (Aronya hasadı)

Elle hasatta ham meyveler ve yeşil meyveler hasat edilmemelidir. Hasadı yapan kişi mümkün mertebe en az taneyi avucunda biriktirmelidir. Böylece meyveler ezilmez, bozulmaz ve tanelere çekici, sağlıklı görüntü veren pus tabakası silinmez.



Şekil 7. Aronya bitkisi elle hasadı

Sonuç ve Öneriler

Aronya, tarım, orman ve gıda sektörü açısından önem arz etmektedir. Küçük işletme ölçeğindeki marjinal araziler için ekonomik değeri yüksek olan aronya yetiştiriciliği son yıllarda dünyada ve ülkemizde de tıbbi ve aromatik bitkilerin ve bunlardan elde edilen ürünlerin kullanımında büyük bir artış dikkati çekmektedir. Özellikle sağlık, gıda, kozmetik ve tarım alanlarında yüksek katma değerli ürünlerin bu coğrafyada yerli imkanlarla üretilmesi, işlenmesi, paketlenmesi, pazarlanması yani üretimden tüketime kadar değer zincirinde yer alan her aşamanın yönetilmesi, katma değer in ülkemizde kalmasını sağlayacaktır. Aronya meyveleri taze olarak, meyve suyu sanayisinde, tek başına veya diğer meyve suları ile kokteyl yapılarak, ilaç sanayisinde kuru meyvesi, çiçekleri, kökleri ve yaprakları, süt ve süt ürünleri teknolojisinde, aronyalı dondurma, aronyalı süt, kuru meyve teknolojisinde, meyveli ekmek, çörek, kek, puding ve pastalarda, baharat sanayisinde, meyve salatalarında, reçel, marmelat ve konserve sanayisinde, kuru yaprağı ve kuru meyvesi çay olarak ve diyet menülerinde kullanılmaktadır. Aronya bahçesinin kurulacağı bölgede iklim ve diğer ekolojik koşulların uygunluğu, teknik bakım işlemlerinin usulüne uygun olarak yerine getirilmesi, yer ve çeşit seçiminin önemi, büyük pazarlara yakınlık, iç ve dış ticaret imkanları aronya tarımının yaygınlaşmasını yakından etkileyecek unsurlar olarak sıralanabilir.

Kaynaklar

- Anonim 2023a Aronya yetiştiriciliği: Erişim linki <https://imecemobil.com.tr/tarim/aronya-aronia-melanocarpa-yetistiriciligi/>, Erişim tarihi: 04.05.2023
- Anonim 2023 b: Aronya tarımı, Erişim linki: <https://www.ufuktarim.com/aronya-yetistiriciligi>, Erişim tarihi: 01.04.2023
- Hardin JW. 1973. The enigmatic chokeberries (Aronia, Rosaceae). Bulletin of the Torrey Botanical Club 100: 178–184.
- Kulling S.E. ve Rawel H.M. Chokeberry (Aronia Melanocarpa)-A Review on the Characteristic Components and Potential Health Effects 2008
- Özder, A, 2020 Bazı Aronya Çeşitlerinin (Aronia Melanocarpa L.) Gelişme Performanslarının Belirlenmesi, Aydın Adnan Menderes Üniversitesi Fen Bilimleri Enstitüsü Bahçe Bitkileri Anabilim Dalı Yüksek Lisans Tezi
- Knudson M.2009. Plant Guide for black chokeberry (Photinia melanocarpa) (Michx). USDA-Natural Resources Conservation Service, https://usdasearch.usda.gov/search?affiliate=nrcs_www_plantmaterials9994&commit.x=0&commit.y=0&dc=null&page=3&query=knudson&utf8=%E2%9C%93
- Poyraz Engin, S., 2018. Aronya Meyve Türünün Bitkisel Özellikleri ve Adaptasyonuna İlişkin Gözlemler. Bahçe Haber 7(1): 8-11.
- Poyraz Engin S., Boz Y., Mert C., Fidancı A. ve İkinci A. 2018, Growing Aronya Berry (Aronia melanocarpa (Michx) Elliot) 1. International Gap Agriculture&Livestock Congress 25-27 April 2018 – Şanlıurfa/Turkey
- Poyraz Engin, S., Boz, Y., 2019. Türkiye ve Dünyada Aronya Yetiştiriciliği. VI. Ulusal Üzüm Sü Meyveler Sempozyumu, 5-7 Eylül 2019, Samsun (Basım aşamasında).
- Scott, R.W., Skirvin, R.M. 2007. Black chokeberry (Aronia melanocarpa Michx.): A semi-edible fruit with no pests. Journal of the American Pomological Society, 61(3): 135.
- TÜİK. (2019). Türkiye İstatistik Kurumu, Bitkisel Üretim İstatistikleri, <http://tuikapp.tuik.gov.tr/>.
- Tokusoglu Ö. 2017a. Proje Director. Bilim Sanayi ve Teknoloji Bakanlığı Projesi. Proje Yöneticisi. DEPARK Teknopark Univ.Sanayii İşbirliği Projesi BSTB 047226. Aronya (Aronia melanocarpa) Meyvesi Sağlık Ürünleri (Ekstrakt, Toz ve Aronya Çayı ve Tableti) Üretimi: İnovatif Ürünlerde Biyoyararlılık, Antioksidan Fenolik Profil ve Seçimlenmiş Kanser Hücre Hattı Üzerinde Olası Antikarsinojenik Etkilerinin Tesbiti. Baş.Tarihi: 05.01.2018 Bitiş Tarihi: Devam Ediyor. SPİL INNOVA Arge Gıda Danışm. Ltd.Şti., DEPARK TEKNOPARK, Dokuz Eylül Üniversitesi Teknoloji Geliştirme Bölgesi, İnciraltı Yerleşkesi, Balçova, İZMİR

- Tokusođlu Ö. 2017b. Proje Researcher Aronya (*Aronia melanocarpa* (Michx) Elliot) ve Mürver (*Sambucus nigra* L.) Meyve Türlerinin Farklı Ekolojilerde Yetiştiriciliđi, Meyve Karakteristik Bileşenleri ve Biyoyararlılıđının İncelenmesi. TAGEM Projesi- YABK Enstitüsü-Gıda Tarım Hayvancılık Bakanlığı- Ankara TAGEM BBAD /17/A08/P10/01
- Yılmaz, A., Güler, E., Soydemir, H. E., Demirel, S., Mollahalilođlu, S., Çiftçi, V., & Karadeniz, T. (2021). Miracle Plant: Black Chokeberry (*Aronia melanocarpa*). *MAS Journal of Applied Sciences*, 6(1), 83–94. <https://doi.org/10.52520/masjaps.20>

**WATER-SENSITIVE URBAN DESIGN IN THE FIGHT AGAINST CLIMATE
CHANGE: THE ROLE OF URBAN GREEN SPACES AND WATER
CONSERVATION**

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ABSTRACT

Cities are ecosystems that contain natural structures and systems and involve the interaction of cultural and natural structures, in addition to being the areas where anthropogenic activities are concentrated. There is a relationship between urban fabric and infrastructure systems in urban areas. This relationship has become even more important especially with the decrease in green areas in cities and the increase in impermeable surface coatings. Because of global climate change, some study areas such as 'heat island effect, air pollution, flood-flood disasters, deprivation of green space, distribution and maintenance problems, biodiversity loss, desertification, drought and related deteriorating soil and water quality, food security etc.' show the need to reconsider the relationship of cities with nature. Considering that the urban areas in our country expanding, the green network system for the sustainability of cities will stand out as "critical infrastructures" in today's variable and fragile urban environment. Green network and green infrastructure studies are on the agenda to analyze and integrate ecologically based systems within our cities. It will contribute to the improvement of the quality of life in a range based on nature-based solutions that can be elaborated, from energy-efficient structures that can be seen in urban design applications to water-permeable surface coating materials during the climate change adaptation process. To ensure the sustainability of cities, it is necessary to understand the functioning of different ecosystems (stream, agriculture, built environment, etc.) from natural to man-made and to reflect them in design decisions. In urban design applications, the establishment of green infrastructure networks that consider the comfort of natural and cultural life for urban residents and the consideration of relevant nature-based design solutions will facilitate the process as a proactive step. The preparation of urban design projects under the guidance of green infrastructure systems and nature-based solutions will make a significant contribution to the solution of problems in detail and practice. For instance, the integration of approaches and tools such as water-sensitive urban design (WSUD), landscape urbanization

(LU), Landscape-Based Urbanism into the design process is important and urban design understandings are developing in this direction today. In the specified design approaches, interdisciplinary work and cooperation between solutions are necessary. Bio-engineering work, in which the relevant engineering fields are also involved in the design processes, is also important in the development of system details. Despite the overgrowing/homogenizing structure of cities, the elements that make the city more original, livable and identity are green network systems that can be defined as the ecological values of the city. In this study, under the guidance of green infrastructure systems and nature-based solutions in the first plan, water-sensitive urban design, landscape urbanization and issues related to the development of design concepts and system details are emphasized.

Keywords: urban design, climate change, water sensitive design, nature-based solutions.

INTRODUCTION

Günümüzde kent-kır dengesi kentler lehine çarpıcı bir oranda farklılaşmaktadır. Son yıllarda artan nüfus ve küresel hareketlilikle gezegenin %75'i insan etkisiyle şekillenmiştir ve yakın gelecekte bu daha da belirgin bir hal alacaktır. Ayrıca, küresel iklim değişikliği etkilerine bağlı olarak ısı adası etkisi, hava kirliliği, sel-taşkın felaketleri, yeşil alan yoksunluğu, dağılım ve bakım sorunları, biyolojik çeşitlilik kaybı, çölleşme, kuraklık ve bunlara bağlı bozulan toprak ve su kalitesi, gıda güvenliği gibi mücadele alanları kentlerin doğa ile ilişkisinin yeniden ele alınmasına gerek duyulduğunu göstermektedir.

“Herkes İçin Şehirler” konulu *Quito Deklarasyonu* (17-20 Ekim 2016, Quito, Ekvador) ile kentleşme, günümüzde sürdürülebilir ve kapsayıcı ekonomik gelişmenin, sosyal ve kültürel kalkınmanın, doğa ve çevre korumanın, sürdürülebilir kalkınmanın motoru olarak ele alınmaktadır. Kentsel Paradigma Değişimi, *Doğa Odaklı* bir kent senaryosunu ön plana çıkarmakta ve farklılıkların mekanı olan kentlerin, ekosistemi, suyu, doğal habitatları, biyolojik çeşitliliği, koruyan; sürdürülebilir tüketim ve üretim formlarını destekleyen yerleşmeler olacağı öngörülmektedir.

Ülkemizdeki kentsel alanların da genişleyeceği göz önünde bulundurulduğunda kentlerin sürdürülebilirliği için yeşil ağ sistemi günümüzün değişken ve kırılğan kent ortamında “kritik altyapılar” olarak öne çıkacaktır. Kentlerimizin içindeki ekolojik temelli sistemleri analiz etmek ve bütünlüklü hale getirmek için yeşil ağ ve yeşil altyapı çalışmaları gündeme gelmektedir. Özellikle, iklim değişikliği uyum sürecinde kentsel tasarım uygulamalarında görülebilecek enerji etkin strüktürlerden su geçirimli yüzey kaplama malzemelerine kadar detaylandırılabilir doğa-esaslı çözümlere dayanan bir yelpazede yaşam kalitesinin artmasına katkı sağlayacaktır.

Kentlerin aşırı büyüyen/ aynılan yapısına karşın kenti daha özgün, yaşanabilir ve kimlikli kılan öğeler kentin ekolojik değerleri olarak tanımlanabilecek, yeşil ağ sistemleridir. Yeşil altyapı sistemleri ve doğa-esaslı çözümlerin yol göstericiliğinde, su-duyarlı kentsel tasarım, peyzaj şehirleşmesi gibi tasarım anlayışlarının ve sistem detaylarının geliştirilmesi ile ilgili konular, son yıllarda önem taşımakta olup kent planlama pratiklerinin önemli bileşenleri olarak değer kazanmıştır.

KENT-İKLİM-EKOLOJİ

1900-2000 yüzyılı “kentsel devrim”in yüzyılıdır (UN, 1980). 1800’lerde dünya nüfusunun %3’ü, 1900’lerde %14’ü, 2000’de %47’si kentsel alanda yaşamakta ve 2050 yılında ise %72’sinin kentlerde yaşaması beklenmektedir ve Birleşmiş Milletler’in 2017 de revize ettiği

Dünya Nüfus Tahmin Raporu'na göre 2017'de 7.5 milyar olan dünya nüfusunun 2050 yılında 9.8 milyara ulaşacağı tahmin edilmektedir (UN, 2017).

Ülkemizde 50'li yıllardan itibaren devam eden hızlı kentleşme sonucunda şehirlerde yaşayan nüfusun oranı 1950 yılında %25 iken, 1980 yılında %44'e, 2000 yılında %65'e ve 2012 yılında %77'ye kadar çıkmıştır. 2016 yılı sonu itibarıyla ise dünya nüfusunun %54'ü, ülkemiz nüfusunun %88'i şehirlerde yaşamaktadır. 1984 yılında kabul edilen ilk Büyükşehir Belediyesi Yasası ile İstanbul, Ankara ve İzmir Büyükşehir Belediyesi olarak ilan edilmişlerdir. İlk on yıl içinde büyükşehir belediye sayısı 8'e, yirmi yıl içerisinde ise 16'ya yükselmiş, 2016 yılı itibarıyla 6360 sayılı Kanun kapsamında ise 30'a yükselmiş olup köylerin mahalle statüsü kazanması ile birlikte kentleşme oranı da %88'e ulaşmıştır. 30 büyükşehirdeki **16 bin 220 köyün mahalleye dönüşmesiyle** Türkiye'deki 34 bin 434 olan köy sayısı 18 bin 214 adede inmiştir. Bir başka deyişle köylerin yaklaşık %50'si mahalleye dönüştürülmüştür (T.C.Çevre ve Şehircilik Bakanlığı, 2017).

Kentlerin rolünde süregelen değişimlerin altında küresel ekonomik değişimler yatmaktadır. Geçtiğimiz elli yılda, sanayileşme ve takip eden kentleşme pratikleri ile gelişmekte olan ülkelerdeki kentlerin çoğu büyümüştür (Sassen, 1998) ve günümüz kentleri dünya kaynaklarının %75'inin tüketiminden sorumludur (Wiemann, 1996). Yine 20.yüzyılda kendini gösteren temel insan gereksinimi olan barınma ve konut sorununun anılan kentlerde gecekondulaşma ve betonlaşma yoluyla çözümlenmesi sonucu düzensiz ve plansız kentleşme ile kentsel altyapı ve kentsel çevre sorunları ortaya çıkmıştır.

İçinde yaşadığımız yüzyılın mücadelesi, bir yandan kentlerin çevresel koşullarını geliştirirken diğer yandan da sınırlı kaynaklar üzerindeki baskılarını azaltmak olacaktır. Bugün, Avrupa'daki nüfusun 2/3'ünden daha fazlasının kentsel alanlarda yaşaması, kentsel çevre kalitesinin, Avrupa kentlerinin ekonomik yenilenmesinin anahtar bir elemanı gibi algılanmasını ortaya koymaktadır (COST, 1997). Günümüzde kentleşmenin **doğal değerler** üzerindeki olumsuz etkisinin her geçen gün artması, kentleşmeye bağlı **çevresel kirliliklerin** insan sağlığı üzerindeki etkilerini arttırması gibi olumsuz gelişmeler, kenti oluşturan tüm ilgi gruplarını **"ekolojik kent yenileme ve yaşanabilir sağlıklı kent"** kavramı üzerinde çok boyutlu düşünmeye ve sorgulamaya itmekte (Karadağ, 2009) ve ortak çalışmaya ve birlikte çözüm üretmeye zorlamaktadır.

Doğal çevre koşulları şehirlerin kuruluşundaki temel etkenlerdir. Bir şehrin bulunduğu konum, topoğrafik durumu, iklim koşulları, su ögesi, bitki örtüsü ve doğal çevreden kaynaklanan veriler, o şehri diğerlerinden ayırır, tanımlar, özgün kılar, şehre kimlik verir (Deniz, 2004; Kır,

2009). Kent, doğanın kullanımını yanı sıra, insanın biçim verdiği ve kendi kültürü ile yoğurduğu bir yapay çevredir (Can, 1999; Uçkaç, 2006; Kır, 2009).

Geçmişten günümüze dek insanın doğayla karşılıklı etkileşimi sonucunda doğaya egemen olmasıyla başlayan bu yeni insan eliyle şekillenen süreç, endüstri, kentleşme ve yoğun nüfus hareketleri sonucunda çevre sorunlarını gündeme taşımıştır. Bu sorunlardan biri olan hızlı nüfus artışı, beraberinde plansız kentleşmeyi getirmektedir. Ülkemizin, BM nüfus projeksiyonlarına göre 96 milyon kişiyle 2050 yılında Dünyanın en kalabalık 19. ülkesi olacağı bildirilmektedir (UN, 2017). Dolayısıyla, kentleşme eğilimi böyle devam ederse kentleşmenin iklim sistemi üzerindeki baskılarının artması büyük bir sorun olarak karşımıza çıkacaktır. Bu durumun üç temel nedeni bulunmaktadır;

- Milyonlarca nüfusun yoğunlaştığı kentsel alanlar, iklim değişikliği sonucunda meydana gelen etki ve tehlikelerden en fazla zarar gören alanlardır. Bu etki ve tehlikelerin boyutları; kentin konumu, demografik yapısı, sosyo-ekonomik yapısı, fiziki altyapısı, yapıli çevresinin niteliği, afetlere karşı hazırlıklı olması ve kurumsal yapılanmasına bağlıdır (Yüksel, Ü.D., 2014).
- Kentsel alanlar, doğal kaynak tüketiminin %75'inden ve küresel sera gazı salımının %80'inden sorumludur.
- Kentlerdeki nüfus artışına bağlı olarak 2030 yılına kadar yapılaşmış alan miktarının gelişmekte olan ülkelerde üç kat, gelişmiş ülkelerde 2.5 kat artış göstereceği tahmin edilmektedir.

19.yy'ın sonları ve 20.yy'ın başlarında, kentsel kirliliğin insan yaşamını tehdit ettiğine dikkat çeken kent planlamacıları, yazarlar ve düşünce adamları, kentlerin sonunda kendi kendilerini yok etmesinden korkuyordu. Bugün ise, yalnızca insanlık dışı yaşama koşulları değil, aynı zamanda sürdürülemez kaynak kullanımı da kentler açısından tehdit oluşturmaktadır. Sürdürülebilir kentleşme için kentsel performans göstergeleri ve metrikler tanımlanmakta ve çeşitli indexler ve tasarım rehberleri hazırlanmaktadır (Mimar Sinan Güzel Sanatlar Üniversitesi ve T.C.Çevre ve Şehircilik Bakanlığı, 2016).

Kente etkiler iki farklı yaklaşımla ele alınabilir: (Climate Change, 2001; Carmichael, 1999; 2016/ <http://www.un.org/sustainabledevelopment>)

1. İklim sistemindeki değişikliğe göre etkiler
2. Kentin bileşenlerine göre etkiler

1.İklim sistemindeki değişikliğe göre etkiler

Bu etkiler;

- uzun yıllar ortalamalarındaki değişikliklerden
- ekstrem olaylardaki değişikliklerden dolayı ortaya çıkacaktır.

Kentlerde doğal tehlike türlerinden olan

- hidrolojik tehlikelerin (taşkın-ani taşkın, aşırı rüzgar/kıyı taşkını; kütle hareketi-kaya düşmesi, toprak kayması, göçük gibi),
- meteorolojik tehlikelerin (kasırga gibi)
- iklimsel tehlikelerin (ekstrem sıcaklıklar, kuraklık, yangın gibi) meydana gelme olasılığının yükseleceğini belirtmektedir.

2.Kentin bileşenlerine göre etkiler

- Yapılı çevreye etkiler (seller,sıcaklık)
- Altyapıya etkiler (su, kanalizasyon)
- İnsan sağlığına etkiler,
- Biyolojik çeşitliliğe etkiler,
- Hava kalitesine etkiler,

Sosyal ve ekonomik yapıya etkiler

Kentsel alanlardaki kentsel doku organizasyonları ile alt yapı sistemleri arasında bir ilişki vardır. Bu ilişki özellikle kentsel alanlardaki yeşil alanların azalması ve geçirimsiz yüzey kaplamalarının tercih edilmesi ile daha da önemli hale gelmiştir. Bu tercihler sonucunda ulaşım ve yapılaşma ile kentsel peyzaj alanlarında yüzeysel akış oluşumu meydana gelmiştir. Buna paralel olarak kısıtlılık ve problemleriyle süregiden mevcut altyapı sistemleri, ani yağışlar ile yüksek miktar ve hızda suyu yönetemez hale gelmiştir (City of Tucson AZ at <http://www.tucsonaz.gov/water/cycle>).

Bütün bu tablonun sonucunda ise; yeraltı su seviyelerinde düşme, nehir koridoru ve setinde erozyon ve kirlilik konsantrasyonu artışları (Novotny ve Olem, 1994), sel felaketleri (Samsun sel felaketi 2012, Ayamama deresi taşkını 2009, Mersin büyük sel taşkını 2001), altyapı sistemlerinde suyun toplanması, dağıtımı, içilebilir ve atık su bakımı için çok fazla enerji tüketimi¹, su havzalarında fiziksel, kimyasal ve biyolojik bozulma² ve içilebilir tatlı suyun herkes için erişilebilir olmaması türünden yakıcı problemler ile karşılaşmıştır (Sert, 2013).

Günümüzde küreselleşme temelinde sürdürülebilirlik ve dirençlilik (dayanıklılık) sıklıkla tartışılan kavramlardır. Sürdürülebilirlik üç boyutu olan (ekolojik, sosyal ve iktisadi) bir kavram olup ekolojik boyutuyla sürdürülebilirlik; “*üzerinde yaşadığımız dünyanın sahip olduğu doğal kaynakların bugünkü kuşaklar tarafından kullanılmasını ama bu kullanımın gelecek kuşakların, söz konusu kaynaklardan yararlanma imkanlarını ortadan kaldırmayacak bir düzeyde*

olması”nı ifade etmektedir (Şahin, 2011). Dirençlilik; Afet Risk Azaltma Uluslararası Ofisi (UNISDR) Hyogo Eylem Planı sonuç raporunda, “Tehlikelere maruz kalmış bir sistemin, topluluğun veya toplumun, kendi temel yapılarını ve işlevlerini koruma ve onarma dahil, bir tehlikenin etkileri karşısında zamanında ve etkin bir şekilde direnme, soğurma, uyum geliştirme ve iyileşme becerisi” olarak tanımlanmaktadır (http://dergipark.gov.tr/resilience-Recilience_Dergisi) Dirençli kentler ise, petrol üretiminin sınıra ulaşması ve iklim değişiminin baş göstermesi ile meydana gelen sorunlara çözüm üretmek için geliştirilmiş olup kentsel direnç kavramı böylelikle planlamanın içine dahil edilmiştir (Karahan, 2018).

Azaltım süreci karbondioksit salımı ve enerji tüketimi arasındaki farklı parametrelerin incelenmesi ile ortaya konulmaktadır. Bu değişkenler; (1) karbon yoğunluğu (birim enerji üretimi başına CO₂ miktarı), (2) enerji yoğunluğu (gayri safi milli hasıla başına tüketilen enerji miktarı), (3) kişi başı milli gelir ve (4) nüfus olarak belirlenebilir. Karbon yoğunluğu ve enerji yoğunluğu ülkelerin "teknolojik gelişmişlik" düzeylerinin bir göstergesi iken, gayri safi milli hasıla ise ülkenin refah seviyesini ifade etmektedir. Bu durumda, teknoloji, refah ve nüfus faktörleri karbon salımını belirlemektedir. Yapılan çalışmalar, "ekonomideki enerji yoğunluğu" ve "enerjinin karbon yoğunluğu" faktörlerinin önemini ortaya koymaktadır. Sonuç olarak, CO₂ salımını düşürmenin politik ve teknik olarak uygulanabilir yönteminin ‘düşük karbon ekonomisi’ne geçiş olduğu ve bunun da yenilenebilir enerji kaynakları ve enerji verimliliği ile sağlanabileceği açıktır (Tural, 2017). Bu kapsamda;

- Karbonun depolanması ve yutulması
- Enerji talebini azaltması (soğutma+kaynak)
- Kent ve yakın çevresinde rekreasyon olanakları sağlanarak araç talebinin azaltılması (dolaylı)
- Kent ve yakın çevresinde gıda üretimine olanak sağlanması (dolaylı) önlemleri de kentlerin ekolojik yenilenmesinde İklim Eylem Planının önerdiği stratejilerdir.

Uyum süreci açısından bakıldığında ise, iklim değişikliği göstergeleri (artan sıcaklıklar, değişen yağış döngüleri, buz ve karların erimesi ile deniz seviyesi yükselmesi vd.) etken olmaktadır. Sel ve kuraklık gibi tehlikelere neden olan aşırı hava ve iklim ile ilgili olaylar pek çok bölgede daha sık ve yoğun biçimde yaşanmaya başlamıştır ve daha da kısalan döngülerle tekrarlayacaktır. Emisyonların azaltılmasına yönelik küresel çabalar etkili olsa bile, iklim değişikliği kaçınılmazdır ve etkilerine uyum sağlamak için tamamlayıcı eylemler gerekmektedir.

İklim değişikliğinin etkilerini öngörerek; bu etkileri en aza indirmek ve uygun önlemleri almak için uyum gereklidir. Ekosistemler ve su yönetimi, afet riskinin azaltılması, kıyı bölgesi yönetimi, tarım ve kırsal kalkınma, sağlık hizmetleri, kentsel planlama ve bölgesel kalkınma gibi diğer politika alanlarında entegrasyon hayati önem taşımakta ve gerekliliği gün gittikçe artmaktadır. Eylemler, teknolojik önlemleri, ekosisteme dayalı önlemleri ve davranış değişikliklerini ele alan önlemleri içermektedir (<https://www.eea.europa.eu/tr/themes/iklim-degisikligine-uyum/intro>).

Şehir plancıları, peyzaj mimarları ve ekologlar kaybolan doğal değerleri kent içinde yeniden oluşturmanın gayreti içindedirler. “Kent içinde varlık alanı bulan yapılı çevre ve açık alanları kapsayan tüm yeşil ağ elemanları“ kavramı da bu zorunlulukların ve arayışların doğal bir sonucudur. Uyum süreci ile;

- Yüksek sıcaklıkların yönetimi,
- Su kaynakları yönetimi,
- Akarsu sellerinin etkisinin azaltılması,
- Toprak erozyonunun azaltılması,
- Kıyı taşkınlarının azaltılması,
- Canlı türlerinin yeni iklim koşullarına uyum sağlayabilmesi için mekan oluşturması gerekmektedir.

İklim değişikliği etkilerine karşı hayata geçirilecek azaltım ve uyum stratejilerinin hayata geçirilmesinde en önemli araçlardan biri yeşil altyapı planları olacaktır. Bunları destekleyecek şekilde sürdürülebilir hareketlilik ve akıllı büyüme konuları da ulaşım ve arazi kullanım kararları açısından yapılacaklar arasındadır.

İKLİM DEĞİŞİKLİĞİ İLE MÜCADELEDE KENTSEL YEŞİL ALANLARIN VE SU KORUNUMUNUN ROLÜ

Kentler, antropojenik faaliyetlerin yoğunlaştığı alanlar olmalarının yanı sıra doğal yapı ve sistemleri barındıran, kültürel ve doğal yapıların karşılıklı etkileşimini içeren ekosistemlerdir. Kentlerin ekosistem fonksiyonlarını dengeli ve sağlıklı şekilde sürdürebilmesi, kentleri ekosistem algısıyla ele alan planlama pratikleriyle mümkün olabilir (Yaman ve Doygun, 2014; U.S. Geological Survey at <https://water.usgs.gov/edu/earthgwdecline.html>).

Mekânsal Planlama Aynı Zamanda Bir Su Kullanım Kararıdır. Kent ve su planlaması sürdürülebilir bir su sisteminin inşası içinde bir madalyonun iki yüzü gibi ilişkilidir. Su yönetimi ve arazi kullanımı doğası gereği bağlantılıdır. Karada meydana gelen faaliyetler ve

işlemler doğrudan bir havzada içinde suyun kullanımını ve hareketini etkiler. Hidrolojik döngü ve arazi kullanımı arasındaki bu ilişki toprak ya da su hakkında karar verirken önemlidir. İçme suyu, yer altı suyu, yağmur suyu, su kaçakları, atık su ve yeniden kullanılan su, sürdürülebilir kent planlaması ve ekonomik kalkınma kararları hep birlikte düşünülmektedir. Böylelikle kentsel su döngüsü doğal hidrolojik ve ekolojik döngüleri tamamlar (Tamer, 2016).

Su Duyarlı Kentsel Tasarım Nedir ? (Tamer, 2016)

- Su duyarlı kentsel tasarım (WSUD) tüm suların akıllı yönetimi sayesinde sağlıklı ekosistemleri, yaşam ve geçim kaynaklarını destekleyen kentsel çevrelerin planlanması ve tasarımı için bir yaklaşımdır.
- Bu yaklaşımda su yönetimi, doğal hidrolojik ve ekolojik döngülere duyarlıdır. Kısaca kentsel su döngüsünün yönetimi, korunması ve muhafazası ile kent planlamayı bütünleştiren bir yaklaşımdır.

Su Duyarlı Kentsel Tasarım İlkeleri içinde özellikle, (Şekil 1)

- Çatılardan ve diğer yağmursuyu akışlarını toplama dahil yüzeysel akışının yeniden kullanımını sağlayacak ve kentsel gelişimden kaynaklanan yüzey akışlarındaki zirve akımları azaltacak yöntemler geliştirmek ile
- Peyzaj ve entegre su yoluyla kentsel alanlarda görsel, sosyal, kültürel ve ekolojik değerleri geliştirmek için çok amaçlı yeşil alanların tasarlanması, kentsel yeşil ağ için son derece önemli yaklaşımlardır.

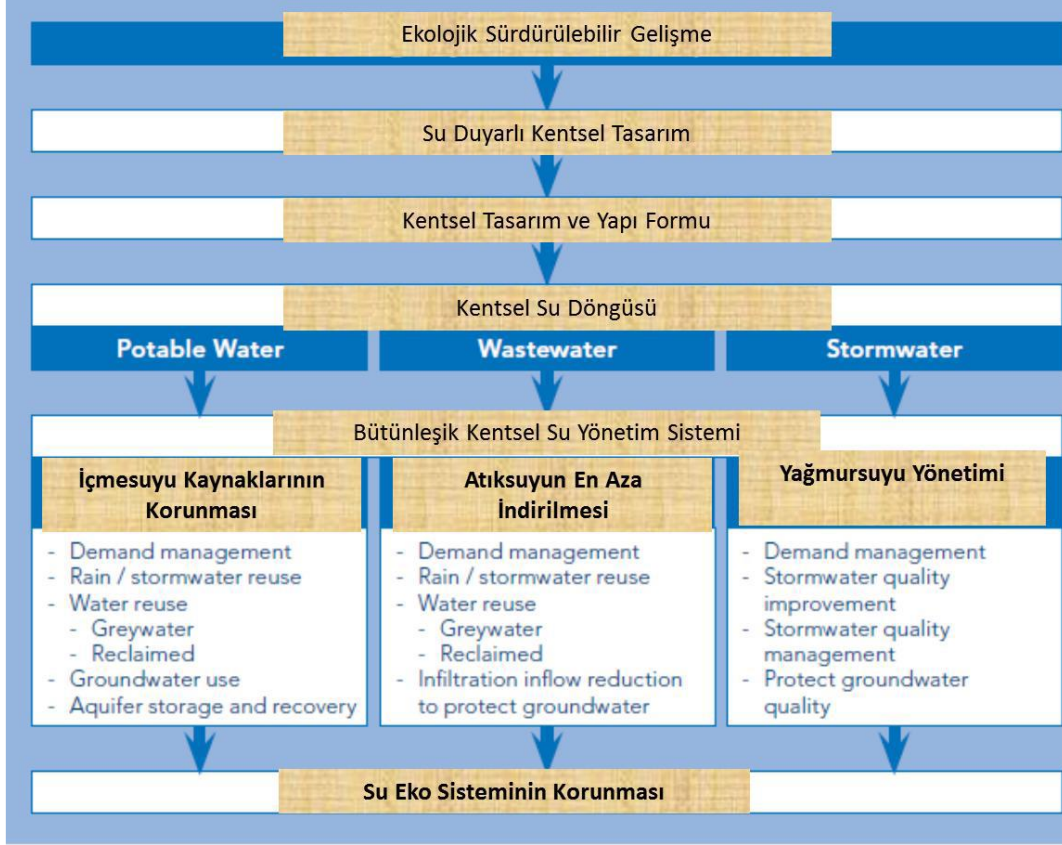
Bütünleşik kentsel su planlaması ile (Tamer, 2016)

Kentsel su talebinin yönetiminde ve arzının planlanmasında daha etkin bir yaklaşımın sağlanması amaçlanmaktadır.

- Bir havza bütünü içinde kaynakların optimal bir şekilde kullanımı, su kaynaklarının devlet ve ulusal politika bağlamında entegre yönetimini de gerektirir.
- Bu koordineli bir planlama süreci, sürdürülebilir kalkınma ve suyun toprak ve ilgili diğer kaynakların (enerji kullanımı da dahil) yönetimi ile ilişkilendirilmesidir.

Kentsel Su Verimliliği Planı

Kentsel Su verimliliği Planı, su kaynaklarını koruma çalışmaları için bir çerçeve görevi görerek kapsam, amaçlar, potansiyel sonuçlar, talebin azaltılması için belirlenen spesifik hedefler ve programların uygulanabilmesi için tavsiyeleri içerir (Durmuş, 2013).



Şekil 1: Ekolojik Sürdürülebilir Gelişme İçin Kentsel Su Döngüsü (Tamer, 2016)

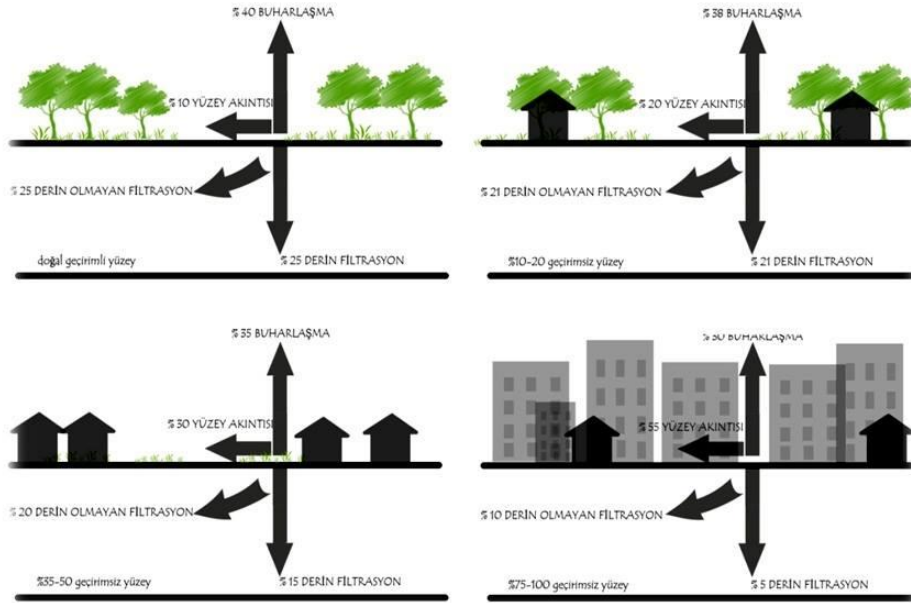
Kentsel Altyapı Sistemleri

Kentsel alanlarda geçirimsiz sert yüzeylerin aşırı bir şekilde artmasının ve açık-yeşil alanların bu artışa ters orantılı olarak azalmasının sonucunda, yağış sonrası yağmur suları toprağa yeterli oranda sızamamaktadır. Bu durumla birlikte; ortaya çıkan fazla yağmur suyu, sert yüzeyler boyunca yüzey akışa geçmekte ve düşük kotlu alanlarda toplanmaktadır (Müftüoğlu ve Perçin, 2015; Butler and Davies, 2004; Dunnett and Clayden, 2007). Kentsel yağmur suyu yönetimini; yağmurun yararlı kısmından sonra geride kalan miktarının, kentsel altyapı ve üstyapıya zarar vermeden uzaklaştırılmasını sağlayan bir dizi önlemler bütünü olarak tanımlamak mümkündür (Müftüoğlu ve Perçin, 2015; Demir, 2012).

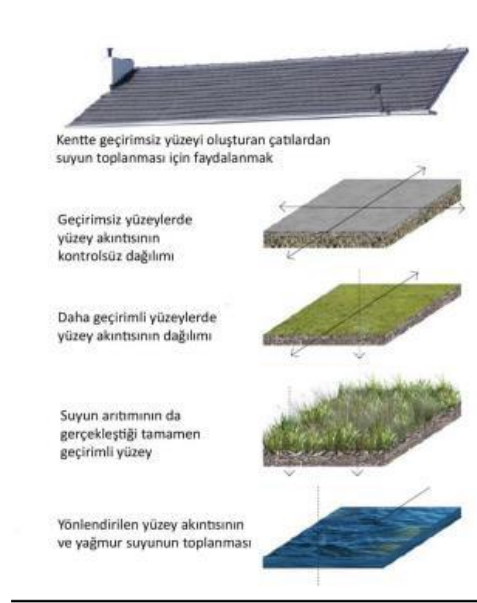
Kentte suyun hareketi, fonksiyonu ve organizasyonu açısından önerilen metodların; kentsel bir altyapı olarak çalışması üzerinden peyzajdaki su sistemleri “aktif” ve “pasif” olarak ikiye ayrılarak ikiye ayrılmıştır. Pasif yağmur suyu toplamada; arazi setleme (site grading), geçirgen yüzeyler (permeable surfaces), yönlendiriciler (diverts), bitkiler ile selsuyunu alıkoyarak, arıtarak bu peyzaj elemanlarından ve yöntemlerinden fayda sağlanmaktadır. Pasif yağmur suyu yakalamada ise arazi üzerindeki (on-site runoff) ve arazi dışındaki akıntıyı (off-site flows)

yakalamak için kullanılan uygun teknikler “pasif” manasında kullanılmaktadır (Kinkade-Levario, 2007).

Kentleşme ile birlikte nüfus artışı ve geçirimsiz yüzeyler arasında doğru bir ilişki vardır. Geçirimsiz yüzey miktarı (geçirimsiz yüzeyle kaplı olduğu yollar, çatılar, beton yüzeyler vb. alan miktarı) kentsel arazi kullanımının etkilerinde anahtar bir çevresel göstergedir (Şekil 2, 3). Doğal peyzaj geçirimsiz yüzeylerle değiştirildiğinde bu su döngüsü bozulmakta; suyun iletim ve depolanması da olumsuz etkilenmektedir. Geçirimsiz yüzeylerle kaplı kentlerde, daha az yüzey suyu, terleme ve buharlaşma için yüzeyde tutulabilir çünkü su geçirimsiz yüzeylerden hızla drene edilir. Bu da kentsel enerji dengesini etkiler.



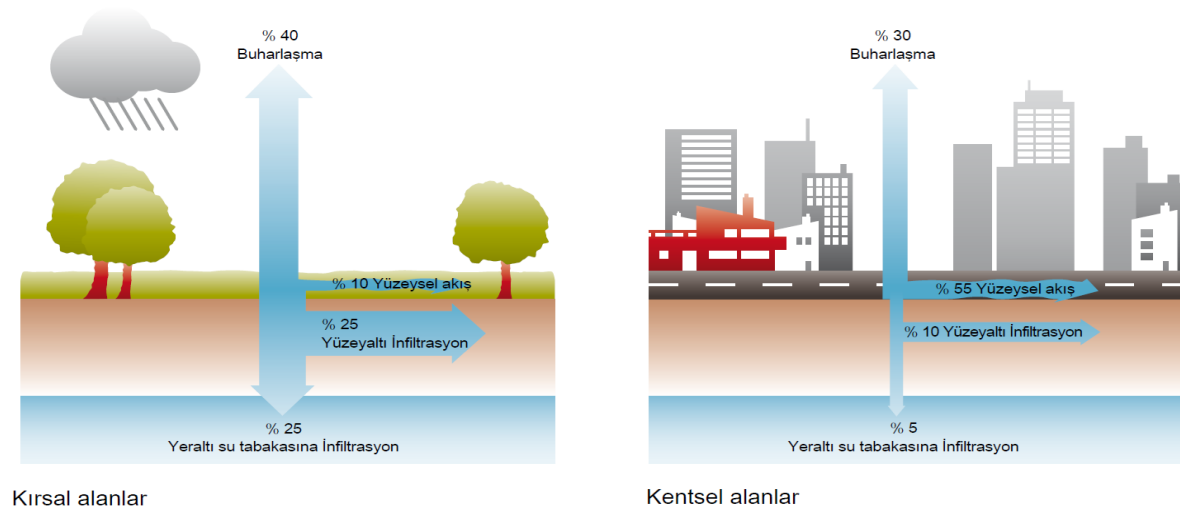
Şekil 2. Geçirimsiz yüzey ve su döngüsü ilişkisi. Prince George's County, Maryland Department of Environmental Resources (1999)'dan alınmış, Esra Sert (2013) tarafından Türkçe'ye çevrilmiş ve yeniden görselleştirilmiştir.



Şekil 3. Farklı yüzeylerdeki suyun davranışı ile ilgili görsel anlatım. Blood'un (2006) çalışmasından alınmış, Esra Sert (2013) tarafından yorumlanmış, Türkçe'ye çevirilmiştir.

Yağmur Sularının Kentlerde Kullanımı

Nüfus yoğunluğundaki hızlı artış yaşam, dolaşım ve endüstri için geniş alan ihtiyacını da beraberinde getirmektedir. Kentleşme ile yeryüzü sistematik olarak geçirimsiz hale gelmektedir (Şekil 4). Geçirimsiz yüzeylerin artması, seli önleyen doğal alanların yok olması başta olmak üzere su kalitesinin bozulmasına kadar birçok sorunla karşılaşmamıza sebep olmaktadır (Demir, 2012). Günümüzde yağmur suyu yönetimi bütüncül bir bakış açısı ile ele alınmaktadır.



Şekil 4. Kentleşmenin yağmur suyu döngüsüne etkisi (Ekinci, 2015)

Yağmur Suyu Yönetim Sistemleri,

1. Geleneksel Sistemler

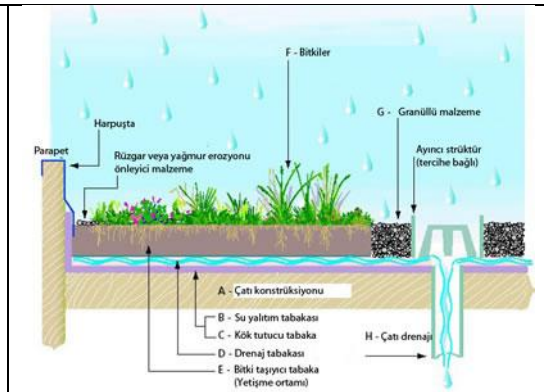
2. Sürdürülebilir Sistemler; A) Yeşil Çatılar, B) Su Geçiren Yüzey Kaplamaları C) Yeşil Çatılar, D) İnfiltrasyon Hazneleri, E) Sarnıçlar ve F) Yağmur Bahçeleri) olmak üzere iki başlık altında ele alınmaktadır.

Yeşil Çatılar, Belirtilerini günümüzde gözlemleyebildiğimiz iklim değişikliği, dünyada bilimsel bir gerçeklik olarak kabul edilmiştir. Bu açıdan yeşil çatılar ekolojik dengenin sürdürülebilirliği açısından büyük önem kazanmaktadır. Yeşil çatılar, şiddetli yağmur ve sel olayları, yüksek kent sıcaklıkları ve atmosfer kirliliği gibi iklim değişikliğine neden olan olaylar karşısında bir ölçüde çözüm sunabilirler (Dunnett and Kingsbury, 2008). Sağlıklı Kentler için Yeşil Çatılar (Green Roof for Healthy Cities) verilerine göre, şehirlerin % 75'i geçirimsiz yüzeylerle kaplıdır, çatılar bunun önemli bir kısmını oluşturmaktadır. Bu ortamda, yeşil çatılar, estetik ve pratik yararlar da sunmaktadırlar. Bitki örtüsü, kuşlar ve böcekler için yaşam ortamı sağlar, karbondioksiti ve diğer kirliliği çeker, havayı arındırır, oksijen üretir, buharlaşma yoluyla havaya serinlik katarak tüm canlıların yaşam ortamları açısından olumlu koşullar yaratırlar (Erkul ve Sönmez, 2014) (Şekil 5). Yeşil çatıların, *Çevresel ve Ekolojik, Sosyal ve Ekonomik Faydaları* gibi çok yönlü faydaları bulunmaktadır.

Yeşil çatı uygulamaları, yağışın akışa geçen miktarını ve akış hızını azaltır. Uygulama sırasında, çatı sisteminin üzerine su geçirmez membran tabakası oluşturulur. Membran tabakasının üzerine, bitki gelişimine olanak sağlayan ve fazla suyun uzaklaştırıldığı ikinci bir tabaka hazırlanır. Sistemin en üstünde bitki örtüsü bulunur. Bitki örtüsü yağmur suyunu yakalarken, gelişim tabakası suyu depolayabilmektedir. Yeşil çatıların hidrolik performansı çok fazla miktarda suyun emilimi için yeterli olmayabilir. Bu nedenle, yağmur suyunun fazlası diğer drenaj sistemlerine aktarılmalıdır (Şekil 6).



Şekil 5. Amerikan Peyzaj Mimarlığı Binası (ASLA) (Erkul ve Sönmez, 2014)



Şekil 6. Yeşil Çatı Katmanları (Thomas ve Thomas, 2003) (Erkul ve Sönmez, 2014)

Su geçiren yüzey kaplamaları, gözenekli ve geçirgen kaplamalar olarak ikiye ayrılır. Gözenekli kaplamalar çim veya çakıl yüzeyi gözenekli beton veya asfalttan oluşurken, geçirgen kaplamalar beton bloklardan oluşmaktadır. Alt tabakalara süzülmeye olanak veren bu kaplamalar, sürdürülebilir drenaj sistemlerinden biridir. Bu tür kaplamalar, yüzey suyu akış miktarının ve debisinin azaltılmasını, kentsel kirleticilerin uzaklaştırılmasını, yağış sularının geçici olarak depolanmasını ve yeraltı suyunun takviyesini sağlamaktadır. Gözenekli ve geçirgen kaplamaların kullanılmasıyla yüzey akışında % 42'ye varan bir azalma gözlenmiştir (Scholz, 2006) (Şekil 7).



Şekil 7. Gözenekli ve Geçirgen kaplamalar
(<https://www.google.com.tr/search?q=G%C3%B6zenekli+kaplamalar>)

İnfiltrasyon Hazneleri, İnfiltrasyon, yağmur suyu veya sulama sularının toprak profili boyunca yer çekiminin etkisi ile yüzeyden aşağı doğru inmesidir. Yağmur suyu infiltrasyonu, sel ve taşkın riskini azaltmak, kirlilik kontrolü sağlamak, yeraltı su tabakasının yenilenmesine katkı sağlayarak alternatif su kaynağı oluşturmak amacıyla suyun depolanarak kontrol altına alınması, sonra zemini çevreleyen toprağa sızdırılarak doğal çevreye iletilmesini sağlayan bir yağmur suyu drenaj yöntemidir. Yağmur suyunun infiltrasyon uygulamaları uzun yıllardır sel ve taşkınlardan korunma ve su kalitesinin iyileştirilmesi amacıyla kullanılmaktadır (Demir, 2012) (Şekil 8)



Şekil 8: Yağmur Suyu İnfiltrasyon Uygulamaları

Yağmur Bahçeleri; yağmur suyunun çatılar, araç yolları, yürüyüş yolları, araç parkları gibi bölgelerden akışını sağlayarak suyu bünyesinde absorbe ederler. Bu yöntem, diğer yöntemlerin aksine yağmur suyunun yeraltında toplanarak akışı azaltır (Şekil 9). Çevremizde yağmur suyunun yüzeysel akışa geçen miktarı kırsal alanlarda %10 iken, kentsel alanlarda %55'e kadar ulaşmaktadır. Yüzeysel akışa geçen yağmur suyu özellikle kentsel alanlarda beraberinde ciddi kirleticiler getirmektedir. Günümüzde yağmur suyunun yüzeysel akış ile miktarının artması, yağmur suyu akış süresinin kısalması ve işletim maliyetlerinin artması sonucunda yağmur suyu drenajı konusunda sürdürülebilir stratejiler belirlemek zorunlu hale gelmiştir.



Şekil 9. Tanner Springs Park (Pearl District (Portland –Oregon) Kentin ekolojik olarak canlandırılması projesi kapsamında düzenlenen yağmursuyu bahçesi. Kentin kuzeyinden geçen Willamette Nehrine doğru açılan yeşil koridor üzerinde planlanmış parklardan biri.

(<http://www.ramboll.com/projects/germany/tanner-springs-park>)

Yağmur suyunu yönlendirmek, yavaşlatmak ve arıtmak için kullanılan; *yağmur bahçeleri (rain gardens)*, *peyzaj kanalları (landscape swales)*, *yapılandırılmış sulak alanlar (constructed wetlands)*, *bitkilendirilmiş çatı örtüleri (vegetated roofs)* vb. pek çok sistem vardır. Son 10-15 yıldır bu anlamda kullanılan teknikler bütünü "*Düşük Etkili Tasarım*" olarak da adlandırılmaktadır. (Low Impact Development-LID). Topraktaki suyu yeraltı su seviyesi üzerine çıkarabilmek amacıyla yakalamak ve depolamak, sucul ekosistemdeki yeşil su seviyeleri ile toprak nemini arttıran uygulamalardır (Kinkade-Levario, 2007; Sert, 2013).

Yağmur bahçesi (rain garden)

Yağmur bahçesi yeryüzündeki suların herhangi bir işleme tabi tutmadan yönlendirilerek bitkilerin yetiştirilebildiği sığ çukur alanlara “yağmur bahçesi” veya diğer bir deyişle “biyolojik tutma alanları (bioretention)” olarak nitelendirilir (Demir, 2012). Yağmur bahçeleri sürdürülebilir yağmur suyu yönetimi kapsamında büyük önem taşır. Yeraltı suyunu besleyerek evapotranspirasyon oranını artırır. Yüzeysel suyu sıcaklığını ve yüzey akış hızını düşürür. Ayrıca biyolojik çeşitliliği artırarak kentsel alanlardaki ekolojik dengenin korunumunu sağlar. Yağış sonrası yüzey akış miktarının azaltılması, yeraltı suyu besleniminin iyileştirilmesi ve noktasal kaynaklı olmayan kirleticilerin alıcı sulara ulaşmadan tutulması amacıyla kullanılan yağmur bahçeleri; konut sahipleri, belediyeler ve diğer kamusal alanlar için son derece basit ve maliyet etkin bir yağmur suyu yönetimi aracıdır (Müftüoğlu ve Perçin, 2015; Jaber et al., 2012) (Şekil 10).



Şekil 10. Yağmur bahçesi (<http://www.cityofdubuque.org/>)/2016

Bu sebeplerle, “kentsel altyapı olarak peyzaj” kavramı kapsamında doğal ve fonksiyonel yeşil altyapı sistemleri oluşturmak mümkündür. Çünkü peyzaj elemanları sürdürülebilirlik kapsamında ele alındığında doğal ekolojik prensipler içerir, şöyle ki; kentsel alanlarda oluşan yüzeysel su akışlarını yönlendirmek veya suyun hareketini organize etmek doğal organizasyonlarla sağlanmalıdır. Peyzajın kendi form ve dokusunu kullanarak ve estetik özelliklerini değerlendirerek kentsel altyapı sistemlerinde yağmur suyu yönetimi sağlamak mümkündür. Yağmur suyunu yavaşlatmak, yönlendirmek, absorbe etmek, farklı rekreasyonel etkinlikleri yapmaya imkân sağlamak ancak peyzajın elemanları ile sağlanır.

Yağmur bahçesi doğrudan güneş alan bölgelere ve gölgede ağaç altlarına konumlandırılmalıdır. Düz alanlar yerine hafif eğimli bölgelerde, yeraltı su seviyesinin yüksek olduğu bölgeler tercih edilmelidir. Yağmur bahçesi büyüklüğüne karar verirken bölgenin iklim verileri özellikle yağış verileri dikkate alınmalıdır. Bahçenin derinliği Müftüoğlu ve Perçin (2015)“de verildiği gibi şu şekildedir;

- Eğer alanın eğimi %4“ten az ise, yağmur bahçesinin derinliği 7-12 cm arasında olmalıdır.
- Eğer alanın eğimi %5-7 arasında ise, yağmur bahçesinin derinliği 15-18 cm arasında olmalıdır
- Eğer alanın eğimi %8-12 arasında ise, yağmur bahçesinin derinliği 20 cm olmalıdır (The Native Plant Society of New Jersey, 2005, Doğangönül ve Doğangönül, 2008).

Bitkili su arkları

Bitkili su arkları, suyun tahliye kanalına iletilmeden önce azaltılmasını ve akış hızını azaltmayı hedefleyen açık ve sığ kanallardır. En etkin arklar genellikle %4 den az bir eğimle yapılanlardır. Eğim en fazla %6 olmalıdır. Derinlik estetik ve güvenlik gerekçeleriyle az tutulmalıdır (Karpuzcu, 2005) (Şekil 11).



Şekil 11. Bitkilendirilmiş Su Arkları

Bitkilendirilmiş çöküntü alanları (grass swales / landscape swales)

Bitkilendirilmiş kanallar ve lineer çöküntü alanlarıdır. Yağmur suyunu toplamak ve hareketini yönlendirmek, yönlendirme sırasında yavaşlatmak ve arıtarak bir gölcüğe vb. bir toplanma yerine yönlendirmek amacıyla kullanılırlar Temel fonksiyonları; akıntının hızını düşürürken bir filtreleme aracı gibi davranmalarıdır. Geçirimli döşeme ve bitkilendirilmiş çatılar bu amaca hizmet eden diğer iki metod olarak karşımıza çıkmaktadır. Çim kanallar ya da çöküntü alanları

pek çok arazi koşuluna uyumludur ve tasarıma uyarlanabilir, uygulama masrafları ise görece düşüktür (Şekil 12-13) (Sert, 2013).



Şekil 12. Kanalın her iki tarafındaki hemerocallis (zambaklar) suyun filtrelenmesini destekleyicidir. Çevredeki ofis bloklarının çatılarından suyu topluyor (Dunnet and Clayden, 2007)(Sert, 2013'den alıntı)

Bitkilendirilmiş çatı örtüleri (vegetated roof)

Kentteki sel suyu akıntısını azaltmada ciddi bir yüzdesi olan bitkilendirilmiş çatı örtüleri ya da yeşil çatılar, geçirimsiz yüzeyleri azaltmada çok etkilidir. Kentsel alanlarda bitkilendirilmiş çatı yüzeyleridir. Yaklaşık 7,62 cm. alt tabaka, ılıman iklimlerde akıntıyı yıllık %50'den fazla azaltabilmektedir (USEPA, 2000). Yeşil çatı örtüleri ince yeşil tabaka ile bitkilendirilmiş, insanın yaşama ve kullanımına imkan sağlayan mekanlardır (Şekil 14). Özellikle kentsel alanlarda ısı adası etkisinin azaltılmasında ve kent insanının daha iyi bir çevrede yaşamasında önemli bir bileşendir (Sert, 2013). Bitkilendirilmiş çatılarda kullanılacak olan drenaj sistemleri ile çatı yüzeyine düşen yağmur suyunun tahliye sistemine ulaşımı bir saat kadar geciktirebilmektedir. Bu da sel oluşum riskini azaltmada önemli bir faktördür,



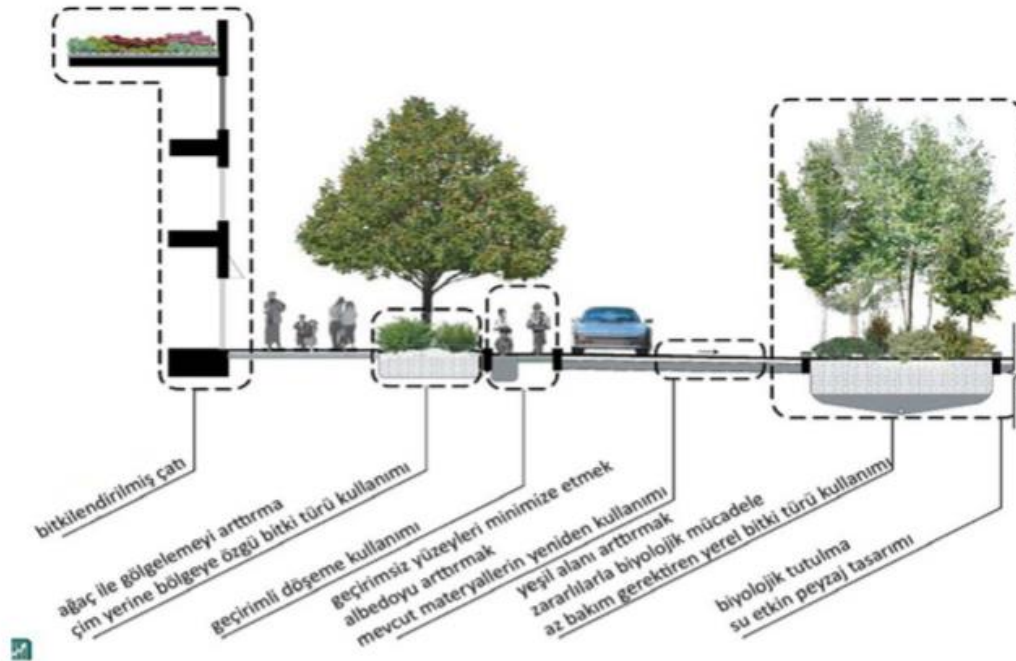
Şekil 14. Bitkilendirilmiş Çatı Örtüsü
(<http://www.emlaktasondakika.com/haber/genel/bitkilendirilmis-catilar-kuresel-isinmanin-etkilerini-azaltiyor/2016>)

Aktif (yapılandırılmış) sistemler ile yağmur suyu toplama, depolama ve filtreleme

Aktif (yapılandırılmış) sistemler ile yağmur suyunu toplama, depolama ve filtrelemede pasif sistemlerden farklı olarak strüktürel müdahale devreye girmektedir. Yani strüktürel anlamda tasarlanmış, uygulanmış sistemlerdir. Ayrıca aktif yağmur suyu toplamada su yalnızca yönlendirilmez aynı zamanda daha sonra kullanılmak üzere depolanır. Biyolojik tutulma (bioretention), Yapılandırılmış sulak alanlar (constructed wetlands) ile Yağmur tankları ve sarnıçlar (rain tanks, cisterns) örnek olarak verilebilir (Sert, 2013).

Biyolojik tutulma (bioretention) strüktürleri

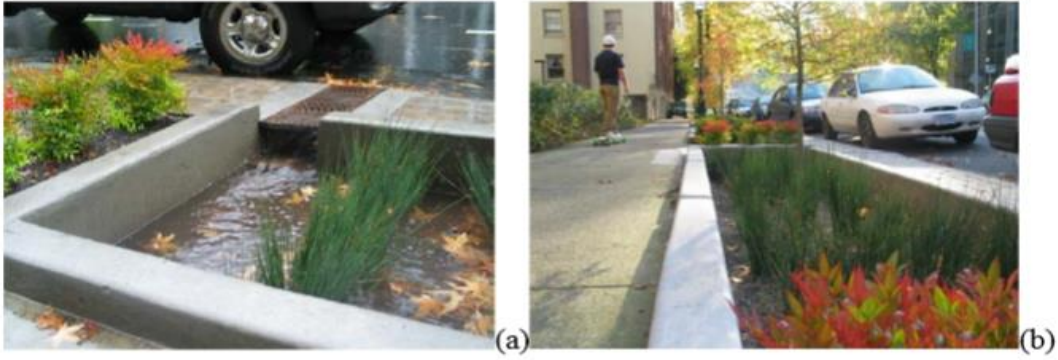
Biyolojik tutulma (bioretention); karasal temelli, bitkilerin kimyasal, biyolojik ve fiziksel özellikleri için mikroorganizmaları; sel suyu akıntısının taşıdığı kirletenlerin giderilmesi için ise toprağı kullanan su kalitesi ve nicelik kontrolü pratiğidir. Biyolojik tutulma tasarımında doğada yaşanan süreçlerin, az çok aynı süreçlerle tekrarlanmaya çalışılması izlenen bir yol olarak karşımıza çıkmaktadır. Biyolojik tutulma konsepti; yeni konut alanlarında, yeni ticaret ve endüstri alanlarında, canlandırma ve akıllı büyüme (smarth growth) projelerinde, sel suyu yönetimi kentsel iyileştirme projelerinde, sokak peyzajı projelerinde, özel konut peyzajlarında, park ve tren yollarında uygulanabilmektedir (Sert, 2013) (Şekil 15-16-17).



Şekil 15. Bu bütüncül tasarım kurgusunu sokak kesitinde anlatan görsel. New York City Department of Design + Construction (2005)'dan alınmış, Esra Sert (2013) tarafından Türkçe'ye çevrilmiştir.



Şekil 16. (a) Yoğun yağmur yağışında bitkiler geçici olarak suyun altında kalır
(b) Yağmursuz günde bitkilendirilmiş kanal ve tampon bitkilendirmesi (Sert, 2013)



Şekil 17. (a) Toplayıcı sistem ve bitkilendirilmiş kanal bağlantısı
(b) Yağmursuz günde sel suyu saksısının görünüşü (Sert, 2013)

Yapılandırılmış sulak alanlar (constructed wetlands)

Sulak alan ekosistemleri zengin biyolojik çeşitlilik ve biyolojik üretim kaynağı olma gücünü bünyelerinde barındırırlar. Sulak alanlar; yeraltındaki dengeyi koruma, erozyon kontrolü, yeraltı suyu boşaltma, rüzgarı engelleme, su baskını kontrolü, atık ve toksiklerin birikimini önleme, sahil alanları iklim dengesini sağlama, su transferi, rekreasyon ve turizme katılma ve katkının dışında çeşitli bitki ve hayvan türlerine de ev sahipliği yapar. Yapılandırılmış sulak alanlar da kentsel peyzajda şarj edilebilir geçirgen bir yüzey oluşturmaya ve benzer faydaları sağlamaya yaramaktadır (Şekil 18) (Sert, 2013).



Şekil 18. HuaXin yerleşim bölgesinin yapılandırılmış sulak alan uygulaması sırasında ve sonrasında gösteren fotoğraflar (Stokman, 2008) (Sert, 2013'den alıntı)

Yağmur tankları ve sarnıçlar (rain tanks, cisterns)

Yağmur suyunu; su zinciri, borusu vb. yardımıyla çatıdan yere indirdikten sonra suyun aktığı-iletildiği sistemin çakıllı-bitkilendirilmiş vs. alandan geçerek (genellikle uygulamalarda su direk toplanır) toplama bölümüne doğru aktarıldığı, yürürken döşemede herhangi bir engel oluşturmayacak biçimde detaylandırılabilir, bitkilerin, toprağın ve materyallerin arıtma işlevi ile birlikte düşünülmesi gereken sistemlerdir (Şekil 19) (Sert, 2013).



Şekil 19. 1990'ların öğrenci konutları Berlin, Almanya, yerleşmenin planlanmasında sürdürülebilirlik konseptini her yerde devam ettiren yağmur iniş, kanal detay ve su drenaj çözümleri görsel olarak da projeyi destekler niteliktedir (Dunnet and Clayden, 2007) (Sert, 2013' den alıntı).

EKO-KENT Kavramı Kapsamında Yapıların Ekolojik Sürdürülebilirliği

Ekolojik bilinçlenme, yapı sektöründe de binaların karbon salınımlarını ve çevreye olan olumsuz etkilerini azaltmaya yönelik çözümler bulmaya itmiştir. İnşaat sektörü de iklim değişikliğiyle mücadele için dünyada '*yeşil dönüşüm*'e girmiştir. Bu çerçevede çevre dostu, ekolojik binaların yapılması gündeme gelmiştir. Çevre dostu bina yapımına ilgi giderek artarken sürdürülebilir ilkelerle gelişim gösteren yeşil bina kavramı ortaya çıkmıştır (Akça, 2011).

Yeşil binaların yaşam dönemi boyunca sahip oldukları düşük enerji ve su tüketimi, atık yönetimi, projelerin ekosisteme olan etkisinin minimize edilmesi ve çevre dostu malzemelerin kullanımının artması gibi nedenler, performansı yüksek yeşil binaları yatırımcılar gözünde çekici hale getirmiştir. Yeşil binaların yaygınlaşmasında ve bu yaygınlaşma sürecinde binaların performanslarının somut bir şekilde belirlenebilmesinde sertifika sistemleri etkin rol oynamıştır (Çelik, 2016).

Yeşil binaların uygulamasının yaygınlaşmasını sağlamak ve teşvik etmek amacıyla; dünyadaki yeşil bina konseyleri tarafından binaların sürdürülebilirliğini bir takım standartlar çerçevesinde

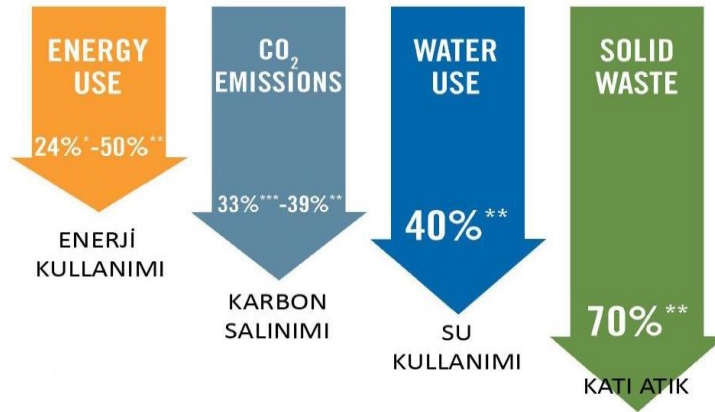
onaylayan, yeşil bina değerlendirme sistemleri yani sertifikasyon sistemleri geliştirilmiştir. Farklı ülkeler tarafından geliştirilen yeşil bina sertifika sistemlerinin başlıcaları; (Sev ve Canbay, 2009) (Şekil 20).

	1990' da İngiltere' de ortaya çıkan BREEAM, Yapı Araştırma Kurumu Çevresel Değerlendirme Metodu (BREEAM), İngiltere' de Yapı Araştırma Kurumu (BRE) tarafından geliştirilerek, 1990 yılında uygulamaya geçirilen ölçütlere dayalı değerlendirme sistemlerinin ilk örneğidir.
	1996' da Kanada da ortaya çıkan SBTOOL, SBTool (daha önceki adıyla GBTool), 1998 yılında 14 katılımcı ülke ile kurulmuş olan uluslararası bir değerlendirme sistemidir. 2008 yılında katılımcı ülke sayısını 21' e çıkartmıştır. SBTool' un hedeflediği tek başına doğrudan yapılara uygulanmayan, genel bir değerlendirme çerçevesi olup, değerlendirmede 7 performans kriteri belirlemiştir.
	1998' de Amerika Birleşik Devletleri' nde ortaya çıkan LEED, LEED Sertifikalandırma Sistemi, USGBC tarafından geliştirilerek, 1998 yılında sürdürülebilir bina endüstrisinde yeşil bina tanımlamaya ve değerlendirmeye yönelik uygulamaya geçirilen bir sistemdir.
	2003' de BREEAM' den uyarlanarak Avustralya' da oluşturulan GREENSTAR, Avustralya Yeşil Bina Konseyi (GBCA) tarafından 2003 yılında geliştirilen <i>Green Star</i> , BREEAM ile büyük benzerlik taşımakta olup, yapıların yaşam döngüsü etkilerini değerlendirmeyi hedeflemektedir.
	Alman Sürdürülebilir Bina Konseyi 2007 yılında kuruldu ve 2008 yılında Dünya Yeşil Bina Konseyi' ne üye oldu. Alman Sürdürülebilir Bina Konseyi' nin birincil hedefi, kendi sertifikasyon sisteminin kurulması ve daha sonra geliştirilmesi oldu. Bu bağlamda 2009 yılında ofis ve idare binaları için DGNB Sertifikasyon Sistemi kuruldu. Bu sistem geliştirilerek 2010 yılında mevcut ve yeni binalar, eğitim kurumları ve ticari binaları da kapsayan uluslararası bir sistem haline geldi (Anbarcı vd., 2012) .
	2004' de Japonya' da ortaya çıkan CASBEE' dir (www.cedbik.org). Japonya Sürdürülebilir Yapı Konsorsiyumu (JSBC) ve Yeşil Bina Konseyi (JaGBC) işbirliği ile 2001' de geliştirilen CASBEE, Japonya' nın yanı sıra Asya ülkelerinin de sürdürülebilirlik esaslarını dikkate alarak hazırlanmıştır.


Şekil 20. Yeşil Bina Sertifika Sistemleri İçinde Dünya'da En Çok Kabul Görenler

Günümüzde, farklı ülkeler tarafından kullanılmakta olan otuzdan fazla yerel değerlendirme sistemi vardır. Bu değerlendirme sistemleri arasında en gelişmiş kabul edilenleri, 1990 yılından itibaren kullanılmakta olan ve toplam 110.000 binayı değerlendirmek için kullanılmış, kayıtlı

olarak bekleyen yarım milyon binada da kullanılması planlanan İngiltere kökenli BREEAM (*Building Research Establishment Environmental Assessment Method*) ile 1998 yılında kullanılmaya başlanan, 91 ülkeden 35.000 binanın sertifika almak için kayıtlı olduğu ABD kökenli LEED (*Leadership in Energy and Environmental Design*) dir. Bu sistemleri Avustralya Yeşil Bina Konseyi tarafından geliştirilmiş olan Green Star ve 2009'da Almanya'da ortaya çıkan DGNB (*Deutsche Gesellschaft für Nachhaltiges Bauen*) takip etmektedir (Çelik, 2016). BREEAM, LEED, CASBEE, yeşil bina değerlendirme sertifikasyon sistemlerinin ortak ele aldığı konular; Sürdürülebilir Araziler, **Su Korunumu**, İç Hava Kalitesi, Uygun Malzeme ve Yapı Elemanı Seçilmesi, **Su Korunumunda Etkinlik**, Enerji ve Atmosferdir (Tonguç, 2012). Ülkemizde, Çevre, Şehircilik ve İklim Değişikliği Bakanlığı tarafından hazırlanan 12 Haziran 2022 tarihli '*Binalar ile Yerleşmeler için Yeşil Sertifika Yönetmeliği*' gereğince ulusal yeşil bina ve yeşil yerleşme sertifika sistemi (YES-TR) oluşturulmuştur. Türkiye'de konuyla ilgilenen bina sahipleri ve yatırımcılar, LEED veya BREEAM Yeşil Bina Değerlendirme sistemlerinden birini kullanarak binalarını sertifikalandırmayı tercih etmektedir. Şekil 21'de görüldüğü gibi, yeşil binalar enerji kullanımında %24-50, karbon salınımında %33-39, su kullanımında %40, katı atık da ise %70 tasarruf potansiyeline sahiptir. Bu da bu konudaki hassasiyeti arttırmaktadır (Erten, 2016). Ülkemizde LEED Sertifikası almış olan yapılarla ilgili örnekler Şekil 22'de verilmektedir (Çelik, 2016).



Şekil 21. Yeşil Binaların Tasarruf Potansiyeli (Erten, 2009)

		
Zorlu Center	ERKE Yeşil Akademi	Sabancı Üniversitesi Nanoteknoloji Merkezi
		
Şişecam ARGE Binası	Li-Fung Merkez Yapısı	

Şekil 22. Ülkemizde LEED Sertifikalı Yapılara Örnekler

SON SÖZ

Günümüzde artık yoğun insan kullanımına sahne olan kentlerle, ekoloji arasında nasıl bir uyum yakalanabilir sorusuna cevap aranmaktadır. Peyzaj Mimarları ve Kent Planlamacıları, azalan ve kaybolan doğal değerleri kent içinde yeniden oluşturmanın gayreti içindedirler.

Kentlerde son yıllarda dile getirilen “yeşil senaryo” ve “doğa içinde kent” kavramları da bu zorunlulukların ve arayışların doğal bir sonucudur.

19.yy’ın sonları ve 20.yy’ın başlarında, kentsel kirliliğin insan yaşamını tehdit ettiğine dikkat çeken kent planlamacıları, yazarlar ve düşünce adamları, kentlerin sonunda kendi kendilerini yok etmesinden korkuyordu. Bugün ise, yalnızca insanlık dışı yaşama koşulları değil, aynı zamanda sürdürülemez kaynak kullanımı da kentler açısından tehdit oluşturmaktadır.

Sürdürülebilir kent planlamasının ve çevre yönetiminin önündeki siyasi ve mali engelleri yıkma çabalarının ortak bir noktası vardır: görüş alışverişi yapan ve ortak çalışan kararlı insanların dinamikliği. Kentlerin insan uygarlıklarını sağlayan ve sonunda bu uygarlıkları kurtaracak işte bu insan enerjisi yoğunluğudur. Tüm anlatılanlar doğrultusunda **salt iki boyutlu imar planlarından** kentlerin geleceğini ipotek almaktan kurtaracak olan ekoloji öncelikli kentsel tasarım çözümleri gündeme gelmeli, planlama ile birlikte **eko-mühendislik** çalışmalarının birlikte yürüyeceği bir bütünsellik içinde ele alınmasını gerekmektedir.

KAYNAKLAR

Akça, “Leed Yeşil Bina Değerlendirme Sistemi Ölçütlerinin Tasarım Ölçekleri, Kavramsal Kademelenme ve Kaynak Kullanımı Düzeyinde Tutarlılığının Ölçülmesi Üzerine Bir Araştırma”, Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul, (2011).

Butler, D. & Davies, J.W., 2004. Urban Drainage, Second Edition, Spon Press, Taylor&Francis Group, London and New York, ISBN 0-203-14969-6 Master e-book ISBN, 536 p.

Can, N. (1999), Kent Kimliği, Yüksek Lisans Tezi, Gazi Üniversitesi, Ankara

Carmichael, G, 1999. The Emerging Focus of Urban Environments, Report and Proceedings of the WMO Ra II/Ra V Gaw Workshop on Urban Environment, Beijing, China, 1-4 November 1999, WMO/Td-No. 1014.

Climate Change, 2001. Intergovernmental Panel on Climate Change, UNEP, WMO, Meeting the Urban Challenge, Population Reports, Series M, Number 16 (2001).

COST,1997. Déclaration commune d'intention “pour la mise en oeuvre d'une action européenne de recherche concertée intitulée action COST E12 “Forets et Arbres de Villes”, COST 229/97, Bruxelles.1997.

Çelik, K., Leed Sertifika Sistemleri ve Türkiye’deki Uygulamalarının Değerlendirilmesi, T.C.İstanbul Kültür Üniversitesi Fen Bilimleri Enstitüsü Mimarlık Anabilim Dalı, Yapım Yönetimi ve Teknolojisi Programı, Yüksek Lisans Tezi, 2016, 183 s., İstanbul.

Demir, D., 2012. Konvansiyonel Yağmur Suyu Yönetim Sistemleri ile Sürdürülebilir Yağmur Suyu Yönetim Sistemlerinin Karşılaştırılması, İTÜ Ayazağa Yerleşkesi Örneği, İTÜ Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dalı, Yüksek Lisans Tezi, İstanbul.

Deniz, K. (2004). “Konya’da Farklı Üç Kentsel Mekanda Kent Kimliği Üzerine Bir Araştırma”, S.Ü., Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, Konya

Kır,İ., (2009). Kent Meydanlarının Kent Kimliği Üzerine Etkileri İzmir Örneği. Ege Üniversitesi Fen Bilimleri Enstitüsü Yüksek Lisans tezi (Yayınlanmamış), İzmir.

Uçkaç, L., (2006). Kentsel Tasarımın Kent Kimliği Üzerine Etkileri: Keçiören Örneği. A.Ü. Fen Bilimleri Enstitüsü Peyzaj Mimarlığı Anabilim Dalı (basılmamış doktora tezi) Ankara

Doğangönül, Ö. ve Doğangönül, C. 2008. Küçük ve Orta Ölçekli Yağmursuyu Kullanımı. 2. Baskı, Teknik Yayınevi, Ankara, s. 499.

Dunnett, N. and Clayden, A. 2007. Rain Gardens-Managing water sustainably in the garden and designed landscape. Timber Press Inc., USA, p. 186.

Dunnett, N. and Kingsbury, N., 2008, Planting Green Roofs and Living Walls, 336 p. ISBN-13: 9780881929119, Timber Press, Portland, London.

Durmuş, Ö., 2013. T.C.Bilim, Sanayi ve Teknoloji Bakanlığı, Verimlilik Genel Müdürlüğü Yayın No:720, Su Verimliliği, Ankara.

Ekinci, B., Uzman Yardımcısı, T.C.Orman ve Su İşleri Bakanlığı, Su Yönetimi Genel Müdürlüğü, Su Kaynaklarının Sürdürülebilirliği ve Dünya’daki Su Verimliliği Çalışmalarının Türkiye’de Uygulanabilirliği, 11.08.2015

Erkul, E. ve Sönmez, A., Çevre Duyarlı Mimarlık Yeşil Çatı Sistemleri ve Çevresel Etkileri, Mimarlık Dergisi, Mimarlık 375, Ocak-Şubat 2014.

Erten, D., “Çevre Dostu Yeşil Bina Sertifika Sistemi Breeam ve Ulusal Enerji Metodolojisi”, 29. Enerji Verimliliği Haftası, (2009).

Erten D. (2011), Yeşil Binalar, Sürdürülebilir Üretim ve Tüketim Yayınları V. Çevre ve Şehircilik Bakanlığı, Ankara

Jaber, F., Woodson, D., LaChance, C. and York, C. 2012. Stormwater Management: Rain Gardens, The Department of Soil and Crop Sciences and Texas A&M AgriLife Communications, The Texas A&M System, USA, p. 20.

Karpuzcu, M. (2005) Su Temini ve Çevre Sağlığı, Özal Matbaası.

Karahan, A.Ö., 2018. Dirençli Kentler Bağlamında Karaman Kentinin Değerlendirilmesi, Y.Lisans Tezi, A.Ü.Fen Bilimleri Enstitüsü Peyzaj Mimarlığı Anabilim Dalı, 254 s.

Kinkade-Levario, H., 2007, Design for Water: Rainwater Harvesting, Stormwater Catchment, and Alternate Water Reuse, New Society Publishers; 1 edition, 240 pages.

Mimar Sinan Güzel Sanatlar Üniversitesi ve T.C.Çevre ve Şehircilik Bakanlığı, 2016. Kentsel Tasarım Rehberleri Cilt I-II-III, Kentsel Tasarım Uygulama ve Araştırma Merkezi, KENTTAM, İncekara Matbaacılık, İstanbul.

Müftüoğlu, V., Perçin, H., 2015. Sürdürülebilir Kentsel Yağmur Suyu Yönetimi Kapsamında Yağmur Bahçesi. İnönü Üniversitesi Sanat Ve Tasarım Dergisi, 5(11): 27-37.

The Native Plant Society of New Jersey 2005. Rain Garden Manual for New Jersey. The Native Plant Society of New Jersey, USA, p. 24.

Novotony, V. and Olem, H. (1994) Water Quality: Prevention, Identification and Management of Diffuse Pollution. Van Nostrand Reinhold, New York, 18-25.

Sassen, S., 1998. “Urban Impacts of Economic Globalization”, Comparative Urban Studies Occasional Paper Series, No:5, Woodrow Wilson International Center for Scholars, Washington, D.C.

Scholz, M. & Grabowiecki, P. 2006. Review of Permeable Pavement Systems, Building and Environment, Elsevier Science, UK.

Sert, E., 2013. Enerji Etkin Kentsel Peyzaj Tasarımında Yağmur Suyu. İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Peyzaj Mimarlığı Bölümü, Peyzaj Mimarlığı Bölümü Anabilim Dalı, Yüksek Lisans Tezi, İstanbul.

Sev, A. ve Canbay, N., “Dünya Geneline Uygulanan Yeşil Bina Değerlendirme ve Sertifika Sistemleri”, Yapı Dergisi Yapıda Ekoloji Eki: Ekolojik Mimarlıkta Somut Adımlar (Nisan), 42-47., (2009).

Şahin, Y., 2011. Kentleşme Politikası, Murat Han Yayınevi, 2.Baskı, ISBN No: 978-605-5451-23-3, 434 s., Trabzon.

Tamer, N.G., Bugünden Yarına Kent ve Su Planlaması, Kent ve Kentliler 21.Yüzyıl için Planlama Seminerleri, A.Ü. Siyasal Bilgiler Fakültesi, 02 Haziran 2016, Cebeci/Ankara.

Thomas, M. ve Thomas R., 2003, “Green Roofs for Sustainable Cities”,

Tonguç, “Sürdürülebilir Tasarımın Okul Öncesi Eğitim Yapıları Örneğinde İrdelenmesi”, Yüksek Lisans Tezi, Kocaeli Üniversitesi, Fen Bilimleri Enstitüsü, Kocaeli, (2012).

Tural, H.N. Sürdürülebilirlik, Verimlilik, İklim ve Enerji,
<https://tr.linkedin.com/pulse/s%C3%BCrd%C3%BCr%C3%BClebilirlik-verimlilik-iklim-ve-enerji-hamdi-nadir-tural> Erişim Tarihi: Kasım, 2017.

T.C.Çevre ve Şehircilik Bakanlığı, 2017. Şehircilik Şurası Komisyon Raporları-Ekim 2017, 356 s., Ankara.

UN (United Nations)., 1980. The Growth in th World’s Urban and Rural Population 1950-2000, Population Studies, No:68, New York.

UN, (United Nations), 2017. World Population Prospects, Department of Economic and Social Affairs/Population Division, The 2017 Revision, 53 p., New York.

USEPA (United States Environmental Protection Agency). 2000., Liquid Assets 2000:America’s Wate Resources at a Turning Point, Office of Water (4101) Washington, DC 20460

Wiemann, C., 1996. “Downsizing Infrastructure”, Technology Review, May/June, 1996.

Yaman, G., Doygun, H., Yeşil Alanların Kent Ekosistemine Katkılarının Kahramanmaraş Kenti Örneği’nde İncelenmesi. II. Ulusal Akdeniz Orman ve Çevre Sempozyumu “Akdeniz ormanlarının geleceği: Sürdürülebilir toplum ve çevre” 22-24 Ekim 2014 – Isparta.

Yüksel, Ü.D., İklim Değişikliğine Yerel Çözümler: Doğal Bitki Örtüsüyle Sürdürülebilir Uygulamalar, Bölüm Adı: İklim Değişikliği ve Kentsel Alanlardaki Etkileri, 2014, Peyzaj Araştırmaları Derneği, Editör: Semiha Özdemir GÜLİN, Türkçe Bilimsel Kitap, Kontrol No: 1237227.

<http://www.ramboll.com/projects/germany/tanner-springs-park> (2016)

<http://www.cityofdubuque.org/2016>

U.S. Geological Survey at <https://water.usgs.gov/edu/earthgwdecline.html>

City of Tucson AZ at <http://www.tucsonaz.gov/water/cycle>

<http://www.un.org/sustainabledevelopment/>

<http://www.emlaktasondakika.com/haber/genel/bitkilendirilmis-catilar/2016>

[. \(https://www.eea.europa.eu/tr/themes/iklim-degisikligine-uyum/intro\).](https://www.eea.europa.eu/tr/themes/iklim-degisikligine-uyum/intro)

**MARTIN WALSER'İN “EIN FLIEHENDES PFERD” ADLI ANLATISININ VE
TIYATRO UYARLAMASININ KARŞILAŞTIRMALI BİR ANALİZİ**

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ÖZET

Dünya edebiyatında olduğu gibi, Alman edebiyatında da edebi türler arası uyarlamalara sıklıkla rastlamak mümkündür. Örneğin, romandan, öyküden tiyatro sahnesine, filme, radyo oyununa uyarlanan çok sayıda eser mevcuttur. Bu çalışmada, Alman yazar Martin Walser'in "Ein fliehendes Pferd" (Kaçan Bir At) adlı anlatısı ve eserin Ulrich Khuon tarafından kaleme alınmış olan tiyatro uyarlaması odak noktasıdır. Walser'in bu eseri Alman edebiyatına özgü bir tür olan "Novelle" (Uzun Öykü) olarak bilinmekle beraber, bu çalışmada anlatı terimi kullanılmaktadır. Roman, öykü, masal gibi türlere anlatı denmesi uygundur. 1978 yılında yayınlanmış olan bu anlatı Walser'e büyük başarı sağlamış ve en çok satan kitaplar arasına girmiştir. Daha sonraki yıllarda eserin edebi uyarlamaları da yazara başarı getirmiştir. Eserde özellikle toplum ve karşı cins ile ilişkiler içerisindeki kişisel kimlik arayışı, yaşlanma ve iletişimsizlik gibi konular ele alınmaktadır. Eserde olay bir yaz tatili döneminde dört kişi arasında cereyan etmektedir: Anlatının asıl kahramanı Helmut Halm, kırk altı yaşında bir lisede öğretmendir. Eşi Sabine ile on bir yıldır tatillerini Konstanz Gölü'nde geçirirler. Helmut'un neredeyse yirmi yıldır görüşmediği okuldan arkadaşı Klaus Buch ve eşi Helene ile de tesadüfen orada karşılaşırlar. Eser, kendini itici bulan Helmut Halm ile tam tersi, enerji dolu Klaus Buch'un birbirinden çok farklı yaşam biçimlerine sahip olan bu iki erkek karakterin ve eşlerinin olaylar örgüsü içerisinde yaşadıkları kimlik çatışmalarını ve değişimini anlatmaktadır. Bu çalışmanın amacı, metin analizi ve metin yorumu yöntemi eşliğinde Walser'in anlatısının ve tiyatro uyarlamasının karşılaştırmalı olarak ele alınarak, iki farklı tür arasındaki farklılıkları tespit etmektir. Çalışmanın sonuçlarında, tiyatro oyununun konu içeriği olarak anlatıdan çok fazla sapmadığı, sadece eserin sahneye mekansal, zamansal ve finansal koşullar nedeniyle birebir aktarılmasının mümkün olmadığı saptanmaktadır. Edebi uyarlamaların beraberinde getirdiği güçlükler de çalışmanın sonuçları arasında yer almaktadır.

Anahtar Kelimeler: Martin Walser, Edebi Uyarlama, Karşılaştırma, Metin Analizi, Metin Yorumu

A COMPARATIVE ANALYSIS OF MARTIN WALSER'S NARRATIVE "EIN FLIEHENDES PFERD" AND ITS THEATRICAL ADAPTATION

ABSTRACT

As in world literature, it is possible to frequently encounter literary genre adaptations in German literature. For example, there are many works adapted from novels, stories to the theater stage, to movies, to radio plays. In this study, the narrative of the German writer, Martin Walser, named "Ein fliehendes Pferd" (A Running Horse) and the theatrical adaptation of the work written by Ulrich Khuon are the focus. Although this work of Walser is known as "Novelle" (Long Story), which is a genre specific to German literature, the term narrative is used in this study. It is appropriate to call genres such as novels, stories, tales as narratives. Published in 1978, this work was a great success for Walser and became one of the best-selling books. This work deals with issues like personal identity, getting older and lacks in communication, especially in society and relations with the opposite sex. The event takes place between four people during a summer vacation: The main hero of the work, Helmut Halm, is a forty-six-year-old teacher in a high school. He and his wife Sabine have been spending their holidays at Lake Konstanz since eleven years. There, by chance, they meet Helmut's friend from school, Klaus Buch, whom he has not seen for almost twenty years, and his wife, Helene. The narrative tells the identity conflicts and changes experienced between Helmut Halm, who finds himself repulsive, and Klaus Buch, who is full of energy; these two male characters have very contrary lifestyles from each other. The aim of this study is to determine the differences between the two different genres by comparatively examining Walser's narrative and its theatrical adaptation, accompanied by text analysis and text interpretation methods. The results of the study show that the play did not deviate too much from the novella in terms of the subject content, only that it was not possible to transfer the work to the scene one-to-one due to spatial, temporal and financial conditions. The difficulties brought by literary adaptations are also among the results of this study.

Keywords: Martin walser, literary adaptation, comparison, text analysis, text interpretation

1. GİRİŞ

Alman yazar Martin Walser (1927-) öncelikle 1945 sonrası Alman edebiyatının temsilcileri arasında önemli bir yere sahiptir. Yazarın günümüze dek, roman, anlatı, kısa öykü, tiyatro oyunu, radyo oyunu ve deneme gibi çeşitli edebî türlerde çok sayıda eseri mevcuttur. Çoğu eserlerinde sosyal ilişkiler, kimlik arayışı, iletişimsizlik, yaşlanma ve evlilik gibi temalar ön plandadır. Gero von Wilpert Walser'in eserlerinde bireyin toplumla olan ilişkisine değinmektedir (Wilpert 1976: 734).

Bu eserler arasında 1978 yılına ait "Ein fliehendes Pferd" (Kaçan Bir At) adlı anlatısı yazara en çok başarı sağlayan eseri olması nedeniyle öne çıkmaktadır. Bu eserin değeri, sadece en çok satan kitaplar arasına girmesinden dolayı değil, aynı zamanda edebi uyarlamalarının gerçekleşmesinden dolayıdır. Eserin her hali ile başarılı olduğu bir gerçektir. Bu çalışmada, Walser'in bu eseri ve 1985 yılında Ulrich Khuon tarafından kaleme alınmış olan tiyatro uyarlaması karşılaştırmalı olarak metin analizi ve metin yorumu yöntemi eşliğinde ele alınmaktadır. Çalışmanın amaçlarının başında, iki farklı tür arası farklılıkların saptanması ve edebi uyarlamanın beraberinde getirdiği zorlukların gözler önüne serilmesi gelmektedir. Çalışma Walser'in orijinal eseri ve tiyatro uyarlamasının karşılaştırmalı olarak ele alınması ile sınırlıdır. Bu çalışma ile Walser'in eserinin daha önce dikkate alınmamış bir yönü üzerinde durulması ve bu alana ait araştırmalar içindeki bir boşluğun doldurulması hedeflenmektedir.

2. EDEBİ TÜRLER VE EDEBİ UYARLAMA

Alman edebiyatında edebî türler üç ana başlık altında toplanmaktadır. Bunlar epik, şiir ve dram olarak adlandırılmaktadır. Epik türler arasında uzun, orta uzunlukta ve kısa olmak üzere bir ayırım söz konusudur. Roman uzun türlere örnek iken, öykü kısa türlere girmektedir. Orta uzunluktaki türlere örnek olarak ise Alman edebiyatına özgü bir tür olan Novelle (Uzun Öykü) verilebilir. Novelle için öykünün uzunluğunu ve romanın kısası açıklaması yaygındır. Bununla beraber, roman, öykü ve masal gibi Novelle için de anlatı denmesi en uygundur. Bu çalışma için anlatı terimi tercih edilmektedir.

Çalışmanın odak noktasını oluşturan Walser'in "Ein fliehendes Pferd" adlı anlatısının ve bu eserin tiyatro uyarlamasının karşılaştırmalı analizi için bu iki farklı edebî türün açıklanması yerindedir. Tiyatro oyunu dram türü arasındadır ve genellikle perde, sahne, diyaloglar ve monologlardan oluşmaktadır. Gero von Wilpert Novelle ve tiyatro oyunu arasındaki yakınlığa, kardeşliğe işaret etmektedir (Wilpert 1989: 629).

Bu çalışmada önem arz eden bir diğer kavram ise edebi uyarlamadır. Bu kavram ile anlaşılan farklı edebi türler arası yapılan düzenlemelerdir. Örneğin, romandan, öyküden tiyatro sahnesine, filme, radyo oyununa uyarlamalar günümüze dek ilgi uyandırmaktadır.

3. WALSER'İN "EIN FLIEHENDES PFERD" ADLI ESERİ VE TİYATRO UYARLAMASI

Walser'in Alman vatandaşlarının yaşam krizlerini ve orta yaşlarındaki sorun alanlarını ele aldığı "Ein fliehendes Pferd" adlı eseri, sadece iki hafta içinde yarı zamanlı bir çalışma olarak ortaya çıkmıştır. Bu kadar hızlı yazılmış olmasına karşın, Walser'e büyük başarı sağlamış olması da ilginç bulunabilir. Eser 1978 yılından itibaren en çok satan kitaplar arasında yer almıştır.

Aynı şekilde bu anlatı türündeki eserin 1985 yılında dramaturg Ulrich Khuon tarafından kaleme alınmış olan tiyatro uyarlamasının da başarı getirmesi dikkat çekmektedir. Eserin iki farklı türdeki hali açısından beliren en önemli ortak nokta her iki türün de yazara başarı ve ün sağlamış olmasıdır. Anlatı dokuz bölümden ve 151 sayfadan oluşmakta ve anlatım süresi beş gündür. Khuon'un tiyatro versiyonu ise 78 sayfa halinde iki perdeden oluşmakta ve 90 dakika süreyle tiyatro severlerin beğenisine sunulmaktadır.

Eserde olay bir yaz tatili döneminde dört kişi arasında cereyan etmektedir: Anlatının asıl kahramanı Helmut Halm, kırk altı yaşında bir lisede öğretmendir. Eşi Sabine ile on bir yıldır tatillerini Konstanz Gölü'nde geçirirler. Helmut'un yirmi yıl boyunca görüşmediği eski okul arkadaşı Klaus Buch ve eşi Helene ile de tesadüfen orada karşılaşırlar. Eser, kendini itici bulan Helmut Halm ile tam tersi, enerji dolu Klaus Buch'un birbirinden çok farklı yaşam biçimlerine sahip olan bu iki erkek karakterin ve eşlerinin olaylar örgüsü içerisinde yaşadıkları kimlik çatışmalarını ve değişimini anlatmaktadır.

Anlatının birinci bölümünün başında Helmut ve eşi Sabine tatillerinin üçüncü gününün akşamı deniz kıyısında bir kafeteryada otururlar. Sabine yürüyen insanları keyifle seyrederken, Helmut yaz günü hala yanmamış soluk teni ve beyaz pantolonu yüzünden kendini bir tuhaf hisseder. Bronzlaşmış insanlar yanından geçerken ona yaklaşımları onu çok rahatsız ederken, bir taraftan da zihnini tatil evinde onu okuması için bekleyen Kierkegaard'ın günlükleri meşgul eder.

Asıl hikaye beklenmedik bir şekilde, eski bir sınıf arkadaşı olan Klaus Buch ve karısı Helene'in Helmut ve Sabine'in karşısına çıkmasıyla başlamaktadır. Anlatı ayrıca aynı akşam şarap evinde, Klaus'un yemek esnasında aniden korkmuş bir şekilde attığı çığlık ile diğer masalardaki insanların bile yerinden fırladığı bir sahneye sahiptir. Halms'in Spaniel cinsi köpeği Otto, Klaus'un elini yalar. Oyunda Otto'dan hiç bahsedilmemektedir. Bu anlaşılabilir bir durumdur;

çünkü bir köpek eğitilmiş olsa bile sahnede geniş bir seyirci kitlesi önünde beklenmedik tepkiler verebilir ve oyunun gidişatını tehlikeye sokabilir.

Ertesi gün iki aile, Klaus ve Helene'den farklı olarak Halm'lerin kendilerini büyükanne ve büyükbaba gibi hissettikleri keyifli bir yelken gezisine çıkarlar. Her şeyi hazırlamış olan Klaus, eski eşi ile gençliğinde yaşadığı mutsuz günleri ve ergenlik döneminde şahit olduğu Helmut'un cinsel başarısızlığı ile ilgili konuşur.

Anlatı ile karşılaştırıldığında, oyunda ne gezinti yeri ne de Konstanz Gölü ilk sahne olarak gösterilmektedir. İlk sahnede Helmut, gezinti yolunda yürüyüş yaptıktan sonra tatil evindeki koltuğunda oturmaktadır. Oyun doğrudan tesadüfi karşılaşmanın ertesi günü ile başlamaktadır.

Her iki tür arası paralellikler de söz konusudur. Her iki türde de birinci şahıs anlatıcıların, aşırı baskı ve çaresizlik tarafından aktif eyleme yönlendirilinceye kadar, başlangıçta olup bitenlere pasif bir şekilde maruz kaldıklarına da dikkat çekmektedir. Hem anlatının başkahramanı Helmut Halm hem de oyundaki Helmut karakteri, monologlaştırıcı bir anlatım tarzıyla okuyucuyu ve seyirciyi öznel olarak karşısına almakta ve kendi içselliklerini anlatının merkezine yerleştirmektedir. Her iki türde de birinci şahıs anlatıcıların, aşırı baskı ve çaresizlik tarafından aktif eyleme yönlendirilinceye kadar, başlangıçta olup bitenlere pasif bir şekilde maruz kaldıklarına da ortaya çıkmaktadır. İki erkek karakter arasındaki zıtlığı da artıran erotizm ya da erotik imalar üzerine sohbetler ya da fıkralar hem anlatıda hem de tiyatro oyununda gözler önüne serilmektedir.

Anlatı ile oyun arasında gösterilen paralelliklere ek olarak çarpıcı bazı farklılıklara işaret etmek gerekmektedir. Anlatının zaman uzatan bir anlatıma sahip olması dikkat çekmektedir; yani anlatı süresi, anlatım süresinden daha uzundur. Anlatı, Halms ve Buch çiftlerinin birlikte geçirdikleri beş günü, özellikle de kaçan at ve tekne enkazının olduğu sahneyi ayrıntılarıyla içermektedir. Hızlandırılmış bir anlatımın olduğu oyunda bunun mümkün olmadığını varsaymak gerekmektedir.

Bir diğer önemli fark, eylemin kapsamıdır. Anlatıda olaylar, ilk akşam mesire yeri, Halms'ın tatil evi, sonraki günlerde restoran, yürüyüş turu sırasında doğa, Konstanz Gölü ve son olarak tren gibi farklı mekanlarda gerçekleşmektedir. Anlatının aksine tiyatro oyununda anlatım yeri olarak sadece Halms'ın oturma odası sahnelenir ki bu da birçok tiyatro sahnesinin çok büyük olmamasından dolayı kolayca anlaşılabilir. Ayrıca sahne çeşitliliği, dekorasyon ve büyük finansal gereksinimler gerektirdiği için, oyunun bu oturma odası alanının dışına çıkmaması anlaşılır bir durumdur.

Yürüyüş turunun üçüncü gününde erkeklerin karşısına çıkan kaçan at aynı zamanda anlatının da başlığıdır; bu sahne tüm metin açısından önem taşımaktadır. Anlatının aksine, kaçan atla ilgili oyunda doğrudan değil, yalnızca tesadüfen bahsedilmektedir. Bu kaçan at sahnesi anlatının doruk noktasını oluşturmaktadır; oyunda ise bu sahneye yer verilmediği saptanmaktadır.

Son olarak, Halms'in Spaniel cinsi köpeği Otto'dan da bahsedilmelidir. Oyun aynı zamanda erkek ismine rağmen dişi bir Spaniel cinsi köpek olan Otto'dan da yoksundur. Kendini mükemmel bir şekilde sunan Klaus'un, yalnızca Otto'dan korkmasından dolayı bile Halms'in Spaniel cinsi köpeği anlatıda büyük önem taşımaktadır. Kitaptaki hayvanların olduğu sahneleri, eğitilmiş bir at ya da köpekle canlandırmak bile, hayvanların kalabalık karşısında içgüdüsel olarak daha da huzursuz olmalarından dolayı oldukça zordur. Bu nedenle tiyatro oyununda bu sahnelerden kaçınılmış olması gayet anlaşılmalıdır.

4. SONUÇ

Bu çalışmada Walser'in en ünlü eserleri arasında öne çıkan "Ein fliehendes Pferd" adlı anlatı ve bu eserin tiyatrodaki edebi uyarlaması karşılaştırmalı olarak analiz edilmiştir. Karşılaştırmanın sonuçları olarak her iki tür arasında benzerliklerin yanı sıra farklılıkların bulunduğu ortaya çıkmıştır.

Anlatıya kıyasla, iki perdeden oluşan tiyatro oyununda tüm öykünün kelimesi kelimesine verilmesinin mümkün olmadığı anlaşılmıştır. Oyunun anlatıdan aşırı sapmadığı görülmekle beraber, mekansal, zamansal ve aynı zamanda finansal koşullar nedeniyle eserin birebir tekrar verilmesinin mümkün olmadığı saptanmıştır.

Tüm bunlara ek olarak, edebi uyarlamaların beraberinde getirdiği güçlükler de yapılan analizler neticesinde netleşmiştir. Kaçan at sahnesinin tiyatro oyununda yer almamasının en büyük nedeninin, kocaman bir hayvanın dar bir alanda bulunmasının sakıncalı olacağı düşüncesidir. Bunun gibi, benzer durumlara yönelik dekoru uygulamak hem zaman ve hem de maddi sebeplerden dolayı çok kolay değildir.

5. KAYNAKÇA

- Khuon, U. (1985). Ein fliehendes Pferd. Frankfurt am Main: Suhrkamp.
- Klarer, M. (2011). Grundlagen der Literaturwissenschaft. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Magenau, J. (2008). Martin Walser. Reinbek bei Hamburg Rowohlt.
- Walser, M. (1978). Ein fliehendes Pferd. Frankfurt am Main: Suhrkamp.
- Wilpert, G. v. (1976). Deutsches Dichterlexikon: Biographisch-bibliographisches Handwörterbuch zur deutschen Literaturgeschichte. Stuttgart: Alfred Kröner.
- Wilpert, G. v. (1989). Sachwörterbuch der Literatur. Stuttgart: Alfred Kröner.

KENTLEŞMEDEN KAYNAKLANAN SAĞLIK SORUNLARI VE ÇÖZÜMLERİ

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ÖZET

Kentleşmenin gelişmesi, yığılmaların düzenlenmesi ile ilgili olmakla birlikte, üzerinde pek çalışılmayan, çözüm süreci zor ve uzun süren bir sorundur. Kentleşmenin en önemli rollerinden biri kentsel çevrenin kökeninden başlar. Birçok tarihsel dönemde kültürel, demografik, sosyo-ekonomik yerleşme süreçlerinde konumlarını genişletmekte, nicelik ve nitelik bakımından gelişmektedir. Yeniden yapılanma süreçleri kentlerin daha geniş bir uygarlık içinde gelişimini, yığılma çerçevesindeki kentleşme süreçlerinin yoğunluğunu etkilemektedir. Kentleşmenin ve nüfus yerleşiminin genişlemesine bağlı olarak ekonomik-sosyal ve teknik ilerlemenin, bilimin, eğitimin ve kültürün gelişmesine uygun meslekler-uzmanlıklar ve gelenekler yaratılmaktadır. Kentlerin bölgesel göçlerine bağlı olarak, yerleşim düzeyi, kentleşmenin özellikleri, türleri ve yoğunluğu çeşitlilik, eşitsizlik, çok yönlü ekonomik-sosyal ilişkiler yaratmakta, gelişmede üretim ve hizmet alanlarının yerleşim faaliyetlerinde ilerici etkinliği genişletmektedir. Modern zamanlarda şehirler. Şehirler ve şehirleşme sorunu, çeşitli bilim alanlarının, uzmanların, ekonomistlerin, coğrafyacıların vb. araştırma konusudur. Bunun nedeni, kentleşme ve bunun sonucunda oluşan kentlerin, coğrafyanın tüm dallarının incelediği devasa bir süreçler alanı olmasıdır. Günümüzde, kentsel aglomerasyon ve ulaşım-ekonomik ilişkilerin gelişmesi, şehirler ve köyler arasındaki farklılıkların azaltılması, ekonomik-sosyal yerleşim ve göç ilişkilerinin bölge ve bölge sisteminde genişlemesini sağlamaktadır.

Anahtar Kelimeler: şehirler, kentleşme, ekonomik-sosyal, kasaba ve köyler, yığılma

HEALTH PROBLEMS CAUSED BY URBANIZATION AND SOLUTIONS

ABSTRACT

Although the development of urbanization is relevant for the regulation of agglomerations, it is a problem that is hardly studied and the solution process is difficult and long-staged. One of the most important roles of urbanization starts from the origin of its urban environment. In many historical periods of cultural, demographic, socio-economic settlement processes, it expands its positions, develops in terms of quantity and quality. Reconstruction processes affect the development of cities in a wider civilization, the intensity of urbanization processes within the framework of agglomeration. In connection with the expansion of urbanization and population settlement, appropriate professions-specializations and traditions are created in accordance with the development of economic-social and technical progress, science, education and culture. Depending on the territorial migration of cities, the level of settlement, the characteristics, types, and intensity of urbanization create diversity, inequality, multifaceted economic-social relations, expand progressive activity in the activity of location of production and service areas in the development of cities in modern times. The problem of cities and urbanization is the object of research of various fields of science, specialists, economists, geographers, etc. The reason for this is that urbanization and the cities formed as a result of it are a huge field of processes studied by all branches of geography. Currently, the development of urban agglomeration and transport-economic relations, reducing the differences between cities and villages, expands economic-social settlement and migration relations in the territory and regional system.

Keywords: cities, urbanization, economic-social, towns and villages, agglomeration.

1. GİRİŞ

Kentleşme uzun zamandır insani gelişme ve ilerleme ile eş tutulmuştur, ancak son araştırmalar kentsel koşulların önemli eşitsizliklere ve sağlık sorunlarına da yol açabileceğini göstermiştir. Kentleşme, nüfusun kırsal alanlardan kentsel alanlara kitlesel hareketini ve bunun sonucunda kentsel çevrede meydana gelen fiziksel değişiklikleri ifade eder. 2019 yılında Birleşmiş Milletler tahminlerine göre dünya nüfusunun yarısından fazlası (4,2 milyar kişi) şu anda şehirlerde yoğunlaşmış durumda ve 2041 yılında bu sayının 6 milyar kişiye ulaşacağı tahmin ediliyor. Kentler tüm toplumlarda çok yönlü işlevler yerine getirir. Birçok ülkenin teknolojik gelişiminin ve ekonomik büyümesinin kalbidirler, fakat aynı zamanda yoksulluk, eşitsizlik, çevresel tehlikeler ve bulaşıcı hastalıklar için koşullar yaratırlar (Naghiyev, 2006). Çok sayıda insanın şehirlerde bir araya gelmesi, özellikle yoksullar için birçok sorun yaratır. Örneğin, kentsel gecekondu mahallelerine yerleşen birçok kırsal göçmen yanlarında ailelerini ve evcilleştirilmiş hayvanları - hem evcil hayvanlar hem de çiftlik hayvanları - getiriyor. Bu insan ve hayvan akışı, tüm göçmenleri dolaşımdaki bulaşıcı hastalıklara ve kentsel bir bulaşma döngüsü oluşturma potansiyeline karşı savunmasız hale getiriyor. Buna ek olarak, kentsel yoksulların çoğu, düzensiz, sıkışık koşullar, aşırı kalabalık, açık kanalizasyonlara yakın ve tepeler, nehir kıyıları ve heyelanlara, sellere veya endüstriyel tehlikelere eğilimli su havzaları gibi coğrafi olarak hassas alanlara sahip gecekondu mahallelerinde yaşama eğilimindedir. Tüm bu faktörler bulaşıcı ve bulaşıcı olmayan hastalıkların yayılmasına, kirliliğe, yetersiz beslenmeye, trafiğe vb. katkıda bulunur. koşullar yaratır. Yoksulların yaşadığı sorunlar diğer kent sakinlerini de etkilemektedir. Kentleşme eğilimi devam ettikçe, yayılma etkisi artmakta ve dünya nüfusunun giderek daha fazla etkilenmesiyle küresel hale gelmektedir. Kentleşmeden kaynaklanan başlıca sağlık sorunları arasında yetersiz beslenme, kirliliğe bağlı sağlık koşulları ve bulaşıcı hastalıklar, kötü sanitasyon, barınma koşulları ve ilgili sağlık koşulları sayılabilir. Halk sağlığı sistemlerini ve kaynaklarını zorlamanın yanı sıra, bireysel yaşam kalitesi de doğrudan etkilenir (Balayev, 1998).

2. KENTLEŞMENİN BESLENME ÜZERİNDEKİ ETKİSİ

Kentleşme, yoksulların beslenme sağlığını olumsuz etkiliyor. Şehirlerdeki sınırlı finansal kaynaklar ve daha yüksek gıda fiyatları ile, şehirli yoksulların besleyici bir diyeti yoktur, bu da hastalığa, iştah kaybına ve etkilenenler arasında besinlerin zayıf emilimine yol açar. Ayrıca çevre kirliliği de yetersiz beslenmeye neden olur; sokak yemekleri genellikle hijyenik olmayan koşullarda hazırlanır ve bu da gıda kaynaklı hastalıklara (örn. botulizm, salmonelloz ve şigeloz) yol açar. Şehir sakinleri ayrıca, büyüyen bir küresel halk sağlığı sorunu olan aşırı

beslenme ve obeziteden muzdariptir. Obezite ve diğer yaşam tarzı koşulları kronik hastalıklara (kanser, diyabet ve kalp hastalığı gibi) katkıda bulunur. Aynı zamanda Dünya Sağlık Örgütü, yoksul ülkelerde diyabet, kardiyovasküler hastalık, kanser, hipertansiyon ve inme gibi bulaşıcı olmayan hastalıklara neden olan obezite salgını konusunda alarma geçiyor. Obezite, tarihsel olarak bollukla karşılanan artan kalori alımı ve azalan fiziksel aktivite tarafından yönlendirilir. Gelişmekte olan ülkelerin kentleşmiş bölgelerindeki insanlar, fiziksel alan eksikliği, işte sürekli oturma, aşırı enerji alımı ve düşük enerji harcaması nedeniyle zaten obeziteye karşı savunmasızdır. Bu alanlarda, rekreasyon faaliyetleri de dahil olmak üzere altyapı için genellikle çok az alan vardır. Ayrıca, gelişmiş ülkelerde olduğu gibi, gelişmekte olan ülkelerde de, büyük işverenler genellikle merkezlerini kentsel başkentlere yerleştirir ve işler giderek daha yerleşik hale gelir. Obezite geliştirme riskiyle ilişkili bir başka suçlu, beslenme geçişi olarak da bilinen gıda alımındaki değişiktir (hayvansal gıdaların, şekerin, katı ve sıvı yağların, rafine tahılların ve işlenmiş gıdaların artan tüketimi). Örneğin Çin'de son 30 yılda kentleşmeyle birlikte beslenme kalıpları değişti ve obezitede artışa yol açtı. 2003 yılında Dünya Sağlık Örgütü, gelişmiş ve yüksek oranda kentleşmiş ülkelerde 300 milyondan fazla insanın etkilendiğini tahmin etti. O zamandan beri obezite prevalansı her geçen gün artmaya devam etmektedir (Balayev, 2007). Kirlilik, kentsel çevrede sağlığın bozulmasına yol açan bir başka önemli faktördür. Örneğin, Dünya Sağlık Örgütü, iç ve dış hava kirliliğinin 6,5 milyon insanı (tüm küresel ölümlerin %11,6'sı) öldürdüğünü ve hava kirliliğine bağlı ölümlerin yaklaşık %90'ının düşük ve orta gelirli ülkelerde meydana geldiğini tahmin ediyor. Yetersiz beslenme ve kirlilik, kentsel popülasyonlarda bulaşıcı hastalıkların üçüncü ana nedenine katkıda bulunur. Yoksullar sıkışık koşullarda, açık kanalizasyonların ve durgun suların yakınında yaşıyor ve bu nedenle sürekli olarak sağlıksız atıklara maruz kalıyor. Yetersiz sanitasyon, helmintlerin ve diğer bağırsak parazitlerinin bulaşmasına yol açabilir. Sıkışık kentsel alanlardan kaynaklanan kirlilik (örn. CO₂ emisyonları), yerel ve küresel iklim değişikliğine ve doğrudan sağlık sorunlarına neden olur.

3. KENTLEŞME VE HASTALIKLAR

İnsandan insana bulaşmaya ek olarak, hayvanlar ve böcekler, kentsel ortamlarda hastalık için etkili vektörler olarak hareket eder ve zengin ve fakir arasında ayrım yapmaz. Tüberküloz (TB), sıtma, kolera, dang humması ve diğerleri gibi kentsel bulaşıcı hastalıkların etkisi iyi belgelenmiştir ve küresel bir endişe kaynağıdır. Ulusal ve uluslararası araştırmacılar ve politika yapıcılar, bu tür sorunları çözmek için çeşitli stratejiler araştırdılar, ancak sorunlar hala devam ediyor. Örneğin, mega şehirler için çözümler üzerine yapılan araştırmalar 1990'ların başına

kadar uzanıyor. Bu çalışmalar, kirliliğin, güvenilir olmayan elektriğin ve işlevsiz altyapının öncelikli girişimler olduğu sonucuna vardı; yine de hava kirliliği, şehirlerdeki su kalitesi, tıkanıklık, afet yönetimi sorunları, kentsel ulaşımın sağlığa etkileri ve karayolu trafiği ciddi sorunlar olarak karşımıza çıkmaktadır (Balayev, 1996). İstatistikler, Hindistan'ın Mumbai kentinde demiryollarında her gün en az 10 kişinin öldüğünü gösteriyor. Vietnam, trafik kazalarının sayısında çarpıcı bir artış gösteren bir başka ülke örneğidir. Ülke altyapısının iyileştirilmesi, artan araç sayısı ve caddelerdeki insan trafiğini karşılayamamaktadır. Rapora göre Vietnam'ın 95 milyon nüfusu ve yollarında 18 milyondan fazla motosiklet bulunuyor. Kentleşme geri döndürülemez bir olgu haline gelse de, kentin sorunlarını çözmek için yoksulların sosyo-ekonomik durumunu iyileştirmek gibi sorunun temel nedenlerini ele almalıyız. Kırsal alanlardaki koşullar düzelene kadar insanlar şehirlere göç etmeye devam edecek. Kırsal kalkınmanın zorlukları göz önüne alındığında, temel nedenler yakın gelecekte ortadan kaldırılamaz, bu nedenle hükümetler ve kalkınma ajansları, çarpık kentleşmeyi azaltmaya çalışırken, kentleşmenin zorluklarına uyum sağlamaya odaklanmalıdır.

SONUÇLAR VE ÖNERİLER

- 1) Nesiller arası yoksulluk döngülerini kırmak için erişilebilir istihdam, topluluk katılımı, hareketlilik/göç ve sosyal geçiş dahil olmak üzere tüm yaşam yolculuklarını dikkate alan politikalar;
- 2) Daha yakıt tasarruflu araçların kullanımını azaltmak veya teşvik etmek ve ayrıca bisiklete binmeyi, yürümeyi ve diğer insan taşıma biçimlerini teşvik etmek için tasarlanmış kentsel alan ve araç kullanımı üzerindeki vergiler gibi kentsel çevre sorunlarını ele alan politikalar;
- 3) Gıda güvenliğini iyileştirmek için kırsal ve kentsel alanlar arasında daha fazla işbirliğinin planlanması (örneğin, şehir merkezlerine yerel olarak üretilmiş, işlenmemiş ve düşük maliyetli gıda tedarik eden çiftçilere yönelik sübvansiyonlar);
- 4) Kent sakinleri arasındaki refah eşitsizliğini azaltmak için sosyal koruma ve genel sağlık hizmetleri.

KAYNAKLAR

1. Nüfus Coğrafyası Vusat Efendiyev, Salih Nagiyev Bakü-2006
2. R.A. Balayev "Kentleşme bölgelerinin gıda sorunu" Bakü-1998
3. R.A. Balayev "Kentleşme, kentsel ekonomi ve gıda sorunu" Bakü-2007
4. R.A. Balayev "Kentleşme koşullarında gıda sorununun ve tarımsal sanayi üretiminin gelişiminin modellenmesi" Bakü-1996

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ÖZET

Algler, biyoyakıtlar, farmasötikler, nutrasötikler ve yemler ile ilgili çeşitli endüstriler için bir biyolojik kaynak olarak muazzam bir potansiyele sahip olan, ökaryotik yeşil algler ve Gram-negatif prokaryotik siyanobakterileri içeren, her yerde bulunan bir fotosentetik organizmalar grubudur. Artan küresel gıda talebi, tarımsal yoğunlaşmanın artan çevresel etkileri ve küresel iklimimizde gelecekteki değişikliklerin belirsizliği arasındaki gerilim, tarımsal üretkenliği sürdürmek ve artırmak için sürdürülebilir alternatiflere yönelik hayati bir ihtiyacı vurgulamaktadır. Siyanobakteriler de dahil olmak üzere mikroalgler, tarımsal ortamlardaki uygulamalar için çok çeşitli seçeneklere sahip yenilenebilir kaynaklardır. Mikroalgler, aynı zamanda çok çeşitli biyoteknolojik uygulamalara sahip olan önemli biyojeokimyasal döngüleri düzenleyen önemli mikroorganizmalardır. Bu derleme çalışması, mikroalglerin tarımdaki uygulamalarının bitkilerin gelişimine ve verimine olan etkilerini araştırılması amacıyla hazırlanmış olup gelecekte yapılacak olan çalışmalara genel bir bakış sunmaktadır.

Anahtar Kelimeler: Alg, Mikroalg, Gübre, Toprak Düzenleyici, Kimyasal Gübreleme

USE OF MICROALGAE IN AGRICULTURE

ABSTRACT

Algae are a ubiquitous group of photosynthetic organisms that include eukaryotic green algae and Gram-negative prokaryotic cyanobacteria, with enormous potential as a biological resource for a variety of industries related to biofuels, pharmaceuticals, nutraceuticals and feeds. The tension between rising global food demand, the increasing environmental impacts of agricultural intensification, and the uncertainty of future changes in our global climate highlight a vital need for sustainable alternatives to sustain and increase agricultural productivity. Microalgae, including cyanobacteria, are renewable resources with a wide variety of options for applications in agricultural environments. Microalgae are important microorganisms that regulate important biogeochemical cycles, which also have a wide variety of biotechnological applications. This review study has been prepared to investigate the effects of microalgae applications in agriculture on the growth and yield of plants and provides an overview of future studies.

Keywords: Algae, Microalgae, Fertilizer, Soil Conditioner, Chemical Fertilization

1. GİRİŞ

Algler yaklaşık 3,5 milyar yıl önceye dayanan oluşumlarından yararlanılarak tarih boyunca medeniyetler tarafından ilaç ve gıda yapımında kullanılmışlardır (Sukatar, 2002). Algler, Dünya üzerindeki fotosentetik üretkenliğin yaklaşık %50'sine katkıda bulunur ve mikroskobik tek hücrelerden makroskobik kümeler ve 60 m uzunluğa kadar büyüeyebilen deniz yosunlarının karmaşık yapraklı yapılarına kadar uzanır (Barsanti ve Gualtieri Algae, 2014).

Alg kültürlerinin kullanımına yönelik ticari ilginin geçmişi, bunların *Chlorella* ve *Dunaliella* gibi farklı mikroalg suşları kullanılarak WWT'ye uygulanmasıyla yaklaşık 75 yılı kapsamaktadır (Abdel-Raouf ve diğerleri, 2012).

Algler genellikle makroalgler ve mikroalgler olarak ikiye ayrılır. Makroalgler, grubun tatlı su ve deniz türlerini içermesine rağmen, genellikle deniz yosunu olarak bilinen büyük alglerdir (Ge ve Madill, 2018; Lawton ve ark., 2018). Tarımda, deniz yosunu özleri tohum çimlenmesini, bitki büyümesini ve bitki savunmasını uyarır (Abouraïcha ve ark., 2015; Battacharyya ve ark., 2015). Mikroalgler, fitoplanktonun bir parçası olarak ve tüm toprak türleri dahil olmak üzere hemen hemen tüm kara, su ve hava altı yüzeylerinde bulunan mikroskobik alglerdir (Metting ve Pyne, 1986; Tomaselli, 2004). Mikroalgler ya gram-negatif bakteriler olan siyanobakteriler (Cyanophyta ve Prochlorophyta bölümleri) gibi prokaryotiktir ya da örneğin yeşil algler (Chlorophyta bölümü), diyatomlar (Bacillariophyceae sınıfı), öjenoidler (Euglenophyceae sınıfı) ve dinoflagellatlar (Dinophyta bölümü) gibi ökaryotiktir. (Mata ve ark., 2010; Barsanti ve ark., 2014; Nilsson ve ark., 2006). Geleneksel olarak mavi-yeşil algler olarak bilinen siyanobakteriler (sınıf Cyanophyceae), tek hücreli veya iplikçikler halinde, tek başına veya kolonilerde küme halinde, serbest yaşayan organizmalar olarak veya diyatomlar, eğrelti otları, likenler, sikadlar, süngerler, bitkiler ve diğer organizmalardır (Barsanti ve Gualtieri, 2006; Adams ve ark., 1999; Rai ve ark., 2000).

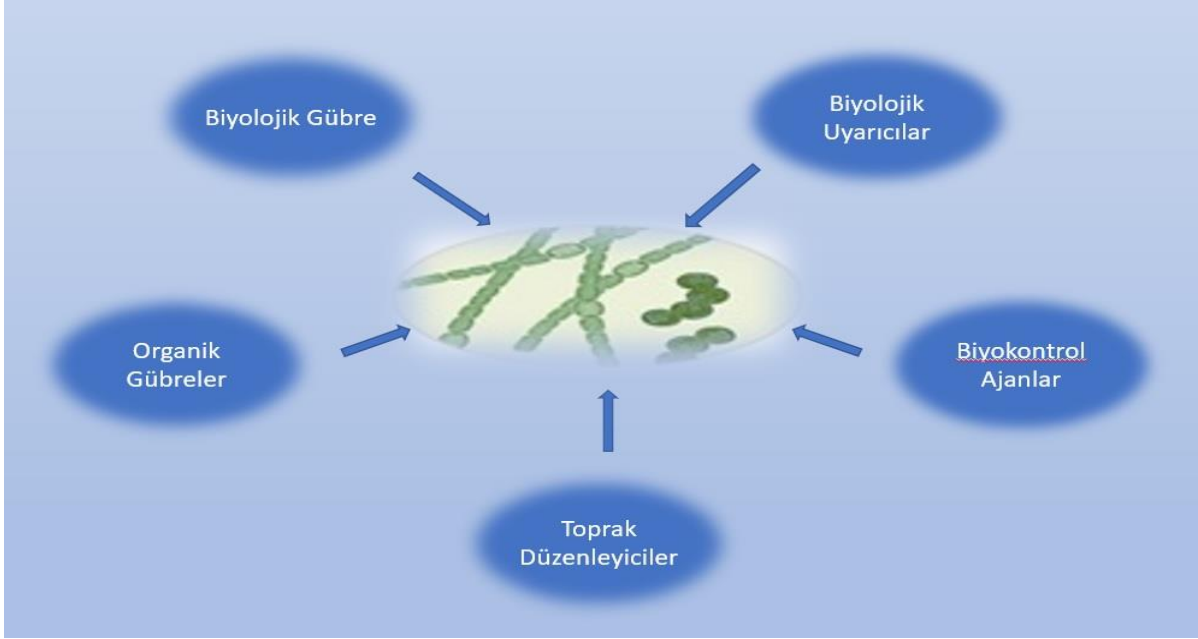
Mikroalgler güneş ışığını kullanarak fotosentez yoluyla karbondioksiti hayvan yemi, yiyecek, biyokimyasal ve potansiyel biyoyakıtlara dönüştürebilirler. Azot fiksasyonu yapabilmeleri sayesinde biyogübre olarakta kullanılmaktadır (Giorgos ve diğerleri, 2014). Mikroalgler ve siyanobakteriler, gıda, yem, biyoyakıtlar ve kimyasal üretime yönelik artan küresel talepleri karşılamak için yeni bir biyokütle kaynağı olarak günümüzde ilgi görmektedir (Giorgos ve diğerleri, 2014). Mikroalgler, tarımda çok yönlü potansiyel kaynaklardır. Geleneksel kimyasal gübrelerin aksine, mikroalgler toprağa uygulandığında bir organik karbon (C) girdisi haline gelmektedir (Renuka ve ark., 2018; Ibraheem, 2007). Biyogübreler, mahsullerin üretkenliğini verimli ve çevre dostu bir şekilde artırarak ve böylece sentetik gübrelerin zararlı etkilerini azaltarak sürdürülebilir tarımda hayati bir rol oynadıkları için bugünlerde kapsamlı araştırmalar yapılmaktadır (Singh ve ark., 2011).

Mikroalgler, atmosferdeki karbonu potansiyel ürünlere dönüştürerek azaltmak için çeşitli şekillerde kullanılabilen fotosentetik mikroorganizmalar olduklarından, iklim değişikliğini hafifletmeye yardımcı olmak için gelecekteki kilit katkılardan biridir (Ryckebosch ve ark., 2011; Molazadeh ve ark., 2019). Mikroalglerin bir karbon bileşikleri kaynağı olarak değeri, farmasötik ve kozmetikte kullanılabilmeleri nedeniyle daha da geliştirilmiştir (Das ve ark.,

2011). Mikroalg biyoteknolojisi, örneğin elektrik üretimi gibi atık su arıtma (WWT) teknolojilerinde de geliştirilmektedir (Jaiswal ve ark., 2020).

Mikroalgler her yerde bulunur. Fotosentetik tek hücreli yaşam, tüm bitki yaşamının ataları olan son derece çeşitli ve sağlam organizmalardır. Bu nedenle, dünyanın hemen hemen her yerinde bulunabilirler ve sıcaklıklar, tuzluluklar, pH değerleri ve farklı ışık yoğunlukları gibi birçok faktörün geniş bir yelpazesini tolere ettikleri için çeşitli çevresel koşullarda büyüebilirler (Barsanti ve ark., 2008). Ayrıca deniz suyunda (Rodriguez-L'opez ve ark., 2020), tatlı suda (Sangapillai ve Marimuthu, 2019), atık suda bulunan artık besinlerde (Graham ve Wilcox, 2000; Barsanti ve Gualtieri, 2006; S'anchez-Bayo ve ark., 2020) ve çöller gibi sıcak ekosistemlerden soğuk ekosistemlere kadar birçok ekosistemler bulunmaktadır.

Mikroalg biyokütlesinin (veya mikroalg bileşiklerinin) topraklar ve bitkiler üzerindeki çeşitli etkileri ve farklı etki mekanizmaları, mikroalglerden toprak iyileştirme, mahsul üretimi ve koruma uygulamalarıyla potansiyel olarak çok sayıda tarımsal ürün turetme fırsatı sunar (Şekil 1).



Şekil 1. Toprak iyileştirme ve mahsul üretimi ve koruması için potansiyel tarımsal mikroalg türevi ürünler (Alvarez ve ark., 2021).

Toprağa uygulandığında (mikroalgal toprak ıslahı), mikroalg biyokütlesi toprak yapısı ve su tutma gibi fiziksel özellikleri iyileştirebilir ve bu nedenle potansiyel uygulamalardan biri olan toprak düzenleyiciler grubuna girmektedir (Ibraheem, 2007; Metting ve Rayburn, 1983; Rossi ve ark., 2017). Gelişen tanımlara göre mikroalgler, canlı mikroorganizmaların aktivitesi yoluyla bitkiye besin tedarikini veya kullanılabilirliğini artırarak toprağa, tohumlara veya bitki yüzeylerine uygulandığında bitki büyümesini iyileştiren mikrobiyal aşılama ajanları olarak da kullanılabilir. (Mahanty ve ark., 2017; Vessey, 2003). Bu aktiviteler, örneğin nitrojen (N₂)-sabitlenme ve P-çözünürleştirmeyi içerir (Mahanty ve ark., 2017; Vessey, 2003).

2. MİKROALGLER İLE İLGİLİ YAPILAN ÇALIŞMALAR

Tarımda yüksek verimi garanti etmek için kimyasal gübre uygulaması kullanılır; Ancak bu kimyasalların gelişigüzel kullanımı farklı çevre sorunlarına yol açmaktadır. Biyogübrelerin kullanımını, kimyasal gübrelerin etkisini azaltmak için çevre dostu bir alternatif olarak ortaya çıkmıştır. Keşfedilen çok sayıda biyogübre arasında, fotosentetik mikroorganizmalara dayalı formülasyonlar, toprak verimliliğini iyileştiren ve mahsul verimini artıran performansları nedeniyle öne çıkmaktadır (Guo ve ark., 2020).

Dineshkumar ve ark. (2018), farklı dozlarda alg biyokütlesi kullanarak çeltiğin büyümesini ve üretkenliğini değerlendirmişlerdir. Araştırmacılar alg biyokütle kullanımının bitkinin performansı üzerinde olumlu bir etkiye sahip olduğunu ve verimde %21'lik bir artış sağladığını bildirmiştir. Bu sonuçlar, Jochum ve ark. (2018)'nin yürüttükleri çalışma ile de doğrulanmıştır. Jochum ve ekibi mikroalg biyokütlesi (polikültür) ile işlenen çeltiklerden üretilen ile yapılan işleme benzer veya bundan daha iyi sonuçlar almıştır. Mikroalg veya siyanobakteriyel uygulamalarla mahsul verimliliğindeki bu artış, farklı mekanizmalarla gerçekleşmektedir. Siyanobakterilerdeki heterosistler, nitrojenaz için uygun bir mikro-anaerobik ortam sağlama ve filamanın geri kalanındaki vejetatif hücreler için birleşik azot ve esas olarak glutamin sağlama işlevine sahiptir (Vieira, 2017).

Osman ve ark. (2010) heterosistik ve heterosistik olmayan siyanobakterileri ve bunların bezelye verimi için biyolojik gübreleme potansiyelini değerlendirmişlerdir. Araştırmacılar siyanobakterilerin aşılmasının kimyasal gübre kullanımını %50 oranında azalttığını ve tohumların besin değerini iyileştirdiğini bildirmişlerdir. Mikroalg ve siyanobakteriyel biyofilm oluşumu, kararlı biyogübreler üretebilecek şekilde biyokömür gibi katı desteklerin kullanılmasıyla artırılabilir sonucuna varmışlardır (Kholssi ve ark., 2018). Bir başka çalışmada ise Bidyarani ve ark. (2016), heterosist oluşturan iki biyofilm aşılama formülasyonu kullanarak (*Anabaena laxa* ve *Anabaena laxa* ve *A. tolorusa* – *mesorhizobium ciceri* karışımı) nohut bitkilerinin büyümesini ve üretkenliğini değerlendirirken, çalışmalarında özellikle azot fiksasyonu, toprak klorofil içeriği ve toprakta bulunan azot miktarında gerçekleşen bitki büyümesi, besin emilimi ve mikrobiyolojik aktiviteler arasında pozitif bir korelasyon olduğunu bildirmişlerdir. Son zamanlarda Del Monte Fresh Produce Inc., Arizona'nın ham çölünde alg biyogübreleri ile saha denemeleri yapmıştır. Yosunla gübreleme, terk edilmiş arazinin ıslahına yardımcı olduğunu, fosil girdilerini en aza indirdi ve mahsul verimliliğini artırdığı sonucuna varmışlardır (Anonim,2022).

Mikroalgler tarımda biyogübre, toprak düzenleyici ve yem katkı maddesi olarak kullanılabilir. Azot bağlama yeteneğine sahip siyanobakterilerden oluşan biyogübreler, pirinç ekimi için tropik ovalarda kullanılmaktadır. Ökaryotik tek hücreli yeşil mikroalgler, ılıman iklim bölgelerinde erozyonu kontrol etmek için yağmurlama ile sulanan tarım arazilerine toprak düzenleyici maddeler olarak uygulanmaktadır (Shaaban, 2001). Mikroalglerin toprak katkı maddesi olarak kullanılmasının, kök hacimlerini, klorofil oluşumunu, sürgünlerin kuru ağırlığını ve bitki boyunu önemli ölçüde iyileştirdiğini gözlemlemiştir (Shaaban, 2001).

Kholssi ve ark. (2019), Buğday bitkisinde bitki büyümesini teşvik etmek için mikroalg kullanılmışlardır. Uygulanan *Chlorella sorokiniana* şuşları ile bitkilerdeki toplam kuru

biyokütle oranı %30 arttırmakla birlikte, bitkilerin toprak üstü kısmını %22 ve toprak altı kısmını ise %51 oranında arttırmıştır. Doğrudan besin zenginleştirmeye ek olarak, mikroalgler bitkiler için büyüme destekleyicileri olarak işlev gören bileşikler üretebilir (Guo ve ark., 2020). Mutale-joan ve ark. (2020), mikroalglerden elde edilen 18 ham biyolojik ekstraktın domates bitkilerinin büyümesi üzerindeki biyostimülatör etkilerini araştırmış ve burada kök ve sürgün uzunluğunun yanı sıra kuru ağırlıkta iyileşme gözlemlemişlerdir. Farklı bir çalışmada ise yeşil mikroalg *Chlorella vulgaris*'in havayla kurutulmuş veya püskürtülerek kurutulmuş biyokütlesi uygulaması yapılmıştır. Sonuç olarak mısır ve buğdayda bitki parametrelerini geliştirmiştir (Abdel-Rahim ve Hamed, 2013; Dineshkumar ve ark., 2019).

3. SONUÇ

Topraktaki besin noksanlığı, tarımda verim artışını sınırlayan kritik faktörlerden biridir. Bu sorunu aşmak için üreticiler geleneksel tarımda sentetik gübreler yoğun olarak kullanmaktadırlar. Bununla birlikte, bu geleneksel tarım modeli, tarım arazilerindeki toprak kalitesi ve mikrobiyal ekolojik denge bozulmasına rağmen bitkilere kimyasal gübre uygulaması ile besin sağlarlar. Ayrıca, kimyasal gübrelerin üretimi yüksek elektrik enerjisi tüketimine sahip olamakta ve bu da dünya çapında yoğun karbon emisyonuna neden olur.

Mikroalgler kimyasal gübrelerin ve böcek ilaçlarının yerini alma konusunda yüksek bir potansiyele sahiptir. Bu durumda mikroalgin kullanımı, pestisitler ve hidrokarbon kirleticiler gibi toprağa eklenen kimyasal gübrelerin bir kısmını kısmen değiştirme ve azaltma kapasitesi ile desteklenmektedir. Bu nedenle, kültür bitkilerine temel besin maddelerini sağlayan çevre dostu bir model, modern tarımın gelişimi için önemlidir. Açıklanan tüm avantajlara ek olarak, mikroalg kültürlerinin çevreye zararlı bileşiklerin uzaklaştırılması için fiziksel ve kimyasal işlemlere bir alternatif oluşturduğunu vurgulamak önemlidir.

KAYNAKÇA

- Abouraïcha, E., El Alaoui-Talibi, Z., El Boutachfaiti, R., Petit, E., Courtois, B., Courtois, J., El Modafar, C., 2015. Induction of natural defense and protection against *Penicillium expansum* and *Botrytis cinerea* in apple fruit in response to bioelicitors isolated from green algae, *Sci. Hortic. (Amsterdam)*. 181, 121–128, <https://doi.org/10.1016/j.scienta.2014.11.002>.
- Abdel-Rahim, E. F. M., Hamed, S. M., 2013. Efficacy of *Anabaena flos aquae* alga against larvae of the cotton leaf worm, *Spodoptera littoralis* (Boisd.), *Egypt. J. Biol. Pest Control* 23 (1), 1–7.
- Abdel-Raouf, N., Al-Homaidan, A. A., Ibraheem, I.B.M., 2012. Microalgae and wastewater treatment. *Saudi J. Biol. Sci.* 19, 257–275. <https://doi.org/10.1016/j.sjbs.2012.04.005>.
- Adams, D., Duggan, P., 1999. Tansley Review No. 107. Heterocyst and akinete differentiation in cyanobacteria, *New Phytol.* 144 (1), 3–33, <https://doi.org/10.1046/j.1469-8137.1999.00505.x>.
- Alvarez, A. L., Weyers, S. L., Goemann, H. M., Peyton, B. M., & Gardner, R. D., 2021. Microalgae, soil and plants: A critical review of microalgae as renewable resources for agriculture. *Algal Research*, 54, 102200.
- Anonim, 2022. Date, P.E., Final report for LNC15-375. <https://projects.sare.org/project-reports/lnc15-366/>
- Barsanti, L., Gualtieri, P., 2006. *Algae: Anatomy, Biochemistry, and Biotechnology*. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
- Barsanti, L., Coltelli, P., Evangelista, V., Frassanito, A.M., Passarelli, V., Vesentini, N., Gualtieri, P., 2008. Oddities and curiosities in the algal world. In: Evangelista, V., Barsanti, L., Frassanito, A.M., Passarelli, V., Gualtieri, P. (Eds.), *Algal Toxins: Nature, Occurrence, Effect and Detection*. NATO Science for Peace and Security Series A: Chemistry and Biology. Springer, Dordrecht, pp. 353–391. https://doi.org/10.1007/978-1-4020-8480-5_17.
- Barsanti, L., Gualtieri, P., 2014. *Anatomy, Biochemistry, and Biotechnology*, 2nd, CRC Press, Taylor & Francis Group, Boca Raton, FL, USA, pp. 1–48.
- Battacharyya, D., Babgohari, M. Z., Rathor, P., Prithiviraj, B., 2015. Seaweed extracts as biostimulants in horticulture, *Sci. Hortic. (Amsterdam)*. 196, 39–48, <https://doi.org/10.1016/j.scienta.2015.09.012>.
- Bidyarani, N., Prasanna, R., Babu, S., Hossain, F., Saxena, A. K., 2016. Enhancement of plant growth and yields in Chickpea (*Cicer arietinum* L.) through novel cyanobacterial and biofilmed inoculants. *Microbiol. Res.* 188–189, 97–105. <https://doi.org/10.1016/j.micres.2016.04.005>.
- Das, P., Aziz, S. S., Obbard, J. P., 2011. Two phase microalgae growth in the open system for enhanced lipid productivity. *Renew. Energy* 36, 2524–2528. <https://doi.org/10.1016/j.renene.2011.02.002>.
- Dineshkumar, R., Kumaravel, R., Gopalsamy, J., Sikder, M. N. A., Sampathkumar, P., 2018. Microalgae as bio-fertilizers for rice growth and seed yield productivity. *Waste. Biomass. Valor.* 9, 793–800. <https://doi.org/10.1007/s12649-017-9873-5>.

- Dineshkumar, R., Subramanian, J., Gopalsamy, J., Jayasingam, P., Arumugam, A., Kannadasan, S., Sampathkumar, P., 2019. The impact of using microalgae as biofertilizer in maize (*Zea mays* L.), *Waste and Biomass Valorization* 10, 1101–1110, <https://doi.org/10.1007/s12649-017-0123-7>.
- Food, Health and High Value Products. Springer, Singapore City, pp. 397–411. https://doi.org/10.1007/978-981-15-0169-2_12.
- Guo, S., Wang, P., Wang, X., Zou, M., Liu, C., Hao, J., 2020. Microalgae as biofertilizer in modern agriculture. In: Alam, M.A., Xu, J.L., Wang, Z. (Eds.), *Microalgae Biotechnology for Food, Health and High Value Products*. Springer, Singapore City, pp. 397–411. https://doi.org/10.1007/978-981-15-0169-2_12.
- Ge, S., Madill, M., Champagne, P., 2018. Use of freshwater macroalgae *Spirogyra* sp. for the treatment of municipal wastewaters and biomass production for biofuel applications, *Biomass Bioenergy* 111, 213–223, <https://doi.org/10.1016/j.biombioe.2017.03.014>.
- Giorgos, M., Dries, V., Koenraad, M., 2014. Microalgal and cyanobacterial cultivation: the supply of nutrients. *Water Res.* 65, 186–202. <https://doi.org/10.1016/j.watres.2014.07.025>.
- Graham, L. E., Wilcox, L. W., 2000. *Algae*. Prentice Hall, Upper Saddle River, NJ.
- Guo, S., Wang, P., Wang, X., Zou, M., Liu, C., Hao, J., 2020. Microalgae as biofertilizer in modern agriculture. In: Alam, M.A., Xu, J.L., Wang, Z. (Eds.), *Microalgae Biotechnology for*
- Ibraheem, I. B. M., 2007. Cyanobacteria as alternative biological conditioners for bioremediation of barren soil, Egypt. *J. Phycol.* 8, 99–117, <https://doi.org/10.21608/EGYJS.2007.114548>.
- Jaiswal, K.K., Kumar, V., Vlaskin, M. S., Sharma, N., Rautela, I., Nanda, M., Arora, N., Singh, A., Chauhan, P. K., 2020. Microalgae fuel cell for wastewater treatment: recent advances and challenges. *J. Water. Process. Eng.* 38, 101549 <https://doi.org/10.1016/j.jwpe.2020.101549>.
- Jochum, M., Moncayo, L. P., Jo, Y. K., 2018. Microalgal cultivation for biofertilization in rice plants using a vertical semi-closed airlift photobioreactor. *PloS One* 13, e0203456. <https://doi.org/10.1371/journal.pone.0203456>.
- Kholssi, R., Marks, E. A. N., Montero, O., Mat´e, A. P., Debdoubi, A., Rad, C., 2018. The growth of filamentous microalgae is increased on biochar solid supports. *Biocatal. Agric. Biotechnol.* 13, 182–185. <https://doi.org/10.1016/j.bcab.2017.12.011>.
- Kholssi, R., Marks, E. A. N., Miñ´on, J., Montero, O., Debdoubi, A., Rad, C., 2019. Biofertilizing effect of *Chlorella sorokiniana* suspensions on wheat growth. *J. Plant Growth Regul.* 38, 644–649. <https://doi.org/10.1007/s00344-018-9879-7>.
- Lawton, R. J., de Nys, R., Paul, N. A., 2013. Selecting reliable and robust freshwater macroalgae for biomass applications, *PLoS One* 8 (5) e64168, <https://doi.org/10.1371/journal.pone.0064168>.
- Mahanty, T., Bhattacharjee, S., Goswami, M., Bhattacharyya, P., Das, B., Ghosh, A., Tribedi, P., 2017. Biofertilizers: a potential approach for sustainable agriculture development, *Environ. Sci. Pollut. Res.* 24, 3315–3335, <https://doi.org/10.1007/s11356-016-8104-0>.

- Mata, T. M., Martins, A. A., Caetano, N. S., 2010. Microalgae for biodiesel production and other applications: a review, *Renew. Sust. Energ. Rev.* 14, 217–232, <https://doi.org/10.1016/j.rser.2009.07.020>.
- Metting, B., Rayburn, W. R., 1983. The influence of a microalgal conditioner on selected Washington soils: an empirical study, *Soil Sci. Soc. Am. J.* 47, 682–685, <https://doi.org/10.2136/sssaj1983.03615995004700040015x>.
- Metting, B., Pyne, J. W., 1986. Biologically active compounds from microalgae, *Enzym. Microb. Technol.* 8, 386–394, [https://doi.org/10.1016/0141-0229\(86\)90144-4](https://doi.org/10.1016/0141-0229(86)90144-4).
- Mutale-joan, C., Redouane, B., Najib, E., Yassine, K., Lyamlouli, K., Laila, S., Zeroual, Y., Hicham, E. A., 2020. Screening of microalgae liquid extracts for their bio stimulant properties on plant growth, nutrient uptake and metabolite profile of *Solanum lycopersicum* L. *Sci. Rep.* 10, 2820. <https://doi.org/10.1038/s41598-020-59840-4>.
- Molazadeh, M., Ahmadzadeh, H., Pourianfar, H. R., Lyon, S., Rampelotto, P. H., 2019. The use of microalgae for coupling wastewater treatment with CO₂ biofixation. *Front Bioeng. Biotechnol.* 7, 42. <https://doi.org/10.3389/fbioe.2019.00042>.
- Nilsson, M., Rasmussen, U., Bergman, B., 2006. Cyanobacterial chemotaxis to extracts of host and nonhost plants, *FEMS Microbiol. Ecol.* 55, 382–390, <https://doi.org/10.1111/j.1574-6941.2005.00043.x>.
- Osman, M. E. H., El-Sheekh, M. M., El-Naggar, A. H., Gheda, S. F., 2010. Effect of two species of cyanobacteria as biofertilizers on some metabolic activities, growth, and yield of pea plant. *Biol. Fertil. Soils* 46, 861–875. <https://doi.org/10.1007/s00374-010-0491-7>.
- Rossi, F., Li, H., Liu, Y., De Philippis, R., 2017. Cyanobacterial inoculation (cyanobacterisation): perspectives for the development of a standardized multifunctional technology for soil fertilization and desertification reversal, *Earth-Science Rev.* 171, 28–43, <https://doi.org/10.1016/j.earscirev.2017.05.006>.
- Rai, A. N., Soderback, E., Bergman, B., 2000. Cyanobacterium-plant symbioses. *New Phytol.* 147 (3), 449–481, <https://doi.org/10.1046/j.1469-8137.2000.00720.x>.
- Renuka, N., Guldhe, A., Prasanna, R., Singh, P., Bux, F., 2018. Microalgae as multifunctional options in modern agriculture: current trends, prospects and challenges, *Biotechnol. Adv.* 36, 1255–1273, <https://doi.org/10.1016/j.biotechadv.2018.04.004>.
- Rodríguez-L'opez, A., Fern'andez-Acero, F. J., Andr'es-Vallejo, R., Guarnizo-García, P., Macías-Sanchez, M. D., Gutiérrez-Dias, M., Burgos-Rodríguez, S., 2020. Optimization of outdoor cultivation of the marine microalga *Nannochloropsis gaditana* in flat-panel reactors using industrial exhaust flue gases. *J. Appl. Phycol.* 32, 809–819. <https://doi.org/10.1007/s10811-019-01990-8>.
- Ryckebosch, E., Muylaert, K., Foubert, I., 2011. Optimization of an analytical procedure for extraction of lipids from microalgae. *J. Am. Oil Chem. Soc.* 89, 189–198. <https://doi.org/10.1007/s11746-011-1903-z>.
- Sangapillai, K., Marimuthu, T., 2019. Isolation and selection of growth medium for freshwater microalgae *Asterarcys quadricellulare* for maximum biomass production. *Water Sci. Technol.* 80, 2027–2036. <https://doi.org/10.2166/wst.2020.015>.

- S´anchez-Bayo, A., Morales, V., Rodríguez, R., Vicente, G., Bautista, L. F., 2020. Cultivation of microalgae and cyanobacteria: effect of operating conditions on growth and biomass composition. *Molecules* 25, 2834. <https://doi.org/10.3390/molecules25122834>.
- Shaaban, M. M., 2001. Nutritional status and growth of maize plants as affected by green microalgae as soil additives. *J Biol Sci*, 1, 475–9.
- Singh, D. P., Prabha, R., Yandigeri, M. S., and Arora, D. K., 2011. Cyanobacteria-mediated phenylpropanoids and phytohormones in rice (*Oryza sativa*) enhance plant growth and stress tolerance. *Antonie Van Leeuwenhoek*, 100(4): p. 557-568
- Sukatar, A., 2002. Alg Kültür Yöntemleri, Ege Üni. Fen Fak. Kitaplar Serisi No:184
- Tomaselli, L., 2004. The microalgal cell, in: A. Richmond (Ed.), *Handbook of Microalgal Culture: Biotechnology and Applied Phycology*, Blackwell Science Ltd., Oxford, UK, pp. 3–19.
- Vessey, J., 2003. Plant growth promoting rhizobacteria as biofertilizers, *Plant Soil* 255 (2003) 571–586, <https://doi.org/10.1023/A:1026037216893>.
- Vieira, R. F., 2017. *Ciclo Do Nitrogênio Em Sistemas Agrícolas*. Embrapa, Brasília.

**KÜLTÜREL MİRAS TURİZMİ KAPSAMINDA KUZEY KIBRIS'IN YENİLEBİLİR
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ÖZET

Kuzey Kıbrıs sahibi olduğu coğrafi konum ile birçok yenilebilir doğal ot çeşitliliğine sahiptir. Adanın sahibi olduğu coğrafi özellikler ve iklimsel etmenler yenilebilir otların çeşitliliğinde en önemli etmen olarak karşımıza çıkar. Bu otların değerlendirilip Kıbrıs mutfak kültürüne kazandırılması ise adanın yüzyıllar içinde birçok farklı medeniyete ev sahipliği yapması ile açıklanabilir. Kıbrıs, neolitik çağdan günümüze kadar uzanan tarihi boyunca jeopolitik konumunun önemi sebebiyle de her zaman bölgedeki en güçlü uygarlıkların ilgisini çekmiş ve dönem dönem bir çoğunun egemenliği altına girmiştir. Bu medeniyetler Mısırlılar, Hititler, Fenikeliler, Asurlar, Persler, Makedonyalılar, İyonyalılar, Ptolemeler, Romalılar, Bizanslılar, Lüzinyanlar, Venedikliler ve Türkler olarak sayılabilir. Farklı bir çok medeniyete ev sahipliği yapan Kıbrıs kimi zaman kültürünü bu medeniyetlere yansıtmış kimi zamanda bu medeniyetlerin kültürlerinden etkilenmiştir. Bu karşılıklı etkileşim adanın gastronomi kültürüne de yansımış ve doğal ortamlarında yetişen otların farklı pişiriliş şekilleri Kıbrısın somut olmayan kültürel mirasının bir parçası haline gelmiştir. Bölgedeki çeşitlilik yöre halkının yemek kültürüne de yansımıştır. Adada sık tüketilen yenilebilir otlar incelendiğinde, Ayrelli, Yumurta otu, Kara ot (gara tiken- sahura), Gaz Ayağı, Dirigungullo (ince yapraklı bir bitki), Girdama (Kıyı Koruğu), Gafgarıt (bir tür yabani enginar), Yabani Ispanak, Badayidano, Raica, Cinara, Gömeç, Gabbar, Hosdez, Lapsana, Çitlemit ilk akla gelen otlar arasında yer alır. Çalışmada adanın yenilebilir doğal otlarına, bu otların kullanım şekillerine, ayrıca yine bu otların kültürel miras açısından önemine değinilmiş, kültürel miras turizmine kazandırılması açısından önerilere yer verilmiştir.

Anahtar Kelimeler: Yenilebilir Otlar, Kültürel Miras, Kuzey Kıbrıs.

**EDIBLE PLANTS OF NORTHERN CYPRUS WITHIN THE SCOPE OF CULTURAL
HERITAGE TOURISM**

ABSTRACT

Northern Cyprus has many edible natural grass varieties with its geographical location. The geographical features and climatic factors of the island are the most important factors in the diversity of edible grasses. The fact that these herbs were evaluated and brought to the Cypriot culinary culture can be explained by the fact that the island has hosted many different civilizations over the centuries. Cyprus has always attracted the attention of the most powerful civilizations in the region, due to the importance of its geopolitical position throughout its history from the Neolithic Age to the present, and has come under the rule of many from time to time. These civilizations can be counted as Egyptians, Hittites, Phoenicians, Assyrians, Persians, Macedonians, Ionians, Ptolemies, Romans, Lusignans, Venetians, Byzantines, and Turks. Cyprus, which has hosted many different civilizations, has sometimes reflected its culture to these civilizations and sometimes has been influenced by the cultures of these civilizations. This mutual interaction is also reflected in the gastronomic culture of the island, and the different ways of cooking herbs grown in their natural environment have become a part of the intangible cultural heritage of Cyprus. The diversity in the region is also reflected in the food culture of the local people. When the edible herbs that are consumed frequently on the island are examined, it is seen that Ayrelli, Egg grass, Black grass (gara tiken- sahura), Gaz Ayağı, Dirigungullo (a thin-leaved plant), Girdama (Coastal Grove), Gafgarit (a kind of wild artichoke), Wild Spinach, Badayidano, Raica, Cinara, Gömeç, Gabbar, Hosdez, Lapsana, Çitlemit are among the herbs that come to mind first. In the study, the edible natural grasses of the island, the ways of use of these herbs, as well as the importance of these herbs in terms of cultural heritage are mentioned, and suggestions are given in terms of bringing them into cultural heritage tourism.

Keywords: Edible Plants, Cultural Heritage, North Cyprus.

GİRİŞ

Dünyanın sekseninci (<https://vividmaps.com>), Akdeniz'in ise Sicilya ve Sardunya'dan sonra üçüncü büyük adası (Kaplunan, 2018) olma özelliği taşıyan Kıbrıs adası Akdeniz'in kuzey doğusunda, Eski Dünya Karaları adı ile de bilinen Avrupa, Asya ve Afrika kıtalarının kavşak noktasında yer almaktadır (İlseven, Hıdırer ve Tümer, 2014). Adanın yüzölçümü, 9251 km² olup uzunluğu doğu-batı ucu arasındaki maksimum uzunluğu 225 km ve genişliği ise 96,5 km'dir (<https://users.metu.edu.tr>). Kuzey Kıbrıs'ın toplam yüzölçümü ise 3242 km²'dir. Kuzeyinde Türkiye (70 km), doğusunda Suriye (102 km.) ve Lübnan (165 km) güney doğusunda İsrail (233 km), kuzey batısında Yunanistan (835 km), güneyinde ise Güney Kıbrıs Rum Yönetimi ve Mısır (347 km) ile Mısır yer alır. (<https://pio.mfa.gov.ct.tr>). Kıbrıs, 34°33' ve 35°41' Kuzey enlemleri ve 32°16' ve 34°36' Doğu boylamları arasında yer alan adada (Koday, 1998) bulunduğu konum itibariyle Akdeniz iklimi hüküm sürmektedir. Genel olarak haziran ayında başlayıp eylül ayına kadar süren yaz dönemi sıcak ve kurak hava şartları hakimken kasım ayından mart ayına kadarki süre içerisinde serin ve nemli kış şartları meydana gelmektedir. Ekim, nisan ve mayıs aylarında kendini gösteren sonbahar ve ilkbahar mevsimlerinde ise yüksek oranda değişkenliğe sahip yağış ve sıcaklık özelliği görülür. Adadaki yıllık yağışın %60'ı aralık-şubat ayları arasında yer alırken yaz yağmurları yok denecek kadar azdır. Kıbrıs adasındaki tarım için yetersiz su kaynakları ve genel iklim düzensizliği sebebiyle genellikle olarak kuru tarım tercih edilmektedir. Ada, tarihin farklı dönemlerinde, yaşanan yağış yetersizliği sebebiyle oluşan kuraklık sebebiyle ziraatla geçimini sağlayan yerel halkın bazı dönemlerde kıtlıkla karşılaşmasına neden olmuştur. Yağış yetersizliğinin yoğun olarak görüldüğü özellikle Venedik döneminde peş peşe yedi yıl süren kurak dönemlerin yaşandığı ve bu dönemlerin oldukça sık aralıklarla tekrarlanmasının ardından göçlerin artarak nüfusun azalmasına sebebiyet verdiği bilinmektedir (Çelik, 2014, s.500). Kuzey Kıbrıs'ın hava sıcaklığı yıllık ortalama 19,0 °C'dir. Yıl boyunca en sıcak aylar temmuz-ağustos ayları (gölgede 37,0°C-40,0°C), yılın en soğuk ayı ise genellikle ocak ayıdır (9,0°C-12,0°C) ve yılın en soğuk geceleri de çoğunlukla bu ayda görülür (Yorgancı, 2004).

Kıbrıs'ta insan yaşamına ait izlere ilk olarak Neolitik Çağ'da rastlanmaktadır. Adaya Anadolu ve Suriye topraklarından gelen ilk insanların Neolitik kültürü taşıdıkları tahmin edilmektedir (<https://users.metu.edu.tr>). MÖ 1450'li yıllara gelindiğinde dönemin en güçlü devletlerinden olan Eski Mısır, Suriye topraklarını kontrol altına almış ve Doğu Akdeniz'e tamamen hâkim olabilmek için Kıbrıs'ı da topraklarına katmaya karar vermiştir. Tarih boyunca Kıbrıs'ı üç kez

adayı hakimiyetine alan Mısırlılar, ilk hakimiyetlerini III. Tutmosis döneminde elde etmişlerdir (Gürgen, 2017). Etiler olarak da bilinen Hititlerin, Mısır ile aralarındaki rekabet Kıbrıs'a yansımış, İmparator IV. Tuthaliya zamanında (MÖ 1.320-1265) kısa süreliğine de olsa adaya egemen olmuşlardır. Bu süre zarfında Hitit imparatorluğunun bir parçası olan Kıbrıs'ın sahip olduğu bakır rezervlerinde ötürü ülke ekonomisine katkısı büyük olmuştur (Okkar, 2017). Hitit Krallığının M.Ö. 1200'de yıkılmasının ardından Kıbrıs adasında ikinci Mısır egemenliği başlamıştır. Bu dönemde de Mısırlılar adayı hem askeri bir üs olarak kullanmaya devam etmiş hem de önemli bir ticaret merkezi olarak kullanmışlardır (Akçay, 2018). M.Ö 1100'lere yaklaşıldığında Kıbrıs'ta Akaların izine rastlanır. Orta Asya kökenli bir kavim olan Akalar, Anadolu üzerinden önce bugünkü Yunanistan topraklarına gelmiş ardından buradaki toplulukları birleştirerek Miken Uygarlığını kurmuştur. Kıbrıs adasını da hakimiyetine alan Akaların kurdukları şehir devletlerine "Polis" adı verilir. Kıbrıs'ta da kurdukları her bir koloni, birbirlerinden bağımsız krallıklar şeklinde kendini gösterir. Kıbrıs'taki Aka kolonileri; Salamis, Soli, Baf (Pafhos) ve Marion'dur. Dorlar ise MÖ. 1150li yıllarda Orta ve Doğu Avrupa'dan gelerek önce bugünkü Yunanistan topraklarını ele geçirmiş ardından Ege adalarına yerleşmiş bir kavimdir. Antalya (Pamfilya) üzerinden Kıbrıs'a gelen Dorların Kıbrıs'ta kurmuş olduğu koloninin Curium (Kurium) olduğu bilinmektedir. Aka kültürü ile Dor kültürü arasında benzer özellikler görülür. Bugünkü Lübnan ve Suriye topraklarında yaşamış olan Fenikeliler sahip oldukları toprakların tarıma elverişsiz olması sebebiyle ticarete ve denizciliğe önem vermişlerdir. Kereste ticaretinde ilerleyen, ilk camı yapan ve modern alfabeyi kullanan uygarlık olarak bilinen Fenikeliler MÖ 1000 yıllarında Kıbrıs'ta koloni kurmaya başlarlar Ünlü harf içermeyen Fenike Alfabeti bu dönemde Kıbrıs'ta da kullanılmıştır. 291 yıl süren hakimiyetleri boyunca Kıbrıs'ta kültür ve medeniyet alanında önemli gelişmeler yaşanmıştır (Okkar, 2017, Erzen, 1976). Mezopotamya'da kurulan Asur Devleti önce Anadolu toprakları, bugünkü Suriye ve Filistin ele geçirir. M.Ö 709'da ise Kıbrıs'ı hakimiyeti altına alır. Kıbrıs şehir kralları Asurlulara bağlılıklarını bildirerek haraç öder ve varlıklarını sürdürmeye devam eder (Solsten, 1993). Asurlular M.Ö 600'lü yıllarda güçlerini kaybettiğinde ada kısa bir süreliğine bağımsız bir krallık olarak siyasi hayatını sürdürür fakat M.Ö 609 yılında Asur Devleti yıkılınca adayı üçüncü kez Mısırlılar egemenliği altına alır (Hasanoğlu, 2003). III. Mısır Egemenliği MÖ 609-569 yılları arasında sürmüş ve Mısırlılar Adaya ayrı bir yönetici getirmeyerek Salamis Kralı aracılığı ile adayı yönetmişler ve adayı sadece askeri yerleşke amacı olarak kullanmışlardır (Okkar, 2017, Kortmaz, 2014). M.Ö 525 yılında İran'da kurulan Pers Devleti ile Mısır karşı karşıya gelmiş ve Kıbrıs kralları da bu savaşta Perslileri desteklemiştir. Persler Mısırı ele

geçirmiş ardından da Kıbrıs Pers Devletine bağlanmıştır. M.Ö. 334'te Kıbrıs'ta Makedonya hakimiyeti görülür. Fakat Büyük İskender'in ani vefatı ile imparatorluk dörde bölünür (Makedon Krallığı, Antigonitler: Anadolu, Ptolemeler: Mısır ve Selevkoslar: Suriye Mezopotamya, İran) ve Kıbrıs M.Ö. 294-258 yılları arasında Ptolemeler tarafından yönetilmeye başlanır. Ptolemeler devrinde Kıbrıs, Mısır'dan gönderilen valiler tarafından yarı bağımsız statüsü ile yönetilmiştir (Kortmaz, 2014). M.Ö 168 yılında Suriye kralı Mısır'ı yenerek Kıbrıs'ı ele geçirmiş fakat dönemin en önemli güçlerinden olan Roma Mısır ve Kıbrıs'ı Suriye'nin hakimiyetinden kurtarmıştır. M.Ö. 80 yılında tam bağımsızlığını alan Kıbrıs adası M.Ö 58 yılından M.S 395 yılına kadar Roma İmparatorluğunun himayesine girmiş ve Kilikya eyaletine bağlanmıştır. Bu dönemde Kıbrıs'ın idari merkezi olarak Baf ayin edilmiştir. M.Ö.47'de Roma'nın ünlü imparatoru Julius Caesar (Jül Sezar), Kıbrıs'ı Mısır kraliçesi VII. Cleopatra'ya hibe etmiş, M.Ö.30'da ada tekrar Roma İmparatorluğu egemenliğine girmiş, M.Ö.22'den itibaren ise imparatorluğunun senatolu eyaleti olmuştur (Okkar, 2017). Adanın Roma İmparatorluğu hakimiyetinde olduğu dönemde ekonomik, tarım, ticaret ve bayındırlık alanlarında gelişmeler yaşanmış ayrıca yeni yollar, limanlar, alt yapı çalışmaları ve kamusal binalara ağırlık verilmiştir. Ayrıca bu dönemde adaya su getirilmiş ve adanın su problemi kısmen çözülmüştür. Roma İmparatorluğu'nun 395'te ikiye ayrılmasından sonra Kıbrıs, Bizans İmparatorluğu'nun bir parçası olmuş ve İslam fetihlerine kadar Bizans İmparatorluğu tarafından yönetilmiştir. (Akçay, 2018). 688 yılında Bizans imparatorluğu İslam halifesi Abdülmelik b. Mervan ile antlaşma yoluna gitmiş ve adada üç yüz yıl kadar sürecek olan condominium dönemi başlamıştır. III. Haçlı Seferi için Kutsal Topraklara yönelen ve Aslan Yürekli Richard olarak tarihte bilinen İngiltere kralı I. Richard 1191'de adayı kontrolü altına almış ve adayı 100.000 dinara Tapınak Şövalyeleri'ne satmıştır. Yerli halk ile birçok sorunlar yaşayan şövalyeler adayı tekrar Richard'a teslim etmiş, o da 1192'de Kutsal Topraklardaki mağlubiyetten sonra Kıbrıs'ı Lüzinyanlara (eski Kudüs Kralı Guy de Lusignan'a) devretmiş, yaklaşık üç yüz yıl kadar süren Kıbrıs Krallığı kurulmuştur. Lüzinyan hanedanına mensup Kıbrıs kralları, Batı Avrupa ve Ortadoğu'dan soyluları, şövalyeleri, tüccarları ve zanaatkârları adaya yerleşmeye teşvik etmiştir. Böylece nüfusun çoğunluğunu temsil eden Rumların dışında Latinler ile Ortadoğu'dan gelen Maruni, Ermeni, Yakubi ve Nasturi toplulukları da ada nüfusunun artmasında ve dolayısıyla kültürünün çeşitlenmesinde ve çokkültürlü toplumun temellerinin atılmasında rol oynamışlardır (Yıldız ve Özerden, 2017). Lüzinyan kralı II. James döneminde Kıbrıs komşu devletlerin saldırılarına uğrayınca kral Venediklilerden yardım istemiştir. Gerekli yardımı yapan Venedik kralın ölümünün ardından adayı kontrolü altına

almış, 1489'da resmen ilhak ederek 300 yıllık Lüzinyan çağını kapatmıştır (<https://users.metu.edu.tr>). Lüzinyanlar Kıbrıs adası için Memlûklülere vergi ödüyorlardı. Venedikliler, Kıbrıs'a hâkim olunca Lüzinyanlara ödedikleri vergiyi kendilerinin ödeyeceğini bildirdiler. 1517 yılında Osmanlı hükümdarı Yavuz Sultan Selim'in Memlûk Devletine son vermesinin ardından Venedikliler Memlûklülere verdikleri vergiyi Osmanlılara ödemeye devam ettiler. Böylece ada resmi olarak Osmanlı Devleti'ne bağlanmış oldu (Kortmaz, 2014). Bu tarih itibarıyla iki farklı topluluk olarak değerlendirilebilecek Müslüman Türkler ve Ortodoks Rumlar adada birlikte ve barış içinde yaşamışlardır. 1828 yılında Osmanlılardan ayrılan Yunanlılar ideolojik hedefleri doğrultusunda Kıbrıs'ın da Yunan topraklarına dahil olmasını arzulamış ve huzursuzluklar baş göstermeye başlamıştır. 1878 yılında imzalanan ve Osmanlı'nın büyük toprak kaybı ile sonuçlanan Ayastefanos anlaşması gereği Kıbrıs'ın idaresi İngilizlere bırakılmış ve fakat bu durum iki toplum arasındaki gerginliğin çözülmesini sağlayamamıştır. 1974 yılına kadar olan süre zarfında Müslüman Türk ve Hristiyan Rum toplumları arasında birçok kez çatışmalar yaşanmıştır (Yılmaz, 2017). Türkiye Cumhuriyeti Devleti'nin yüksek desteği neticesinde Kıbrıslı Türklerin menfaatine sonuçlanan 1974 Kıbrıs Barış Harekâtı sonrası ada Kuzey Türk Kesimi ve Güney Rum Kesimi olmak üzere ikiye bölünmüştür (Engin, 2000). Yapılması planlanan anlaşma ve uzlaşma yolu açılmadığından Türk kesimi 15 Kasım 1983'te self-determinasyon hakkını kullanmış, adanın kuzeyinde kendi özgür, bağımsız devletini (Kuzey Kıbrıs Türk Cumhuriyeti) kurmuştur (Güler, 2004).

Nesilden nesile aktararak günümüze kadar ulaşan ve yaşandığı coğrafyanın özellikleri ile harmanlanan kültür (Unesco Türkiye Millî Komisyonu, 2003, par.1), toplumların kimliklerinin oluşmasında önemli bir faktördür. Sahip olunan kültürel faktörlerin korunması o toplumun geçmişine ait değerlerine sahip çıkması anlamı taşır. Diker'e göre (2014, s.152) kültürün iki önemli özelliği bulunur. Bunlardan ilki insanlar tarafından oluşturulan maddi ve manevi değerler bütünü olması, diğeri ise toplumların diğer toplumlara göre ayırt edici özellikleri olarak özgün olması olarak açıklanabilir. Bu anlamda kültürün toplumların kimliklerinin ve benliklerinin oluşmasındaki faktörler bütünü olduğu söylenebilir.

İlk kez 1895 yılında, John W. Harshberger tarafından kullanılmış olan etnobotanik kelimesi, etno (insanlar) ve botanik (bitkiler) kelimelerinin birleşiminden oluşmakta ve farklı insan topluluklarındaki bitki-insan ilişkilerini ifade etmektedir (Kendir ve Güvenç, 2010). Botanik ve antropolojik açıdan insanların bitkileri kullanmasındaki sebep ve sonuçları inceleyen etnobotanik (Diker ve ark., 2017) toplumu oluşturan bireylerin kültürleri ile direkt ilişki

içindedir. Çünkü yerel halkın yiyecek, içecek, ilaç yapımı, dini ritüeller gibi sebepler kullandıkları bitkiler o halkın kültürünün önemli bir parçasıdır. Bu kültür nesilden nesile aktarılamadığı takdirde yok olmaya mahkumdur. Bu anlamda bölgelerin sahibi olduğu kültürler içinde kullandıkları bitkilerin etnobotanik olarak araştırılması, incelenmesi hem bu kültürün hem de adı geçen bitkilerin biyoçeşitliliğinin korunarak bölgedeki ekosistemin sürdürülebilir olmasında önemi arz eder.

Bir bölgeye ait bitkiler ve bu bitkilerin yerel halk tarafından kullanım şekli, somut olmayan kültürel miras kapsamında değerlendirilir (Kendir ve Güvenç, 2010). Bu kültürel miras değerlerinin etnobotanik anlamda incelenip turizm alanında değerlendirilmesi ise turizm ekonomisinde dolayısıyla bölgenin genel ekonomisine sürdürülebilirlik kapsamında önemli bir fayda sağlayacağı açıktır.

Çalışmada Kıbrıs'ın etnobotanik olarak yenilebilir otlarına ve bu otların kullanım şekillerine yer verilmiş ve kültürel turizm anlamında değerlendirilebilmesi için bazı önerilerde bulunulmuştur. Böylece adada yetişen ve yemek olarak pişirilen doğal bitkilerin yerel halk dışında da tanınması, korunması ve değerlendirilmesi ve aynı zamanda bu bitkilere sürdürülebilir turizm anlamında farkındalık oluşturulması beklenmektedir. Araştırma envanter niteliği taşımamakla birlikte genel olarak Kıbrıs'ta bilinen ve sıkça kullanılan yenilebilir otları içermektedir.

2. Kültürel Miras Öğelerinden Kıbrıs'ta Yetişen Yenilebilir Otlar

Kıbrıs adasının bitki örtüsü iklim, yükseklik ve toprak verimliliği gibi bazı etmenler sebebiyle çeşitlilik gösterir. Ne yazık ki bu bitki türlerinin bir çoğu özellikle insan etkisi nedeniyle tehlike altındadır. Özellikle yakın geçmişten itibaren tarım ilaçları ve gübrelerin denetimsiz kullanımı, turizm aktivitelerindeki kontrolsüz artış, dağlardaki denetim yol ağlarının genişlemesi, doğal alanların kentleşmesi ve doğal alanlar içerisindeki çeşitli yapılaşmalara bu tehlikelerin artmasında en büyük etmenler olarak kabul edilmektedir artmıştır. Belirli kriterler dahilinde ada florasının koruma statüsünü değerlendiren Uluslararası Çevre Koruma Ortaklığına (IUCN) göre; “*Kıbrıs Florası Kırmızı Kitabı'nda, 23 tür bölgesel olarak yok olmuş, 46 tür kritik olarak tehlike altında, 64 tür tehlikede, 15 tür tehlike sınırında, 128 tür hassas özellikte ve 45 tür veri yetersizliği yaşamaktadır*” (Yıldırım, 2010).

Bu çerçevede çalışmada Kıbrıs adasının somut olmayan kültürel mirasının önemli bir parçası olan yenilebilir otlardan bazılarına yer verilecektir. Tablo 1'de Kıbrıs'ta bulunan ve yerel halkın

mutfağında yeri bulunan yenilebilir otların bazılarını içermektedir. Bu otların kullanım şekillerinin, faydalarının ve yetiştirme koşullarının belirlenmesi ile Kıbrıs kültürü içindeki yerinin önemine dikkat çekilmesi gerekmektedir. Buna göre ada halkına ait olan bu mirasın korunması ve gelecek nesilleri aktarımı konusunda oluşacak farkındalık aynı zamanda adanın turizm açısından markalaşmasında ve gastronomi turizmi açısından özelliklerinin öne çıkartılmasında önemli bir faktör olacaktır.

Tablo 1: Kıbrıs'ta bulunan ve yerel halk tarafından kullanılan yenilebilir otlar

NO	BITKİNİN ADI	LATINCE ADI
1	Ayrelli	<i>Asparagus stipularis</i> Forrsk.
2	Yumurta otu	<i>Silene vulgaris</i> (Moench) Gareke
3	Molehiya	<i>Corchorus olitorius</i> L.
4	Adaçayı	<i>Salvia fruticosa</i> Miller.
5	Yabani ıspanak	<i>Chenopodium album</i> L.
6	Girdama	<i>Crithmum maritimum</i> L.
7	Lindo	<i>Amaranthus graecizans</i> L.
8	Alıç	<i>Crataegus azarolus</i> L.
9	Mangolla	<i>Eryngium creticum</i> L.
10	Similya	<i>Chrysanthemum coronarium</i> L. var. <i>discolor</i> Urv.
10	Hostes	<i>Cynara cornigera</i> Lindley.

Ayrelli (*Asparagus stipularis* Forrsk.): Kuşkonmaz olarak da bilinen, *Asparagaceae* familyasının bir üyesidir. İki evcikli, otsu ve çok yıllık bir sebzedir. Sürgünleri beyaz ya da yeşil renklerde taze, konserve ya da dondurulmuş vb. olmak üzere farklı şekillerde tüketilebilmektedir. İklim açısından fazla seçici bir yapısının olmaması sebebiyle Afrika'dan Kuzey Avrupa ülkelerine kadar geniş bir coğrafyada yetiştirilebilmektedir. Ancak tomurcuk patlaması ve sürgün gelişimi için toprak sıcaklığının 5 ila 14 °C'lerde olmasını istemektedir (Dufault, 1994). Anadolu topraklarında "Çıtır" olarak da bilinen Yabani kuşkonmaz'ın boyu 2 m kadar erişebilir. Odunsu, dalları dikenli ve sürekli yeşil kalan çok yıllık bir bitkidir. Rizom ve kökleri asparagin ve vitaminler bakımından oldukça zengin olan bu bitki, diüretik olarak kullanılmaktadır (İncekara, 2004). (Şekil 1). Kıbrıs kültüründe iyice yıkanan ayrelliler ucundan başlanarak sapına doğru el ile 3-4 cm uzunluğunda olacak şekilde kolayca kırılacak yere kadar

kırılarak parçalara ayrılır. Geride kalan sert gövde kullanılmaz. Ardından kırılan ayrelliler acı tadın çıkması için haşlanır. Haşlama işleminin ardından zeytin yağı koyulan tavada pişirilir. Son olarak üzerien yumurta kırılır ve karıştırılır. Tabağa alınan yumurtalı ayrellinin üzerine limon sıkılarak tüketilir (<https://www.kibrisortam.com>).



Şekil 1: Yumurtalı Ayrelli (<https://www.kibrisortam.com/ayrelli/>)

Yumurta otu (*Silene vulgaris* (Moench) *Gareke*): Yaklaşık 5 ila 40 cm kadar boylanabilen doğada kendiliğinden yetişebilme kabiliyetine sahip bir bitkidir. Gırcır olarak da bilinen bu bitkiye, yol kenarlarında ya da boş nadasa bırakılmış arazilerde rastlanabilmektedir. Haşlandıktan sonra kızartması, kavurması veya soğanlı yemekleri yapılarak tüketilebilmektedir (Kaya Yıldırım, 2010; Cihangir, 2018). Kıbrıs'ta genel olarak yapılışı ise şöyledir; Yumurta otları iyice yıkayıp, kurutulur ve zeytinyağında kavrulur. Ayrı bir tencerede su kaynatılır ve içine tuz, sirke ilave edilerek yumurtalar içine kırılır. Sarısı kayısı kıvamına gelinceye kadar pişirilir. Servisi sırasında tabağın altına yumurta otu, üzerine ise suda pişirilmiş yumurta eklenir. Son olarak ise üzerine zeytinyağı dökülür ve servis edilir (<https://www.kibrisgazetesi.com>) (Şekil 2):



Şekil 2: Yumurta Otu(<https://www.kibrisgazetesi.com>)

Molehiya (*Corchorus olitorius* L.): Tossa jütü olarak da bilinen bu bitki, *Malvaceae* familyasından *Corchorus* cinsi içinde yer alan otsu yapıya sahip bir bitkidir (Tuncer ve

Ummuhan, 2017). Sıcağı seven bir yapısı olduğundan genellikle tropikal ve subtropikal iklimlerde yetişebilmektedir. Bu nedenle, Çin, Hindistan, Filipinler, Japonya, Karayipler, Malezya, Mısır, Sudan, Tayland ve Bangladeş gibi ülkeler, jüt üreticileri olarak üretim pazarının yaklaşık %95 oranında ihtiyacı karşılamaktadır (Samra et al., 2007; Data et al., 2016; Dumanoglu, 2021). Jüt bitkisi yetişmek için için yaklaşık 22-35 °C sıcaklıkta ihtiyaç duymaktadır. Bitkinin yıllık yağış ihtiyacı yaklaşık 418 mm olup, 120-150 günlük bir büyüme periyoduna gelişmektedir. Bu değerler yetiştirildiği koşula bağlı olarak değişebilmektedir (Bilgili ve ark., 2018) Bu bitkinin Kıbrıs'a Mısır hakimiyeti döneminde ya da 7. yüzyılın ortalarında gerçekleşen Arap akınları döneminde geldiği düşünülmektedir (<https://youncyprus.com>), (Şekil 3). Bir diğer düşünceye göre Hindistan'dan gelmiştir. Kıbrıs halkının severek tükettiği bu ot Arap, Mısır, Hindistan, Suriye, Lübnan, Filistin ve Tunus gibi ülkelerde farklı pişirme metodları uygulanarak tüketilir. Kıbrıs'ta o tencere yemeği olarak yağlı kuzu et ve/veya tavuk ile pişirilip yanında pirinç pilavı, kuru soğan, köy ekmeği ve turşu ile tüketilmektedir (Adalier, 2020).



Şekil 3: Molehiya (<https://www.visitncy.com/tr/kesfet/molehiya/>)

Adaçayı (*Salvia fruticosa* Miller.): Ballıbabagiller ailesi olarak da bilinen *Lamiaceae* (Labiatae) familyasının bir üyesi olan adaçayı, Avrupa'da tıp alanlarda kullanımlarından dolayı "tıbbi" olarak kabul edilmektedir. Kültürü yapılabildiği gibi doğa da kendiliğinden de yetişebilme yeteneğine sahiptir (Ekren ve ark., 2007; Dumanoglu ve Sönmez, 2021) Bitkinin yaprakları, çiçekleri, tohumları ve kökleri vb. pek çok aksamı yaş veya kuru formlarda değerlendirilmektedir (Bayram ve Sönmez, 2006). (Şekil 4).



Şekil 4: Adaçayı (https://en.wikipedia.org/wiki/Salvia_fruticosa)

Yabani ıspanak (*Chenopodium album* L.): Ak kazağı, Ak pazı ya da Sirken olarak da bilinen yabani ıspanak, tek yıllık otsu forma sahip bir bitkidir. Genellikle 150-200 cm kadar boylanabilmektedir. Hem insan hem de hayvan beslenmesinde kendisine yer bulan bir bitkidir (Anwar, 2006; Atalay ve Kamalak, 2019). Doğal olarak yetişen bu bitkinin yaprakları haşlama ya da kavurma şeklinde tüketilebilmektedir (Baytop, 1997; İncekara, 2004) (Şekil 5).



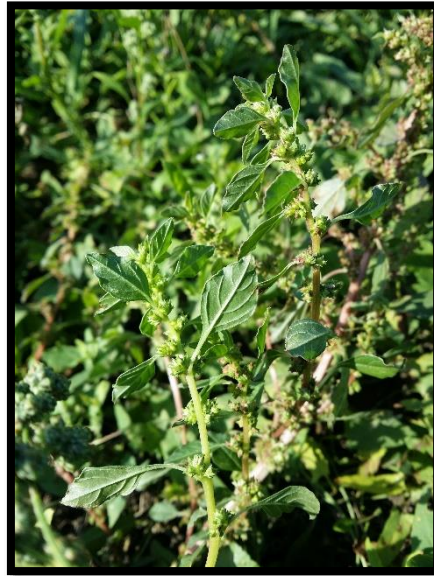
Şekil 5: Yabani ıspanak (https://www.sofra.com.tr/tarifler/zeytinyaglilar-ve-mezeler/sirken_yemegi)

Girdama (*Crithmum maritimum* L.): Deniz rezenesi, deniz teresi ya da kaya kuruğu olarak da bilinen, *Umbelliferae* (Apiaceae) familyasına ait bitki çok yıllık, kazık köklü ve otsu bir yapıya sahiptir. Deniz kenarlarında, kayalık-taşlık alanlarda nadiren de kumluk arazilerde kendiliğinden yetişen bir bitkidir (Davis, 1972; Baytop, 1984; Mucuk ve ark., 2002). Turşu, haşlama veya yemeği yapılarak tüketilebilmektedir (Şekil 6).



Şekil 6: Girdama (<https://kayakorugutursusu.com/kaya-korugu-meze.html>)

Lindo (*Amaranthus graecizans* L.): Horozibiği olarak da bilinen bu bitki genel olarak kıraç toprak özelliklerini sevmekle birlikte, yaklaşık 1m kadar boylanabilen, toprak üstü aksamı kurutulup öğütülerek baharat olarak ya da etli yemekler içerisinde değerlendirilmektedir (Kaya Yıldırım, 2010) (Şekil 7).



Şekil 7: Lindo (<https://alchetron.com/Amaranthus-graecizans>)

Alıç (*Crataegus azarolus* L.): Kıbrıs'ta oldukça sık rastlanan alıç ağaçlarının taze filizleri veya kurutulmuş meyvesi hastalıklarda çıkan ateşi hızlıca düşürme etkisine sahiptir. Yine aynı şekilde, kurutulmuş meyvelerinden yapılan infüzyon ishali durmasına, tansiyonu düşürmeye, mide bulantısını gidermeye, düzensiz kalp atışlarını normalleştirmeye yardımcı olur. Ağacın

meyvelerinin olgunlaştığında toplanarak haşlanması ile çıkan suyundan alıç macunu yapılır. Bu macunun damar sertliğinin giderilmesine yardımcı olduğu bilinmektedir (Yıldırım, 2010), (Şekil 8).



Şekil 8: Alıç Meyvesi, <https://www.e-fidancim.com/>

Mangolla (*Eryngium creticum* L.): Kazayağı ya da Bangallo olarak da bilinen bu bitkinin üst aksamı genel olarak metalik mavi renkte, yaprakları dar ve dikenli bir yapıya sahiptir. Çorak arazilerde ya da 500 m yüksekliğe sahip tepelik alanlarda kendiliğinden yetişebilmektedir. Hastalık (verem vb.) ve yılan sokmaları gibi durumlarda bitkisel tedavi amacıyla kullanılabilir. Ayrıca turşu olarak tüketilebilir. Bunların yanında haşlanarak kuru bakla ya da fasulye yanında veya yemekler içerisinde değerlendirilebilir (Kaya Yıldırım, 2010) (Şekil 9).



Şekil 9: Mangolla (<https://www.botanic.cam.ac.uk/the-garden/plant-list/eryngium-creticum/>)

Similya (*Chrysanthemum coronarium* L. var. *discolor* Urv.): Tek yıllık, krizantem, sümüklüya ya da gelin yemişi olarak da bilinen bu bitkinin boyu yaklaşık 1m'ye kadar çıkabilmektedir. Yol kenarlarında veya çorak arazilerde kendiliğinden yetişebilme yeteneğine sahiptir. Bu bitkinin kaynatılmasıyla elde edilen suyun saçların rengini açmakta kullanılmaktadır. Bunun yanında taze olarak tüketilebildiği gibi yemeklerin (bakla ya da börülce) yanında haşlanarak tüketilebilmektedir (Kaya Yıldırım, 2010) (Şekil 10).



Şekil 10: Similya (<http://biodiversitycyprus.blogspot.com/>)

Hostes (*Cynara cornigera* Lindley.): Bodur bir yapıya sahip, çok yıllık diken otu olarak da bilinen bu bitki yaklaşık 30 cm 'e kadar boylanabilmektedir. Zeytinlikler başta olmak üzere yüksek tepelerde doğal olarak yetişmektedir. Dikenli bir yapısı vardır. Üzerindeki, dikenler alındıktan sonra haşlanarak, yemeklerin yanında, yahni olarak veya kızartması yapılarak tüketilebilmektedir (Kaya Yıldırım, 2010) (Şekil 11).



Şekil 11: Hostes (<https://www.biolib.cz/en/image/id318505/>)

3. Sonuç ve Öneriler

Kıbrıs günümüze kadar uzanan zengin tarihi boyunca birçok medeniyete ev sahipliği yapmış bir adadır. Adanın farklı dönemlerinde ev sahipliğini üstlenen bu medeniyetler kimi zaman kendi medeniyetlerinden kültürel değerler bırakmış kimi zamanda adanın sahibi olduğu kültürleri kendi kültürel değerlerine eklemişlerdir. Bu kültürel etkileşimler ada kültürünün zenginleşerek artmasında büyük bir paya sahiptir.

Gerek gastronomi turizmi gerekse kültür turizmi açısından bakıldığında Kıbrıs adasının kültürel mirası oldukça çeşitlilik gösterir. Bu sebeptendir ki Kıbrıs'ta bulunan bitkiler ve bu bitkilerle hazırlanan yemekler, soslar, reçeller, medikal takviyeler ada halkının kültürünün bir parçası niteliğindedir. Bu mirasın korunmasının ileri kuşaklara aktarım ile gerçekleşeceği açıktır. Bu anlamda adanın sahibi olduğu değerler hem gastronomi turizminin gelişmesi hem de sahip olduğu mirasın korunması ve geliştirilmesi için mutlaka tanıtılmalıdır. Bu tanıtımlar hem adanın markalaşmasına katkı koyacak hem de turizm ekonomisine fayda sağlayacaktır.

Günümüz teknolojisi ile seyahatlerin aradıkları bilgiye ulaşmaları saniyeler içinde gerçekleşmektedir. Gezinler bu teknolojinin getirdiği imkanlar dahilinde gezip görmek, kültürünü deneyimleyip yerel lezzetlerini tatmak istedikleri yerleri saniyeler içinde araştırmakta ve seyahat seçimlerini bu doğrultuda yapmaktadırlar. Bu anlamda var olan hedef kitleleri doğru bilgiler ile yönlendirip merak uyandırmak ve adanın sahip olduğu mirası tanıtmak için turizm alanında söz sahibi başta Turizm ve Kültür Bakanlığı olmak üzere, tur operatörleri ve seyahat acentalarına büyük görevler düşmektedir. Kıbrıs sahibi olduğu flora ve faunası, gastronomik öğeleri ile oldukça ilgi çekici bir destinasyondur. Yapılan araştırmalar yerel halkın mutfağında kullanmayı kültürü haline getirdiği bazı bitkilerin yok olma tehlikesinde olduğunu göstermektedir. Yapılacak araştırmalar neticesinde detaylı envanterler çıkarılmalı, adaya özgü bitkilerin devamlılığının sağlanması için gerekli tedbirler alınmalı ayrıca alınan tedbirler dahilinde yerel değerler gastronomi turizmi kapsamında değerlendirilerek hem yerel halka hem de potansiyel gezginlere farkındalık yaratılmalıdır. Yapılan tüm bu çalışmalarla ülkenin sahibi olduğu değerler korunacak, turizme kazandırılacak ve özellikle bu mirasın gelecek nesillere aktarımı sağlanacaktır.

Referanslar

- Adalier, M. (2020), “Kıbrıs Mutfağında Yerel Ürünlerde Kullanılan Malzemelerin ve Pişirme Yöntemlerinin Bölgelere Göre Analizi”, Doğu Akdeniz Üniversitesi, Yayınlanmamış Yüksek Lisans Tezi
- Akçay, E. Y. (2018), “Roma Dönemi’nde Kıbrıs’ın Yaşadığı Dönüşüm”, İstanbul Gelişim Üniversitesi Sosyal Bilimler Dergisi, 5 (2), ss. 137-148.
- Anwar, M., (2006). The Pharmacognostic and Pharmacological Studies on Medicinal Valued Herbal Drugs *Erythrina variegata* var. *orientalis*, *Matricaria chamomilla*, *Psoralea corylifolia* and *Chenopodium album*. PhD Thesis. Department of Pharmacognosy, Faculty of Pharmacy, University of Karachi Pakistan, 43-49 pp.
- Atalay, A. ve Kamalak, A. (2019). Olgunlaşma Dönemlerinin Sirken (*Chenopodium album*) Otuunun Kimyasal Kompozisyonuna, Besleme Değerine ve Metan Üretimine Etkisi. *Türk Tarım ve Doğa Bilimleri Dergisi* 6(3): 489–493.
- Bayram, E., Sönmez, Ç. (2006). Adaçayı Yetiştiriciliği, Ege Üniversitesi Tarla Uygulamaları ve Araştırma Merkezi Yayın Bülteni, No:48, ISSN 1300-3518, Bornova/İzmir.
- Baytop, T., (1984) “Türkiye’de Bitkilerle Tedavi”, İstanbul Üniv.Yayımları 3255, İstanbul.
- Baytop, T., (1997). Türkçe Bitki Adları Sözlüğü. Türk Dil Kurumu Yayınları: 578.Ankara.
- Bilgili, M.E., Süllü S., Sevilmiş U. (2018). Jüt tarımı ve mekanizasyonu. *Bahri Dağdaş Bitkisel Araştırma Dergisi*, 7(2): 66-75.
- Cihangir, Y. (2018). Geleneksel Kıbrıs Türk Mutfağında Yer Alan Yaban (Ova) Otları. 5.Uluslararası geleneksel ve Yöresel Değerler Sempozyumu (26-28 Ekim).
- Çelik, C. (2014), OSMANLI YÖNETİMİNDE KIBRIS'TA KİTLİK VE ÇÖZÜM YOLLARI (1869-1874), *Cedrus The Journal of MCDI*, II s. 497-525 DOI: 10.13113/CEDRUS.201406473
- Data, E., Rahman, S., Hossain, M.M. (2016). Different approaches to modify the properties of jute fiber: A Review. *The International Journal of Engineering and Science (IJES)*, 5(4): 24-27.
- Davis, PH. (1972). *Flora of turkey and East Aeagen Islands*, Vol-4. University Press, Edinburgh.
- Diker, O. (2014). Algılanan Liderlik Tarzları, Örgüt Kültürü ve Örgütsel Bağlılık İlişkisinin Turizm Endüstrisinde İncelenmesi, Yayınlanmamış Doktora Tezi, Eskişehir Osmangazi Üniversitesi, Sosyal Bilimler Enstitüsü, Eskişehir.
- Dufault, R.J. (1994). Impact of Forcing Summer Asparagus in Coastal South Carolina on Yield. Quality and Recovery from Harvest Pressure. *Journal of the American Society for Horticultural Science* 119(3): 396-402.
- Dumanoğlu Z. ve Ç. Dönmez. (2021). Farklı Sürelerde Depolanan Tıbbi Adaçayı (*Salvia officinalis* L.) Tohumlarının Karşılaştırmalı Olarak Bazı Özelliklerinin Belirlenmesi. *Bursa Uludağ Ziraat Fakültesi Dergisi*. 35(2): 365-375.
- Dumanoğlu, Z. (2021). A Study on The Determination of Some Pysical and Physiological Properties of Seeds of Two Diffrent Jute Varieties (*Corchorus capsularis* L. and *Corchorus olitorius* L.). *ISPEC Journal of Agr. Sciences* 5(2):456-462.

- Ekren, S., Sönmez, Ç., Sancaktaroğlu, S., Bayram, E. (2007). Farklı Biçim Yüksekliklerinin Adaçayı (*Salvia officinalis* L.) Genotiplerinde Agronomik ve Teknolojik Özelliklere Etkisinin Belirlenmesi. *Ege Üniversitesi Ziraat Fakültesi Dergisi*. 44(1):55-70.
- Engin, N. (2000), “1958-1974 Kıbrısta Yaşanan Canlı Hatıralar”, Yakın Doğu Üniversitesi Fen Edebiyat Fakültesi Mezuniyet Çalışması”, Lefkoşa.
- Erzen, A. (1976), “İlkçağ Tarihinde Kıbrıs”, *Belleten Dergisi*, Sayı: Ocak 1976, Cilt 40 - Sayı 157, s. 93-116
- Güler, Y. (2004), “Kuzey Kıbrıs Türk Cumhuriyeti’nin Kuruluşuna Kadar Kıbrıs Meselesi”, *G.Ü. Kırşehir Eğitim Fakültesi Dergisi*, Cilt 5, Sayı 1, (2004), 101-112
- Gürgen, İ. (2017), “M.Ö. 2. Binyılda Kıbrıs”, *Tarihte Kıbrıs I.*, ISBN: 978-605-67945-0-6, İmak Ofset, İstanbul.
- Hasanoğlu, E. (2003). 28 Şubat sürecinde Kıbrıs, çözümler ve öneriler. Başkent Üniversitesi Paneller Dizisi. Ankara.
- Ilseven, S., Hıdırer, G. & Tümer, A. (2014). Kıbrıs Coğrafyası, (Geography of Cyprus) Turkish Education Foundation Publication, Nicosia ,
- İnceraka, N. (2004). Ege Bölgesi’nde Sebze Olarak Tüketilen Yabani Kuşkonmaz, Sirken, Yabani Hindiba, Rezene, Gelincik, Çoban Değneği ve Ebegümecinin Bazı Kimyasal Analizleri”, *Yüzüncü Yıl Üniversitesi, Ziraat Fakültesi, Tarım Bilimleri Dergisi (J. Agric. Sci.)*, 14(1): 1-6
- Kapluhan, E. (2018), “Kuzey Kıbrıs Türk Cumhuriyeti’nin Coğrafi Özellikleri Ve Bu Özelliklerin Eğitime Yansması”, *Iksad Publishing ISBN: 978-605-7923-11-0*
- Kaya Yıldırım, F. (2010). Kuzey Kıbrıs’ın Faydalı Bitkilerinin ve Kullanım Alanlarının Araştırılması, Yakın Doğu Üniversitesi Sağlık Bilimleri Enstitüsü. Farmakognози-Farmasötik Botanik ABD. Yüksek Lisans Tezi, Lefkoşe.
- Kendir, G., Güvenç, A., (2010), “Etnobotanik ve Türkiye’de Yapılmış Etnobotanik Çalışmalara Genel Bir Bakış”, *Hacettepe Üniversitesi Eczacılık Fakültesi Dergisi Cilt 30 / Sayı 1 / ss. 49-80*
- Koday, Z. (1998), “Kıbrıs’ın Jeopolitik Önemi”, *Türk Coğrafya Dergisi*, Sayı:23, s.419-428.
- Kortmaz, M. (2014), “Kıbrıs Türk Tarihi”, *KKTC Milli Eğitim Bakanlığı*, 6. Baskı
- Köklü, Ş., Dolunbay, S., Yakupoğlu, G., Karaca, A., Havan, A. Ve Korkmaz, A. (2020). Bitki Yaşı ve Hasat Zamanının Kuşkonmaz Verimi ve Sürgün Kalitesi Üzerine Etkileri. *KSÜ Tarım ve Doğa Derg* 23 (3): 568-576.
- Mucuk, O., Akgül, A. ve Özcan, M. (2002). Composition and pickling of sea fennel (*Crithmum maritimum* L.) *GIDA* 27(6):469-474.
- Okkar, R. (2017), “İlk Çağlardan Venediklilere Kıbrıs”, *Tarihte Kıbrıs I.*, ISBN: 978-605-67945-0-6, İmak Ofset, İstanbul.
- Samra, I., Piliz, S., Ferdag, C. (2007). Antibacterial and antifungal activity of *Corchorus olitorius* L. (molokhia extracts). *International Journal of Natural and Engineering Science*, 1(3): 39-61.
- Solsten, E. (1993). *Cyprus: A country study*. Washington: GPO.
- Tuncer, B. ve Ummuhan, F. (2017). Molehiya (*Corchorus olitorius* L.) Tohumlarındaki Dormansi Probleminin Çözümüne Yönelik Araştırma. *Turk J Agric Res.*, 4(3): 268-274

- Yıldız, S., Özerden, S. (2017), “KKTC ve Turizm: Salamis Harabelerinin KKTC Turizmi İçindeki Yeri”, Sosyal ve Liberal Bilimlerde Yeni Yönelimler-2, Gece Kitaplığı, ISBN: 978-605-288-134-7, Ankara
- Yılmaz, H. (2017). Kıbrıs Barış Harekâtı Ve Sonuçları . İnönü Üniversitesi Uluslararası Sosyal Bilimler Dergisi, 6 (1), s. 87-98.
- Yorgancı, A., (2004), “Kuzey Kıbrıs'ta Arazi Kullanımı Açısından Uygun Buğday Alanlarının Mekansal Analizi”, 3. Coğrafi Bilgi Sistemleri, Turkey

İnternet Kaynakları

- <https://vividmaps.com/the-worlds-100-largest-islands-side-by-side/> , 22.04.23
- <https://users.metu.edu.tr/birten/adacogr.html> , 22.04.23
- <https://users.metu.edu.tr/birten/tarihoncesi.html> 22.04.23
- <https://pio.mfa.gov.ct.tr/cografı-bilgiler/> 22.04.23
- <https://users.metu.edu.tr/birten/luzinyan.html> 26.04.23
- <https://www.kibrisortam.com/ayrelli/> 15.04.23
- <https://www.kibrisgazetesi.com/kultur-sanat/yumurta-otu-2-porsiyon-h14353.html> 15.04.23
- <https://youncyprus.com/molehiya/#:~:text=Lifli%20yap%C4%B1s%C4%B1ndan%20dolay%C4%B1%20bir%20t%C3%BCr%C3%BC,ak%C4%B1nlar%C4%B1%20d%C3%B6neminde%20K%C4%B1r%C4%B1s%20adas%C4%B1na%20gelmi%C5%9Ftir> 15.04.23

TOPLUM TEMELLİ RUH SAĞLIĞI HEMŞİRELİĞİ: BİR İNCELEME

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Özet

Akıl hastalığından muzdarip nüfusun artışı, akıl sağlığı hemşirelerini toplumlar için çok önemli bir iş gücü haline getirmektedir. Ruh sağlığı hemşireleri zorlu ve potansiyel olarak yüksek stresli ortamlarda çalışmaktalar. Bu koşullar, doğası gereği karmaşık olan bu hastaların bakımında sıklıkla meydana gelen hemşirelik hatalarını artırmaktadır. Akıl sağlığı hizmetlerine erişim, küresel olarak bir halk sağlığı sorunudur. Çok sayıda zihinsel bozukluk için birçok etkili tedavi mevcuttur, ancak birçok kişi yeterli tedavi görmemektedir. Ruh sağlığı bozukluğu olan kişiler; psikolojik sorunlar, fiziksel sorunlar ve sosyal sorunlar gibi sorunlar yaşarlar. Toplum, disiplinler arası sağlığın geliştirilmesi için merkezi bir kaynaktır. Akıl sağlığı hizmetleri, ciddi akıl hastalıkları olan hastalar için giderek artan bir şekilde toplumsal katılıma ve hareketliliğe odaklanmaktadır. Toplum ruh sağlığı rehabilitasyon ekipleri, karmaşık ruh sağlığı ihtiyaçları olan kişileri desteklemekte önemli bir role sahiptir. Hemşireler toplum ruh sağlığı hizmetlerinde merkezi bir rol oynamaktadır. Bu derlemede, kişisel ve toplum ruh sağlığı konusuyla ilgili bazı güncel çalışma sonuçları hemşire bakış açısıyla sunulmuştur.

Anahtar Kelimeler: Ruh sağlığı, psikiyatrik, kişisel, toplum, hemşirelik

1. Giriş

Psikiyatrik bozukluklar engelliliğin başlıca nedenleri arasındadır (Giri ve ark. 2021). Depresyon, dünya çapında yaklaşık 350 milyon insanın etkilendiği ve her yıl 800 bin intiharla sonuçlandığı, dünya çapında en maliyetli ve en fazla yeti yitimine neden olan hastalıklar arasındadır (Carlton ve ark., 2021). Majör depresif bozukluk birçok ergenin yaşam kalitesini etkilemektedir (Waraan ve ark., 2021). Akıl sağlığı hizmetleri, ciddi akıl hastalığı olan hastalar için giderek artan bir şekilde toplum katılımına ve hareketliliğine odaklanmaktadır (Townley ve ark., 2021). Son yıllarda toplum ruh sağlığı hizmetlerine olan talep önemli ölçüde artmıştır. Hemşireler bu hizmetlerde merkezi bir rol oynamaktadır (Burr ve Richter, 2021).

Ruh sağlığı bozukluğu olan kişilerde, psikolojik sorunlar, fiziksel sorunlar ve sosyal sorunları da bulunabilir (Deviantony ve Susanto, 2020). Farklı psikolojik travmalar yaşamak, hayatta kalanlar üzerinde kötü zihinsel, fiziksel, sosyal ve ekonomik sonuçlar gibi olumsuz etkilerle sonuçlanabilir (Dawson ve ark., 2021). Bu kişilerin çoğu, ruh sağlığı bilgisi eksikliği, akıl hastalığına ilişkin damgalanma ve mevcut hizmetlerin farkında olmamaları nedeniyle bakım talep etmemektedir (Grant ve ark., 2021). Bu sorunlar hakkında toplum bilincinin düşük olması, ruhsal sorunlara yönelik tedavi arayışını olumsuz etkilemektedir (Gaiha ve ark., 2021). Depresyon sağlık hizmetleri arayan birçok kişide sıklıkla, eşlik eden tıbbi durumlar vardır (King ve ark., 2021). Ruh sağlığı hizmeti kullanıcıları için kalp-solunum hastalıkları ve diyabet prevalansı artmaktadır (Sara ve ark., 2021). Akıl hastalığı ve Tip 2 diyabeti olan kişilerin, genel popülasyona kıyasla diyabet komplikasyonlarıyla karşılaşma olasılığı daha yüksektir (Cimo ve ark., 2020).

Şizofreni ve bipolar bozukluk hastaları, kısmen kötü kontrollü ve yetersiz tedavi edilen kardiyovasküler faktörlerin yüksek oranları nedeniyle aşırı mortaliteye sahiptir (McGinty ve ark., 2021). Ciddi ruhsal hastalığı olan kişilerde tütün kullanım bozukluğu oranları genel nüfusa göre 2-3 kat daha fazladır (Siegel ve ark., 2021). Yaygın psikotrop ilaçların yan etkileri olarak cinsel işlev bozukluğu, ruh sağlığı bozukluklarının bir belirtisidir (Abbasi ve ark., 2021). Yalnızlık ve sosyal izolasyon, ruh sağlığı sorunları olan insanlar için önemli endişelerdir (Webber ve ark., 2021). Küresel olarak, artan yaşam beklentisi, ilerleyen yaşlarla birlikte özel ihtiyaçları olan yaşlı nüfus için daha yüksek psikiyatrik hizmet bakım talepleri ile sonuçlanmaktadır (O'Sullivan ve ark., 2021).

Psikiyatrik polieczacılık (polifarmasi; bir hastaya iki veya daha fazla psikotrop ilaç uygulanması) pek çok vakada zorlu hastalıklarda uygulanmaktadır. Psikotropik polifarmasinin

yaygınlığı, özellikle toplum ortamında tedavi edilen psikiyatrik hastalarda artmaktadır. Demografik özellikler, hastanın yaşı, cinsiyeti ve psikiyatrik tanı, polifarmaside oranı ve ilaç kombinasyonlarını etkiler durumdadır (Srikumar ve ark., 2021).

2. Toplum temelli ruh sağlığı

Toplum temelli ruh sağlığı programları üç türe ayrılır: 1) vaka yönetimi, 2) terapötik ve 3) terapötik programların psikiyatrik semptomları azaltmada oldukça etkili olduğu yaşam tarzı (O'Donnell ve ark., 2021). Akıl sağlığı profesyonellerinin sorumluluğu, mümkün olan en iyi bakım kalitesini sağlamaktır. Aile, hastanın günlük yaşamına güçlü bir şekilde dahil olur (Moen ve ark., 2021). Aile ve toplum hemşireliğinin rolleri, nüfusun ihtiyaçlarına göre farklılık göstermektedir (Conti ve ark., 2021). Psikotik bozukluğu olan kişiler için aile katılımı, bilimsel kanıtların yanı sıra yasal ve etik düşüncelerle desteklenmekte ve klinik uygulama kılavuzlarında önerilmektedir (Hestmark ve ark., 2021).

Bakımda teknolojiyle zenginleştirilmiş ruh sağlığı hizmetlerinin genişletilmesi, klinisyen talebini azaltıcıdır (Lattie ve ark., 2020). İnternet tabanlı bilişsel davranışçı terapi gibi dijital ruh sağlığı programlarının kullanımı, kaliteyi ve ruh sağlığı hizmetlerine erişimi artırmaktadır (Doukani ve ark., 2021). Bu sağlık araçları, hasta yaşamlarına kolayca entegre edilebilir ve halk sağlığını iyileştirebilir. Web tabanlı videolar ve ruh hali izleme uygulamaları, zihinsel sağlık müdahalelerini olumlu yönde etkilerler. Bu dijital araçların uygulanmasından önce, bu araçları hangi kuruluşların veya bireylerin uygulayacağını ve kullanacağını anlamak çok önemlidir. Gençler teknolojiye daha aşinadır (Knapp ve ark., 2021). Dijital araçların kullanılabilirliğini ve sağlık ihtiyaçlarına ve sosyo-çevresel bağlama uygunluğunu artırmak için, son kullanıcılarla kullanılabilirliği keşfetmek ve alımı kolaylaştırıcıları ve engelleri belirlemek önemlidir (Storm ve ark., 2021).

Ciddi ruh sağlığı sorunlarının yaygınlığı ve insidansı 16-25 yaşları arasında zirvededir (Cohen ve ark., 2020). Obezite ve aşırı kilolu gençlerde ciddi duygusal rahatsızlık oranları yüksektir (Wykes ve ark., 2021). Toplum ruh sağlığı merkezlerine başvuran birçok ergende dışsallaştırma, içselleştirme ve madde kullanım sorunları eşitliği vardır (Sheidow ve ark., 2021). Hemşireler, ebeveynliği desteklemek için erken müdahaleler yoluyla olumlu çocukluk gelişimini teşvik etmede önemli roller oynamaktadır (Anis ve ark., 2021).

Evsizlik önemli bir sosyal sorundur, psikiyatrik hastalıklara yol açar veya pek çok durumda tam tersi olur. Akıl hastalığı olan çoğu evsizin psikiyatrik tedavisinin erişilebilirliği ve sürekliliği, yaşam tarzları nedeniyle istisnai bir seçenektir (Sriramalu ve ark., 2021). Dikkat

Eksikliği/Hiperaktivite Bozukluğu için kanıta dayalı uygulamaların toplum tarafından uygulanması da büyük ölçüde eksiktir (Sibley ve ark., 2021).

Artan nüfusla birlikte, akıl hastalığı olan insanlar küresel boyutta artmakta ve akıl sağlığı hemşirelerini çok önemli bir iş gücü haline getirmektedir (Hercelinskyj ve ark., 2014). Akut yatan ruh sağlığı tesislerinde ruh sağlığı hemşirelerinin işe alınması ve istihdamı bir sorun olmaya devam etmektedir. Literatür ve güncel araştırmalar, iş tatminsizliğine katkıda bulunan birkaç temel faktörü tanımlayarak, baskı ve stresle dolu bir ortama işaret etmektedir. Bu faktörler, artan hasta zorlukları, öngörülemeyen ve zorlu çalışma alanları, şiddet, artan evrak işleri ve azaltılmış yönetim desteğini kapsar (Ward, 2011). Akıl hastalığı, olumsuz tutumlar ve damgalamalarla çevrilidir. Ruh sağlığı hemşirelerinin ruh hastalarına yönelik genel tutumları üzerinde işveren veya işyerlerinin etkisi vardır. Çalışanlar arasında ruhsal hastalığı olan kişilere yönelik daha olumlu tutumlar geliştirilebilir ve işyerlerindeki alt kültüre de aktarılabilir (Mårtensson ve ark., 2014).

Ruh sağlığı hemşireleri zorlu ve potansiyel olarak yüksek stresli ortamlarda çalışırlar. Stres etmenleri tüketici, aile ilişkileri, personel ilişkileri, çalışma ortamı ve organizasyon bağlamında ortaya çıkabilir. Stres ve mesleki zorluklar ruh sağlığı hemşireleri üzerinde tükenmişlik, daha zayıf fiziksel sağlık ve ruh sağlığı gibi zararlı etkilere yol açabilir. Ruh sağlığı hemşireliğinde yılmazlık, stres ve zorluklara olumlu adaptasyonu, bireysel yeteneği veya kişi-çevre etkileşimi olgularını da kapsar. Ruh sağlığı hemşireleri için bireysel, iş birimi ve organizasyonel düzeylerde dayanıklılık oluşturma stratejilerinin uygulanması hakkında daha fazla araştırmaya ihtiyaç vardır (Foster ve ark., 2019).

Terapötik ilişki, ruh sağlığı hemşireliğinin merkezindedir. Klinik ortam, bakımın kalitesi ile ilgilidir. Yüksek kaliteli terapötik ilişkinin faktörleri; daha uygun uygulama ortamı, kaliteli hemşirelik bakımı için teme gereksinimlerin varlığı, daha yüksek akademik başarı ve daha uzun hemşirelik deneyimi şeklinde sıralanabilir. Eğitim, hemşirelik dili ve taksonomisi gibi hemşirelik temellerinin kalitesi ve ortak hemşirelik felsefesi, yüksek kaliteli terapötik ilişkide etkilidir (Roviralta-Vilella ve ark., 2019). Terapötik veya yardım ilişkisi, ruh sağlığı hemşireliğinin temel taşıdır. Hemşirenin etkin ve doğru bir iletişim ve yönetsel ilişkisel becerilerine dayanır. Ruh sağlığı hemşireliği becerilerine ilişkin teorik bilgilere rağmen, bunların uygun kalite standartlarıyla uygulanmadığına ilişkin yeterli kanıt mevcuttur. Empatik tutum, koşulsuz kabul ve aktif dinleme gibi teorik kavramlar günlük hemşirelik mesleğinde gerksinimdir. Uygulama aynı zamanda kavramsal farklılıklar, önyargılar, korkular ve ilişkiyi

sınırlayan ve hasta ile hemşire arasına mesafe koyan kendini koruma mekanizmaları ile sonuçlanmaktadır (Ar, 2013).

Ruh sağlığı hemşireliğinde, terapötik ilişki bakım sürecinin merkezinde yer alır, çünkü kişinin zihinsel ıstırap içindeki dengesinin yeniden kurulması kişiler arası ilişkilere dayanır (Laranjeira, 2021). Batı dünyasında ruh sağlığı bozukluğu olan insan sayısı giderek artmaktadır. En yaygın geleneksel terapiler konuşma terapisi ve ilaçlardır. Geleneksel terapilere bir alternatif ise Antrozoolojidir. Antrozooloji, insanlar ve hayvanlar arasındaki etkileşimi ele alır ve hayvanların insan sağlığına ve zindeliğine büyük katkıda bulunabileceğini gösterir. Akıl sağlığı bozukluklarından muzdarip insanlar, köpeklerine karşı güçlü ve iyileştirici bir bağ yaşarlar. Bu farklı teorilerle açıklanabilir. Hemşirelerin, köpeğin ruh sağlığı bozuklukları olan insanlar üzerindeki olumlu etkisi hakkında bilgi sahibi olması faydalıdır (Skjorestad & Johannessen, 2013).

Profesyonel ilişkiler, terapötik etkileşimler için güvenli, güvenilir ve sağlam bir altyapı sağlar; ancak hemşireler, ilişki sınırlarını belirleme ve sürdürme konusunda zorluklarla karşı karşıyadır. Hastalar özel ayrıcalıklar, romantik etkileşimler ve sosyal medya arkadaşlığı talep etse veya pahalı hediyeler sunsa da, hemşireler bu sınır ihlallerinin hastaların güvenini aşındırabileceğini ve hastalara zarar verebileceğini kabul etmelidir. Bu ihlaller hemşireler için disiplini de etkileyebilir. Profesyonel ilişki kılavuzları dikkatli bir şekilde uygulanmalı ve hemşireler bu ilişkilerdeki duygu ve tepkilerini izlemelidir (Valente, 2017).

İletişim, hemşirelikte klinik liderliğin önemli bir özelliği olarak tanımlanmıştır (Ennis ve ark., 2013). Ruhsal bozukluğu olan bireylerle iletişim çoğu zaman doğrusal olmayan, karmaşık ve değişken bir durum olabilir (Yıldız, 2019). İletişim, ruhsal bozukluğu olan kişilere kapsamlı bakımın geliştirilmesi için koşullar sağlayan hemşireler ve hastalar arasındaki etkileşimi sübvans eder (Paes & Maftum, 2013). Metafor, konuşmaya dayalı psikoterapilerin önemli bir bileşenidir. Ancak hemşirelerin yatan hasta ortamında karşılaştığı hastaların çoğu, en azından başlangıçta, şiddet içeren, içine kapanık, yüksek oranda gerileyen veya düşünce ve duyguları iletme için kelime dağarcığından yoksun oldukları için konuşmaya dayalı yaklaşımlar için uygun adaylar değildir (Birnbaum, 2017).

Çözüm odaklı terapi, ruh sağlığı bakımında yeni ve popüler bir müdahale modelidir. Çözüm odaklı terapinin özü, bireyin sorununun ya da zorluğunun yönünü belirlememesidir. Bunun yerine terapi uygulayıcısı, bireyin neyi farklı istediğini belirler ve ardından bu farkı keşfeder ve detaylandırır (Wand, 2010). Bu terapi danışanın güçlü yanlarını oluşturur ve

geleceğe odaklıdır. Birden fazla klinik ortamda kullanılabilir ve ruh sağlığı hizmetlerine erişen müşteriler için yararlı olmakla sınırlı değildir. Temel ilkeleri öğrenmek ve yaklaşımda temel düzeyde bir beceri geliştirmek, lisans hemşirelik kursunda başarılabilir bulunmuştur. Model bilgisindeki ve temel terapötik becerilerdeki artış sadece bir günlük eğitim gerektirir. Öğrenciler, bu terapötik yaklaşımı öğrenme yönteminin yararlı olduğunu ve hem bilgi hem de beceri temellerini artırdığını bildirmiştir (Evans ve Evans, 2013).

Kaynakça

- Abbasi, Y., Robertson, D., Anosike, A., Pearson, M., Pankhurst, K., & Perera, J. (2021). Audit to assess discussion of sexual dysfunction for new patients entering a community mental health recovery service. *BJPsych Open*, 7(S1), S63-S63.
- Anis, L., Benzies, K. M., Ewashen, C., Hart, M. J., & Letourneau, N. (2021). Fidelity Assessment Checklist Development for Community Nursing Research in Early Childhood. *Frontiers in Public Health*, 9, 496.
- Ar, M. P. (2013). Reflections on therapeutic relationship and its clinical practice in mental health nursing. *Revista de Enfermería (Barcelona, Spain)*, 36(12), 26-31.
- Birnbaum, S. (2017). *Therapeutic Communication in Mental Health Nursing: Aesthetic and Metaphoric Processes in the Engagement with Challenging Patients*. Taylor & Francis.
- Burr, C., & Richter, D. (2021). Predictors of community mental health nursing services use in Switzerland: Results from a representative national survey. *International Journal of Mental Health Nursing*.
- Carlton, L., Woods-Giscombe, C. L., Palmer, C., & Rodgers, S. G. (2021). Barbers as community mental health advocates for African American men: ADAAM-QR web design to address social determinants of depression and access to culturally-relevant resources. *Archives of Psychiatric Nursing*, 35(1), 137-140.
- Cimo, A., Loong, D., & Dewa, C. S. (2020). Exploring the outcomes of a pilot education program tailored for adults with type 2 diabetes and mental illness in a community mental health care setting. *Canadian Journal of Diabetes*, 44(6), 461-472.
- Cohen, D. A., Klodnick, V. V., Kramer, M. D., Strakowski, S. M., & Baker, J. (2020). Predicting child-to-adult community mental health service continuation. *The journal of behavioral health services & research*, 1-15.
- Conti, A., Albanesi, B., Busca, E., Martini, L., Costa, C., & Campagna, S. (2021). Family and community nursing: overview of practice in Europe. *Assistenza infermieristica e ricerca: AIR*, 40(3), 131-136.
- Dawson, S., Bierce, A., Feder, G., Macleod, J., Turner, K. M., Zammit, S., & Lewis, N. V. (2021). Trauma-informed approaches to primary and community mental health care: protocol for a mixed-methods systematic review. *BMJ open*, 11(2), e042112.
- Deviantony, F., & Susanto, T. (2020). Exploring Jember Community View in the Treatment of Mental Health Disorders with the Perspective of a Transcultural Nursing. *NurseLine Journal*, 5(1), 180-185.
- Doukani, A., Pashoja, A. C., Fanaj, N., Qirjako, G., Meksi, A., Mustafa, S., ... & Hug, J. (2021). Organizational readiness for implementing an internet-based cognitive behavioral therapy intervention for depression across community mental health services in albania and kosovo: Directed qualitative content analysis. *JMIR Formative Research*, 5(11), e29280.
- Ennis, G., Happell, B., Broadbent, M., & Reid-Searl, K. (2013). The importance of communication for clinical leaders in mental health nursing: The perspective of nurses working in mental health. *Issues in mental health nursing*, 34(11), 814-819.
- Evans, N., & Evans, A. M. (2013). Solution-focused approach therapy for mental health nursing students. *British Journal of Nursing*, 22(21), 1222-1226.

- Foster, K., Roche, M., Delgado, C., Cuzzillo, C., Giandinoto, J. A., & Furness, T. (2019). Resilience and mental health nursing: An integrative review of international literature. *International journal of mental health nursing*, 28(1), 71-85.
- Gaiha, S. M., Gulfam, F. R., Siddiqui, I., Kishore, R., & Krishnan, S. (2021). Pilot community mental health awareness campaign improves service coverage in India. *Community mental health journal*, 57(5), 814-827.
- Giri, D. K., Chaudhury, S., & Chakraborty, P. K. (2021). Trends and issues in community mental health programs in India: The Ranchi Institute of Neuropsychiatry and Allied Sciences experience. *Industrial Psychiatry Journal*, 30(1), 11.
- Grant, M., Petersen, I., Mthethwa, L., Luvuno, Z. P., & Bhana, A. (2021). Accuracy of a Community Mental Health Education and Detection (CMED) Tool for Common Mental Disorders in KwaZulu-Natal, South Africa.
- Hercelinskyj, G., Cruickshank, M., Brown, P., & Phillips, B. (2014). Perceptions from the front line: Professional identity in mental health nursing. *International Journal of Mental Health Nursing*, 23(1), 24-32.
- Hestmark, L., Heiervang, K. S., Pedersen, R., Hansson, K. M., Ruud, T., & Romøren, M. (2021). Family involvement practices for persons with psychotic disorders in community mental health centres—a cross-sectional fidelity-based study. *BMC psychiatry*, 21(1), 1-11.
- King, C., Goldstein, E., Crits-Christoph, P., & Connolly Gibbons, M. B. (2021). The association between medical comorbidity and psychotherapy processes and outcomes for major depressive disorder in a community mental health setting. *Psychotherapy*.
- Knapp, A. A., Cohen, K., Nicholas, J., Mohr, D. C., Carlo, A. D., Skerl, J. J., & Lattie, E. G. (2021). Integration of Digital Tools Into Community Mental Health Care Settings That Serve Young People: Focus Group Study. *JMIR Mental Health*, 8(8), e27379.
- Laranjeira, C. (2021). Therapeutic relationship in mental health nursing: A scoping review. *European Psychiatry*, 64(S1), S730-S731.
- Lattie, E. G., Nicholas, J., Knapp, A. A., Skerl, J. J., Kaiser, S. M., & Mohr, D. C. (2020). Opportunities for and tensions surrounding the use of technology-enabled mental health services in community mental health care. *Administration and Policy in Mental Health and Mental Health Services Research*, 47(1), 138-149.
- Mårtensson, G., Jacobsson, J. W., & Engström, M. (2014). Mental health nursing staff's attitudes towards mental illness: an analysis of related factors. *Journal of psychiatric and mental health nursing*, 21(9), 782-788.
- McGinty, E. E., Thompson, D., Murphy, K. A., Stuart, E. A., Wang, N. Y., Dalcin, A., ... & Daumit, G. L. (2021). Adapting the Comprehensive Unit Safety Program (CUSP) implementation strategy to increase delivery of evidence-based cardiovascular risk factor care in community mental health organizations: protocol for a pilot study. *Implementation Science Communications*, 2(1), 1-12.
- Moen, Ø. L., Skundberg-Kletthagen, H., Lundquist, L. O., Gonzalez, M. T., & Schröder, A. (2021). The relationships between health professionals' perceived quality of care, family involvement and sense of coherence in community mental health services. *Issues in Mental Health Nursing*, 42(6), 581-590.

- O'Donnell, R., Savaglio, M., Vicary, D., & Skouteris, H. (2021). Effect of community mental health care programs in Australia: a systematic review. *Australian Journal of Primary Health*, 26(6), 443-451.
- O'Sullivan, R., Cosgrave, M., Butler, A., & Lyne, J. P. (2021). Characteristics of a later life population in a general adult community mental health service setting. *Irish Journal of Psychological Medicine*, 1-7.
- Paes, M. R., & Maftum, M. A. (2013). Communication between nursing team and patients with mental disorder in an emergency service. *Cienc Cuid Saude*, 12(1), 55-61.
- Roviralta-Vilella, M., Moreno-Poyato, A. R., Rodríguez-Nogueira, Ó., Duran-Jordà, X., Roldán-Merino, J. F. (2019). Relationship between the nursing practice environment and the therapeutic relationship in acute mental health units: A cross-sectional study. *International journal of mental health nursing*, 28(6), 1338-1346.
- Sara, G., Chen, W., Large, M., Ramanuj, P., Curtis, J., McMillan, F., ... & Burgess, P. (2021). Potentially preventable hospitalisations for physical health conditions in community mental health service users: a population-wide linkage study. *Epidemiology and psychiatric sciences*, 30.
- Sheidow, A. J., Zajac, K., Chapman, J. E., McCart, M. R., & Drazdowski, T. K. (2021). Randomized controlled trial of an integrated family-based treatment for adolescents presenting to community mental health centers. *Community mental health journal*, 57(6), 1094-1110.
- Sibley, M. H., Ortiz, M., Rios-Davis, A., Zulauf-McCurdy, C. A., Graziano, P. A., & Bickman, L. (2021). Stakeholder-Generated Implementation Strategies to Promote Evidence-Based ADHD Treatment in Community Mental Health. *Administration and Policy in Mental Health and Mental Health Services Research*, 1-15.
- Siegel, S. D., Laurenceau, J. P., Hill, N., Bauer, A. M., Flitter, A., Ziedonis, D., ... & Schnoll, R. A. (2021). Assessing barriers to providing tobacco use disorder treatment in community mental health settings with a revised version of the Smoking Knowledge, Attitudes, and Practices (S-KAP) instrument. *Addictive Behaviors*, 114, 106735.
- Skjorestad, S. M., & Johannessen, B. (2013). The relationship between persons with mental health problems and their dogs: a qualitative study within a nursing perspective. *Journal of Nursing Education and Practice*, 3(1), 130.
- Srikumar, K., Walsh, R., Walsh, D., Patel, S., & O'Sullivan, S. (2021). Patient factors associated with the use of psychotropic polypharmacy in patients under the care of a community mental health team in the West of Ireland. *BJPsych Open*, 7(S1), S106-S106.
- Sriramalu, S. B., Elangovan, A. R., Nibin, P. P., Joseph, S. J., Yohannan, S., Haridas, H., & Paramasivam, R. (2021). Family Reintegration of a Homeless Person through Case Management Approach: A Case Report from a Community Mental Health Centre. *Journal of Psychosocial Rehabilitation and Mental Health*, 8(3), 317-325.
- Storm, M., Fjellså, H. M. H., Skjærpe, J. N., Myers, A. L., Bartels, S. J., & Fortuna, K. L. (2021). Usability Testing of a Mobile Health Application for Self-Management of Serious Mental Illness in a Norwegian Community Mental Health Setting. *International Journal of Environmental Research and Public Health*, 18(16), 8667.

- Townley, G., Brusilovskiy, E., Klein, L., McCormick, B., Snethen, G., & Salzer, M. S. (2021). Community Mental Health Center Visits and Community Mobility of People with Serious Mental Illnesses: A Facilitator or Constraint?. *Community Mental Health Journal*, 1-9.
- Valente, S. M. (2017). Managing professional and nurse–patient relationship boundaries in mental health. *Journal of psychosocial nursing and mental health services*, 55(1), 45-51.
- Wand, T. (2010). Mental health nursing from a solution focused perspective. *International Journal of Mental Health Nursing*, 19(3), 210-219.
- Waraan, L., Rognli, E. W., Czajkowski, N. O., Aalberg, M., & Mehlum, L. (2021). Effectiveness of attachment-based family therapy compared to treatment as usual for depressed adolescents in community mental health clinics. *Child and Adolescent Psychiatry and Mental Health*, 15(1), 1-14.
- Ward, L. (2011). Mental health nursing and stress: Maintaining balance. *International journal of mental health nursing*, 20(2), 77-85.
- Webber, M., Ngamaba, K., Moran, N., Pinfold, V., Boehnke, J. R., Knapp, M., ... & Morris, D. (2021). The implementation of Connecting People in community mental health teams in England: a quasi-experimental study. *The British Journal of Social Work*, 51(3), 1080-1100.
- Wykes, T. L., Worth, A. S., Richardson, K. A., Woods, T., Longstreth, M., & McKibbin, C. L. (2021). Examining community mental health providers' delivery of structured weight loss intervention to youth with serious emotional disturbance: An application of the theory of planned behaviour. *Health Expectations*.
- Yıldız, E. (2019). What do nursing students tell us about their communication with people with mental illness? A qualitative study. *Journal of the American Psychiatric Nurses Association*, 1078390319892311.

**IMPROVING OF GROWTH AND QUALITY CHARACTERISTICS OF
ORNAMENTAL PLANTS WITH SELENIUM TREATMENTS: A REVIEW**

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ABSTRACT

The use of ornamental plants has been proposed to restore degraded landscapes, control erosion, reduce energy and water consumption, and improve the aesthetic quality of indoor and outdoor environments in which people live. Ornamental plants are used in different environments and situations, in landscaping and in different green areas (roads, parks and gardens), significantly increasing the quality of life in the countryside or in the city. Although selenium (Se) is an essential micronutrient for humans and animals, its possibly indispensable role in plants has yet to be determined. It is thought that higher plants do not need selenium, but several studies show that low concentrations of selenium improve physiological and biochemical processes in plants. The growth enhancement in Se-treated plants has been associated with the function of regulating water relation, photosynthesis, antioxidant defense systems, uptake of mineral nutrients, and activation of plant growth-stimulating hormones.

Keywords: Quality, ornamental plant plant growth, selenium

INTRODUCTION

Ornamental plants are grown for the purpose of adorning and beautifying indoor and outdoor spaces (Hernández et al., 2014) as well as improving the aesthetic and/or visual quality of a built environment (Kendal et al., 2012). These plants are characterized by their leaves, especially their brightly colored flowers. Recently given the pressure of environmental problems and global change, ornamental plants have come to the fore with their aesthetic properties and blooming capacity to improve the environment and our quality of life. The use of ornamental plants has been proposed to restore degraded landscapes, control erosion, reduce energy and water consumption, and improve the aesthetic quality of indoor and outdoor environments in which people live (Toscano et al., 2019). In many countries, one of the most important branches of horticulture in the field of agriculture-based industry is flower production (Costa et al., 2020).

Ornamental plants are used in different environments and situations, in landscaping and in different green areas (roads, parks and gardens), significantly increasing the quality of life in the countryside or in the city (Francini et al., 2022; Rocha et al., 2022). Increasing demand for high quality products requires post-harvest technologies to extend the vase life of flowers. Since the biological importance of ethylene on ornamental plant production and development has been understood in recent years, methods to reduce its harmful effects on ornamental plants have been investigated. Many chemicals currently used to reduce ethylene responses raise environmental and public health concerns. The development of environmentally friendly methods has become important (Scariot et al., 2014; Costa et al., 2020). Selenium has suitable properties to be an eco-friendly (Cochran et al., 2018). Selenium (Se) is an essential microelement for humans and a beneficial element for plants. Recently, biofortification with selenium has emerged as a key practice to increase plant quality (Razmavar et al., 2021).

A Multi-Purpose Element: Selenium

Selenium is a metalloid with dual properties of both metal and nonmetal elements (Chen et al., 2020; Xiaoa et al., 2021). Compared to other metal or nonmetallic elements, selenium has many advantages. First, its cost is relatively cheap. Secondly, as selenium can be metabolized in the body it is relatively safe for the environments and the residue tolerance of selenium is obviously higher than that of the other metal elements (Rayman, 2012). Selenium has good photovoltaic and photoconductive properties and is widely used in electronics such as photocells, light meters and solar cells. Additionally selenium is used in the glass industry, in photocopying in the toning of photographs and some cosmetics. The other use, taking about 15% is sodium

selenite for animal feeds and food supplements (URL-1). On the other hand, it plays an important role in human and animal nutrition. Its pronounced deficiency, as well as in the case of its higher concentrations, various diseases in humans and animals often occur (Adriano, 1986; Wachowicz et al., 2001; Fordyce, 2005). Selenium is an essential trace element for humans. The World Health Organization (WHO) recommends that the daily selenium uptake for adults should be 50-400 µg (Simpson, 2001). Selenium deficiency can lead a series of health problems, such as heavy metal poisoning, cardiovascular disease, low immunity, cancer. However, continuously taking over 2400 µg of Se everyday for several months may cause the chronic selenium poisoning (Xiaoa et al., 2021). White (2018) reported that although selenium is an essential micronutrient for humans and animals, its possibly indispensable role in plants has yet to be determined (Hawrylak-Nowak et al., 2019). Although it replaces sulfur in amino acids, it does not appear as essential for plant growth (Azza et al., 2010). It is thought that higher plants do not need selenium, but several studies show that low concentrations of selenium improve physiological and biochemical processes in plants (Saffaryazdi et al., 2012; Nawaz et al., 2016).

Usefulness of Selenium in Plant Growth and Nutrition

Selenium (Se) is a necessary trace element for humans and plants (Tapiero et al., 2003). Several researchers (Saffaryazdi et al., 2012; Nawaz et al., 2016) reported that low concentrations of Se improve physiological and biochemical processes in plants. Although some plants have the ability to accumulate selenium and convert it into bioactive compounds, selenium is probably not an essential element for plants (Terry et al., 2000; Minorsky, 2003; Kahakachchi et al., 2004; Germ and Stibilj, 2007). Selenates (VI) have been shown to alter the activity and permeability of cell membranes, which may be the first sign of selenium's effect on plants (Kinraide, 2003). Selenium may enhance plant tolerance against environmental adversities. Selenium treatment has been reported to improve resistance to certain abiotic stresses such as drought (Nawaz et al., 2015; Jiang et al., 2017; Sattar et al., 2019), salinity (Astaneh et al., 2018, Kamran et al., 2020), UV rays (Pennanen et al., 2002), and heavy metals (Kumar et al., 2012; Feng et al., 2021; Huang et al., 2021), high temperature (Djanaguiraman et al., 2018; Seliem et al., 2020), and biotic stress (Quiterio- Gutiérrez et al., 2019). Selenium treatments increased the activity of some antioxidant enzymes (Djanaguiraman et al., 2010; Hasanuzzaman et al., 2010; Valadabadi et al., 2010), and their beneficial effects were related to various physiological processes and regulation of water status, especially under drought (Tadina et al., 2007; Yao et al., 2009; Gülser et al., 2018). In general, growth enhancement in Se-treated plants may be

related to its function of regulating water relation, photosynthesis, antioxidant defense systems, uptake of mineral nutrients, and activation of plant growth-stimulating hormones (Saffaryazdi et al., 2012; Nawaz et al., 2016).

The Responses of Ornamental Plants to Selenium Treatments

Proietti et al. (2012) reported that selenium application can be useful to improve drought resistance in olive trees by protecting the cells from oxidative injuries and regulating water status. In another study, the highest value in N, P and K content and uptake of chamomile (*Matricaria chamomilla*) was obtained when 30 g of selenium was applied with organic residue. Therefore, these applications have been suggested to increase the growth, essential oil and chemical components of the Chamomile (*Matricaria chamomilla* L.) plant (Azza et al., 2010). It was reported that selenium supplementation under moderate salt stress can, at least partially, alleviate the adverse effect of salinity on *Plectranthus scutellarioides* (L.) R. Br. Thereby enhancing its ornamental value and resistance to stress conditions. In addition, it was determined that selenium did not have significant effect on the growth and ornamental qualities of this species under severe salt stress conditions (Hawrylak-Nowak et al., 2019). Lu et al. (2020) reported that low concentrations of Na₂SeO₃ had positive dose effects on antioxidant enzymes (SOD, POD, CAT, APX, GR, DHAR and MDHAR), RWC and the contents of soluble protein, soluble sugar and proline in the petals, which further reduced the production of MDA and H₂O₂ and improved the vase life of *Lilium longiflorum* cut flower. In the another study it was reported that Se increases vase life directly by downregulating ethylene synthesis and indirectly by reducing flower senescence-related events, such as respiration rate, sugar starvation, petal and flower wilting and abscission, and oxidative stress (Costa et al., 2020). Bayat and Aminifard (2020) reported that lower concentrations of selenium supplementation had beneficial effects on pot marigold (*Calendula officinalis* L.) plants under both control and water stress conditions. They also declared that selenium alleviates the negative effects of drought stress by improving water relations, increasing the integrity of cell membranes, accumulation of soluble sugars and antioxidant activity, and it can be recommended to prepare seeds with 1.5 mg l⁻¹ selenium in drought-affected regions. Kleiber et al. (2020) reported that the height and width of the plants exposed to the drought stress increased when 0.4mg dm⁻³ selenium was used in French marigold (*Tagetes patula* L.). Additionally the number of inflorescences was the minimal in the control sample exposed to the drought stress. In the other study (Bayat and Moradinezhad, 2020) 1-methylcyclopropene and selenium delayed

senescence and significantly increased the vase life, water uptake, and relative fresh weight of *N. tazetta* cut flowers in comparison to the control in *Narcissus tazetta* L.

Razmavar et al. (2021) reported that the 40 μ M selenium was a positive effect on plant quality by increasing flower weight, vitamin C, relative water content, total phenolic content, and total flavonoid content in Ivy Geranium (*Pelargonium peltatum* L.). Additionally they suggested to use 40 μ M selenium to alleviate adverse effects induced by postharvest time growth on productivity of *P. peltatum* L.

CONCLUSION

Higher plants do not need selenium, but several studies show that low concentrations of selenium improve physiological and biochemical processes in plants. If selenium-containing materials are used in plant production, their application in high doses may cause problems in terms of environmental pollution. Seleno amino acids such as selenocysteine, selenomethionine and derived selenium yeast are safe, but their very expensive price prevents them from being used as selenium fertilizers in large-scale applications. Sodium selenite is inexpensive and can give plants exactly selenium, but the chemical's high toxicity makes it unsafe for the environment. Therefore, it may be recommended not to apply at high concentrations when making selenium treatment.

REFERENCES

- Adriano S. (1986). Selenium, In: Trace Elements in the Terrestrial Environment, Springer Verlag, pp. 390-420, New York, USA.
- Astaneh R.K., Bolandnazar S., Zaare Nahandi F., Oustan S. (2018). Effect of Selenium Application on Phenylalanine Ammonia-Lyase (PAL) Activity, Phenol Leakage and Total Phenolic Content in Garlic (*Allium Sativum* L.) Under NaCl Stress. Inform. Proc. Agric., 5, 339-344.
- Azza A.M.M., Sahar M.Z., Yassen A.A. (2010). Studies on The Effect of Selenium and Organic Residues on Chamomile (*Matricaria chamomilla* L.) Plants. New York Science Journal, 3 (12), 56-63.
- Bayat H., Aminifard M.H. (2020). Seed Priming With Selenium Improves Growth, Water Relation and Antioxidant Activity of Pot Marigold (*Calendula officinalis* L.) Under Drought Conditions. Acta Sci. Pol. Hortorum Cultus, 20 (1), 27-36.
- Bayat H., Moradinezhad F. (2020). Extending Vase Life of *Narcissus tazetta* L. Cut Flowers Using Selenium and 1-Methylcyclopropene Treatments. Journal of Applied Horticulture, 22 (3), 196-201.
- Chen C., Cao Y., Wu X., Cai Y., Liu J., Xu L., Ding K., Yu L. (2020). Energy Saving and Environment-Friendly Element-Transfer Reactions with Industrial Application Potential. Chin. Chem. Lett. 31 (5), 1078-1082.
- Cochran A.T., Bauer J., Metcalf J.L., Lovecka P., Sura-de Jong M., Warris S., et al. (2018). Plant Selenium Hyperaccumulation Affects Rhizosphere: Enhanced Species Richness and Altered Species Composition. Phytobiomes J., 2, 82-91.
- Costa L.C., Luz L.M., Nascimento V.L., Araujo F.F., Santos M.N.S., França C.F.M., Silva T.P., Fugate K.K., Finger F.L. (2020). Selenium-Ethylene Interplay in Postharvest Life of Cut Flowers. Front. Plant Sci., 11, 584698.
- Djanaguiraman M., Belliraj N., Bossmann S.H., Vara Prasad P.V. (2018). High-Temperature Stress Alleviation by Selenium Nanoparticle Treatment in Grain *Sorghum*. ACS Omega. 3 (3), 2479-2491.
- Djanaguiraman M., Prasad P.V.V., Seppänen M. (2010). Selenium Protects Sorghum leaves From Oxidative Damage Under High Temperature Stress by Enhancing Antioxidant Defense System. Plant Physiol. Biochem, 48, 999-1007.
- Feng R., Wang L., Yang J., Zhao P., Zhu Y., Li Y., Yu Y., Liu H., Rensing C., Wu Z., Ni R., Zheng S. (2021). Underlying Mechanisms Responsible For Restriction of Uptake and Translocation of Heavy Metals (Metalloids) by Selenium Via Root Application in Plants. Journal of Hazardous Materials, 402, 123570.
- Fordyce F.M. (2005). Selenium Deficiency and Toxicity in The Environment. In: O. Selinus, Editor, Essentials Of Medical Geology, Academic Press, London.
- Francini A., Romano D., Toscano S., Ferrante A. (2022). The Contribution of Ornamental Plants to The Contribution of Ornamental Plants to Urban Ecosystem Services. Earth, 3, 1258-1274.
- Germ M., Stibilj V. (2007). Metabolic Importance of Selenium for Plants. Acta Agriculturae Slovenica, 89, 65-71.
- Gülser F., Gülser C., Gökkaya T.H. (2019). The Effects of Selenium Application On Germination Parameters of Pumpkin (*Cucurbita pepo* L.) and Osmotic Potential of Growth Media Under Drought Conditions. 10th International Soil Science Congress on "Environment and Soil Resources Conservation". 17-19 October, 2018. Almaty, Kazakhstan. Pages: 249-255.
- Hasanuzzaman M., Hossain M.A., Fujita M. (2010). Selenium in Higher Plants: Physiological Role, Antioxidant Metabolism and Abiotic Stress Tolerance. J. Plant Sci., 5, 354-375.

- Hawrylak-Nowak B., Rubinowska K., Molas J., Woch W., Matraszek-Gawron R., Szczurowska A. (2019). Selenium-Induced Improvements in The Ornamental Value and Salt Stress Resistance of *Plectranthus scutellarioides* (L.) R. Br. *Folia Hort.*, 31 (1), 213-221.
- Hernández M., Morales A., Saurí D. (2014). Ornamental Plants and The Production of Nature (s) in The Spanish Real Estate Boom and Bust: The Case of Alicante. *Urban Geogr.*, 35, 71-85.
- Huang H., Li M., Rizwan M., Dai Z., Yuan Y., Hossain M.M., Cao M., Xiong S., Tu S. (2021). Synergistic Effect of Silicon and Selenium on The Alleviation of Cadmium Toxicity in Rice Plants. *Journal of Hazardous Materials*, 401, 123393.
- Jiang C., Zu C., Lu D., Zheng Q., Shen J., Wang H., Li D. (2017). Effect of Exogenous Selenium Supply on Photosynthesis, Na⁺ Accumulation and Antioxidative Capacity of Maize (*Zea mays* L.) Under Salinity Stress. *Sci. Rep.*, 7, 42039.
- Kahakachchi C., Boakye H.T., Uden P.C., Tyson J.F. (2004). Chromatographic Speciation of Anionic and Neutral Selenium Compounds in Se-Accumulating *Brassica juncea* (Indian Mustard) and in Selenized Yeast. *J Chromatography A.*, 1054, 303-312.
- Kamran M., Parveen A., Ahmar S., Malik Z., Hussain S., Chattha M.S., Saleem M.H., Adil M., Heidari P., Chen J.T. (2020). An Overview of Hazardous Impacts of Soil Salinity in Crops, Tolerance Mechanisms, and Amelioration through Selenium Supplementation. *Int J Mol Sci.*, 21 (1), 148.
- Kendal D., Williams N.S., Williams K.J. (2012). A cultivated environment: Exploring the Global Distribution of Plants in Gardens, Parks And Streetscapes. *Urban Ecosyst.*, 15, 637-652.
- Kinraide T.B. (2003). The Controlling Influence of Cell-Surface Electrical Potential on The Uptake and Toxicity of Selenate (SeO₄²⁻). *Plant Physiol.*, 117, 64-71.
- Kleiber T., Borowiak K., Kosiada T., Breś W., Ławniczak B. (2020). Application of Selenium and Silicon to Alleviate Short-Term Drought Stress in French Marigold (*Tagetes patula* L.) As A Model Plant Species. *Open Chemistry*, 18, 1468-1480.
- Kumar M., Bijo A.J., Baghel R.S., Reddy C.R.K., Jha B. (2012). Selenium and Spermine Alleviate Cadmium Induced Toxicity in The Red Seaweed *Gracilaria dura* by Regulating Antioxidants System And DNA Methylation. *Plant Physiol. Bioch.*, 51, 129-138.
- Lu N., Wu L., Shi M. (2020). Selenium Enhances The Vase Life of *Lilium longiflorum* Cut Flower by Regulating Postharvest Physiological Characteristics. *Scientia Horticulturae* 264, 109172.
- Minorsky P.V. (2003). Selenium in Plants. *Plant Physiol.*, 133, 14-15.
- Nawaz F., Ahmad R., Ashraf M.Y., Waraich E.A., Khan S.Z. (2015). Effect of Selenium Foliar Spray on Physiological and Biochemical Processes and Chemical Constituents of Wheat Under Drought Stress. *Ecotoxicol. Environ. Saf.*, 113, 191-200.
- Nawaz F., Naeem M., Ashraf M.Y., Tahir M.N., Zulfiqar B., Salahuddin M., Shabbir R.N., Aslam M. (2016). Selenium Supplementation Affects Physiological and Biochemical Processes to Improve Fodder Yield and Quality of Maize (*Zea mays* L.) Under Water Deficit Conditions. *Frontiers in Plant Science*, 7, 1438.
- Pennanen A., Xue T., Hartikainen H. (2002). Protective Role of Selenium in Plant Subjected to Severe UV Irradiation Stress. *J. Appl. Bot.*, 76, 66-76.
- Proietti P., Nasini L., Ilarioni L. (2012). Photosynthetic Behavior of Spanish Arbequina and Italian Maurino Olive (*Olea Europaea* L.) Cultivars Under Super-Intensive Grove Conditions. *Photosynthetica* 50, 239-246.

- Quiterio-Gutiérrez T., Ortega-Ortiz H., CadenasPliego, G., Hernández-Fuentes, Sandoval Rangel A., Benavides-Mendoza A., Cabrera-de la Fuente M., Juárez-Maldonado A. (2019). The Application of Selenium and Copper Nanoparticles Modifies the Biochemical Responses of Tomato Plants under Stress by *Alternaria solani*. *Int. J. Mol Sci.*, 20 (8), 1950. Published online 2019 Apr 20. doi: 10.3390/ijms 20081950
- Rayman M.P. (2012). Selenium and Human Health. *Lancet*, 379 (9822), 1256-68.
- Razmavar Z., Naderi R., Abdossi V., Ladanmoghdam A., Nematollahi F. (2021). Selenium Improves Physiology, Biochemistry, and Quality Characteristic of Flowers in Ivy Geranium (*Pelargonium peltatum* L.). *Journal of Ornamental Plants*, 11 (2), 99-108.
- Rocha C.S., Rocha D.C., Kochi, L.Y., Carneiro D.N.M., Dos Reis M.V., Gomes M.P. (2022). Phytoremediation by Ornamental Plants: A Beautiful and Ecological Alternative. *Environ. Sci. Pollut. Res.*, 29, 3336-3354.
- Saffaryazdi A., Lahouti M., Ganjeali A., Bayat H. (2012). Impact of Selenium Supplementation on Growth and Selenium Accumulation on Spinach (*Spinacia oleracea* L.) Plants. *Not. Sci. Biol.*, 4, 95-100.
- Sattar A., Cheema M.A., Sher A., Ijaz M., Ul-Allah S., Nawaz A., Abbas T., Ali Q. (2019). Physiological and Biochemical Attributes of Bread Wheat (*Triticum aestivum* L.) Seedlings Are Influenced by Foliar Application of Silicon and Selenium Under Water Deficit. *Acta Physiol. Plant.*, 41, 146.
- Scariot V., Paradiso R., Rogers H., De Pascale S. (2014). Ethylene Control in Cut Flowers: Classical and Innovative Approaches. *Postharvest Biol. Technol.*, 97, 83-92.
- Seliem M.K., Hafez Y.M., El-Ramady H.R. (2020). Using of Nano-Selenium in Reducing the Negative Effects of High Temperature Stress on *Chrysanthemum morifolium*. *Ramat. J. Sus. Agric. Sci.*, 46 (3), 47-59.
- Simpson B.B. (2001). *Herbal Remedies Economic Botany Plants in Our World*. pp. 39-43 Ed 3Me Graw-Hill, Boston Burr Ridge, IL Dubuque, IA Madison, WI New York, SanFrancisco, St. Louis Bangkok Bogota Caracas.
- Tadina N.M., Kreft G.I., Breznik B., Gaberscik A. (2007). Effects of Water Deficit And Selenium on Common Buckwheat (*Fagopyrum esculentum* Moench.) Plants. *Photosynthetica*, 45, 472-476.
- Tapiero H., Townsend D.M., Tew K.D. (2003). Dossier: Oxidative Stress Pathologies and Antioxidants: The Antioxidant Role of Selenium and Seleno-Compounds. *Biomed. Pharmacoth.*, 57, 134-144.
- Terry N., Zayed A.M., de Souza M.P., Tarun A.S. (2000). Selenium in Higher Plants. *Ann Rev Plant Physiol Plant Molecul Biol.*, 51, 401-432.
- Toscano S., Ferrante A., Romano D. (2019). Response of Mediterranean Ornamental Plants to Drought Stress. *Horticulturae*, 5, 6.
- URL-1. <https://www.lenntech.com/periodic/elements/se.htm> (Accessed date: 09.03.2023)
- Valadabadi S.A., Shiranirad A.H., Farahani H.A. (2010). Ecophysiological Influences of Zeolite and Selenium on Water Deficit Stress Tolerance in Different Rapeseed Cultivars. *J. Ecol. Nat. Environ.* 2, 154-159.
- Wachowicz B., Zbikowska H.M., Nowak P. (2001). Selenium Compounds in The Environment; Their Effect on Human Health. *Cell. Mol. Biol. Lett.*, 6, 375-381.
- White P.J. (2018). Selenium Metabolism in Plants. *Biochim. Biophys. Acta Gen. Subj.*, 1862, 2333-2342.
- Xiaoa X., Shao Z., Yub L. (2021). A Perspective of The Engineering Applications of Carbon-Based Selenium-Containing Materials. *Chinese Chemical Letters*, 32, 2933-2938.
- Yao X., Chu J., Wang G. (2009). Effects of Selenium on Wheat Seedlings Under Drought Stress. *Biol. Trace Elem. Res.*, 130, 283-290.

VERGİ MAHREMİYETİNİN İHLALİ VE KARŞILAŞILAN SONUÇLAR

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Özet

Mahremiyet kavramı insan yaşamında son derece önemli bir yer tutmaktadır. Sosyal, ekonomik, politik ve hatta kültürel alanlarda kişiler kendi bilgileri dışında kişisel alanlarına girilmesini istemezler. Bununla beraber bu tutum dâhilinde kendileri hakkında bilgi sahibi olan bireylerin ve kurumların bu bilgileri başkasına verebilme ihtimali bile bireylerde huzursuzluğa yol açmaktadır. Devletlerin en önemli gelir kaynağı olan vergi kapsamında da mahremiyet son derece önemlidir. Mükelleflerin vergiye dair bilgilerine erişebilen kişilerin bu bilgileri muhafaza etmeleri ve başkaları ile paylaşmada kanunların çizdiği sınırlar kapsamında hareket etmeleri gerekmektedir. Aksi durumların yaşanması halinde mükelleflerin vergiye bakışlarında olumsuzluklar yaşanmaktadır. Vergi mahremiyetinin ihlal edildiğini duyan veya bu duruma şahit olan mükelleflerin vergi uyumları azalmaktadır. Bununla birlikte olumsuz durumlar, kamu kurumlarına güven problemi yaşamalarına neden olmaktadır. Vergi mahremiyetinin ihlali, 213 sayılı Vergi Usul Kanunu'nun 5. maddesi ve 362. maddesinde yer almaktadır. Mahremiyetin ihlali, ilgili kanunun 362. maddesinde suç olarak düzenlenmiştir. Buna karşın uygulanacak yaptırım hususunda Türk Ceza Kanunu'nun 239. maddesinden söz edilmiştir. TCK'nın 239. maddesine yapılan atıf, içerisinde barındırdığı belirsizlik sebebiyle bir takım karışıklıklara yol açmaktadır. Bu hususta yapılacak düzenlemelerin uygulamada ve algılamada kolaylıkları beraberinde getireceği düşünülmektedir. Tespit edilen bir diğer önemli sorun da vergi mahremiyetini sağlamakla yükümlü olan çalışanların işten ayrıldıkları veya emekli oldukları takdirde bilgi paylaşımı yaparak mahremiyet ihlali yapmalarının önüne geçilmesinin oldukça güç olduğudur. Bu hususta da yapılacak planlamalar ile birlikte görev bitiminde dahi kişilerin vergi mahremiyeti kapsamında hassas olmaları sağlanmalıdır.

Anahtar kelimeler: Vergi, vergi mahremiyeti, vergi suçu

VIOLATION OF TAX PRIVACY AND CONSEQUENCES

Abstract

The concept of privacy has an extremely important place in human life. In social, economic, political and even cultural areas, people do not want to be entered into their personal areas without their own knowledge. However, even the possibility that individuals and institutions that have information about themselves within this attitude may give this information to someone else causes uneasiness in individuals. Privacy is also extremely important within the scope of taxation, which is the most important source of income for states. Persons who have access to taxpayers' tax information must keep this information and act within the limits set by the laws in sharing it with others. In case of adverse situations, taxpayers experience negative attitudes towards tax. Tax compliance of taxpayers who hear or witness that tax privacy is violated decreases. However, negative situations cause them to experience trust problems in public institutions. Violation of tax privacy is included in Article 5 and Article 362 of the Tax Procedure Law No. 213. Violation of privacy is regulated as a crime in article 362 of the relevant law. On the other hand, article 239 of the Turkish Penal Code has been mentioned regarding the sanctions to be applied. The reference to Article 239 of the Turkish Penal Code causes some confusion due to the uncertainty it contains. It is thought that the regulations to be made in this regard will bring convenience in practice and perception. Another important problem identified is that it is very difficult to prevent the employees, who are responsible for ensuring tax privacy, from making a privacy violation by sharing information if they quit their job or retire. Along with the plans to be made in this regard, it should be ensured that people are sensitive within the scope of tax privacy even at the end of their duty.

Keywords: Tax, tax privacy, tax crime

GİRİŞ

Bireyler mahremiyeti hayatlarının her alanında önemserler. Mahremiyetlerinin korunması kişisel alanlarına saygı duyulması son derece önemlidir. Bununla birlikte ekonomik ilişkilerde de mahremiyetin korunması hem devletin hem de devletin kurumlarının önemli görevleri arasında yer almaktadır. Vergi mahremiyeti ile ilgili düzenlemeler Vergi Usul Kanunu'nun 5. maddesinde yer almaktadır. Bu madde kapsamında yapılan düzenlemelere uyulduğu takdirde mükellefler vergisel işlemlerini gönül rahatlığı ile yapabilmekte ve vergiye uyumları artmaktadır. Aksi durumda ise mükelleflerin vergiye bakışları olumsuz etkilenmektedir. Vergi mahremiyetinde üzerinde durulması gereken önemli bir nokta ise Türk Ceza Kanunu'nun 239. maddesine yapılan atıf ile ilişkisidir. Bu hususta bir takım eleştiriler yapılmaktadır. Özellikle mali hukukçular yeni bir düzenlemeye ihtiyaç duyulduğunu ifade etmektedirler.

Mahremiyet kavramı ve Vergi mahremiyeti

Mahremiyet kavramı; genel itibariyle bireylerin yalnız başlarına kalabildikleri, istedikleri ölçüde düşünüp o doğrultuda hareket edebildikleri, başkaları ile kuracakları ilişkisinin ölçüsünü ayarlayabildikleri hakka denmektedir. Mahremiyet hakkı ise; başka bireylerin dışlandığı ve başkaları ile olan etkileşimin tamamıyla kesilmesi anlamına gelmemektedir. Mahremiyet hakkında önemli olan durum kişinin kendi hayatını başkaları ile hangi ölçüde paylaşacağını belirlemesi hakkı olarak ifade edilmektedir (Yüksel, 2003). Mahremiyet hakkının da içerisinde bulunduğu bir takım hakların, insan haklarına ve özgürlüklerine yönelik müdahalelerin hukuka olan uygunluğu ile kamu düzeni kapsamında değerlendirilmesi tartışılmaktadır. Burada üzerinde durulan nokta mahremiyet hakkına yapılan saldırıların insanın hem maddi hem de manevi bakımdan gelişimine yönelik olumsuz durumlardır (Yüksel, 2009). Mahremiyet hakkı bireylerin hayatlarının pek çok alanında önemsedikleri ve devletinde bu konuda üzerinde hassaslaştığı önemli bir noktadır. Vergi temelli düşüldüğünde de özellikle mükellefler için oldukça önemli bir tutumdur.

Vergiler ifade edilirken; kaynağı milli gelir olup, devletlerin kamu harcamalarını karşılamak amacıyla kişilerden egemenlik gücü kapsamında ve ödeme gücü ilkesi çerçevesinde tek taraflı, zorunlu ve nihai olarak alınan paralar tanımı kullanılmaktadır. Toplam kamu gelirlerinin yaklaşık %70-95'i piyasa ekonomilerinde vergi gelirlerinden oluşmaktadır (Eker, 1999). Mükelleflerin özel hayatlarının gizliliğinin korunması anayasa tarafından güvence altına alınmıştır. Vergilendirme işlemi için de bu hakkın kullanılabilmesi vergi hukukunda vergi mahremiyeti ilkesi kapsamında yer almaktadır. Vergi mükelleflerinin ve mükelleflerle ilgili

kişilerin gizli bilgilerinin bu bilgileri öğrenen kişiler tarafından saklanması gerekmektedir. Aksi bir durum yaşanması halinde yanlış davranışta bulunan kişilerin hürriyetlerini bağlayıcı cezalar alacağı kararlaştırılmıştır (Ünsal, 2003).

Vergi mükelleflerinin, anayasal haklar ve vergi hukuku sayesinde sahip oldukları güven duygusu davranışlarını şekillendirmektedir. Bu doğrultuda bilgilerinin gizli kalacağını düşünerek vergi idaresine bilgilerini gönül rahatlığı ile vermekte olup hem vergi idaresindeki işleyişin doğru ve sağlıklı olması hem de kendilerini güven içerisinde hissetmeleri açısından bu husus son derece önemlidir.

Vergi mahremiyeti ve yasalar

Vergi mahremiyeti mükellefler açısından son derece önemlidir. Hem Vergi Usul Kanunu hem de AATUHK’da bir takım düzenlemeler mevcuttur. 213 sayılı VUK’un 5. Maddesinde 6183 sayılı AATUHK’un 107. Maddesinde vergi mahremiyetine yer verilmiştir. Bununla birlikte 2010 senesinde anayasaya dahil olan kişisel verilerin korunması hakkı ve 6669 sayılı Kanun ve 108 sayılı Avrupa Konseyi Sözleşmesi vergi hukuku özelinde vergi mahremiyetine yoğunlaşılmasına sebep olmuştur (Durdu, 2019). 213 sayılı Vergi Usul Kanunu’nun 5. Maddesinde vergi mahremiyetine yer verilmiştir. Vergide gizliliğe uymama görevden doğan suçlar kapsamında yer almaktadır. Vergi temelli sırların ifşa edilmesi bir suç teşkil etmektedir.

İlgili kanunun 5. Maddesinde “*Vergi muameleleri ve incelemeleri ile uğraşan memurlar, vergi mahkemeleri, bölge idare mahkemeleri ve Danıştayda görevli olanlar, vergi kanunlarına göre kurulan komisyonlara iştirak edenler, vergi işlerinde kullanılan bilirkişiler*” görevlerinden ayrılışları bilgileri ifşa edemez, kendileri veya başka kişilerin menfaatine bu bilgileri kullanmazlar ifadeleri yer almaktadır (213 sayılı VUK).

Vergi muameleleri ve vergi incelemeleri ile uğraşan memurlar kapsamında verginin tarh, tahakkuk, ve tahsil işlemlerini yapan memurlar, bu işlemleri onaylayan şefler, müdür yardımcıları ve müdürler ile yazı işleri memurları yer almaktadır. Vergi incelemesinde yetkili olan kişilerin içerisinde ise vergi müfettişleri, müfettiş yardımcıları ve vergi idaresi bünyesindeki kurum amirleri yer almaktadır. Vergi yargı mercilerindeki görevlilerin kapsamına ise hakimler, danıştay üyeleri, tetkik hakimleri ve savcılar dahil olmaktadır. Kanunda görevli ifadesinin yer almasından kaynaklı olarak katipler, idare memurları ve raportörlerde bu kapsama dahil olmaktadır (213 sayılı VUK; Bayraklı, 2018).

Vergi mahremiyeti kapsamındaki istisnalar ve cezalar

Vergi konusunda mükelleflerin bilgilerinin saklanması ve ifşa edilmemesi çok önemli olup buradan tüm bilgilerin paylaşılmaması sonucu çıkarılmamalıdır. Vergi mahremiyeti kapsamında bir takım istisnalar yer almaktadır. Bunlar arasında gelir vergisi yükümlülerinin yıllık gelir vergileri, sermaye şirketlerinin kurumlar vergisi matrahları ile beyanları üzerinden tarh olunan gelir ve kurumlar vergileri ile vergi yükümlülerinin isimleri ile unvanları ilgili vergi daireleri tarafından uygun görülen yerlere asılacak cetveller ile ilan edilmektedir. Gelir vergisi yükümlüleri vergi tarhına esas olan kazanç tutarları ile vergi miktarlarını gösterildiği levhaları merkezlerine, şubelerine kolayca okunacak şekilde asmaları gerekmektedir. Yine istisnalar kapsamına giren diğer bir durum kesinleşen vergi ve cezaların Hazine ve Maliye Bakanlığı tarafından ilan edilmesi durumudur. Yine sahte ve yanıltıcı belge düzenleyenlerin vergi inceleme raporları bağlı oldukları mesleki kuruluşlara bildirilmektedir. Bu durum da vergi mahremiyetinin ihlali kapsamında değerlendirilmemektedir (213 sayılı VUK).

Vergi mahremiyetinin ilan edilmesi durumunda kişiler TCK'nın 239. Maddesine göre cezalandırılırlar. "Ticari sır, bankacılık sırrı veya müşteri sırrı niteliğindeki bilgi veya belgeleri açıklanması" başlığının altında yer alan maddede hapis cezası 1-3 yıl arası olarak belirlenmiş olmakla beraber beş bin güne kadarda adli para cezası uygulanacağı kanunda yer almaktadır (5237 sayılı Türk Ceza Kanunu).

Vergi mahremiyetinin ihlalinin cezalandırılmasının kanuni karşılığı bir takım tartışmaları da beraberinde getirmektedir. Arslan (2013), vergi mahremiyetinin ihlalinin ilk olarak Türk Ceza Kanunu'nun 134, 137, 239 ve 258. Maddelerinde yer alan suçlar kapsamında değerlendirildiği görünse bile ifşa unsuru ile beraber gizliliğini Vergi Usul Kanunu'ndan kaynaklanması gerektiğini ifade etmiştir. VUK madde 362'nin özel bir norm olduğunu vergi mahremiyetinin ihlal edilmesi suçunun TCK'nın 239. Maddesinde muhafaza edilmesinin gereksiz olduğunu savunmaktadır. Duman (2016), vergi mahremiyeti ihlalinin VUK'un 5. Maddesi ve 362. Maddesinde düzenlendiğini karşılığında uygulanacak yaptırımın TCK'nın 239. Maddesinde atıfta bulunulduğunu ifade etmiştir. Burada atıf usulünün problemlili olduğu ifade edilmiştir. Türk Ceza Kanunu'nda yer alan suç ile ilişkili hangi hükümlere atıf yapıldığı konusunda aksaklıklar yaşandığı belirtilmiştir. Yapılan atfın ilgili madde hükümlerinin hepsine mi yoksa belirli bir kısmına mı yapıldığı tartışmaları beraberinde getirmekte olduğu aktarılmıştır. Küçükaya (2022) ise Duman (2016) ile benzer şekilde fikir beyan etmiştir. Atfın maddenin tamamına mı yoksa ceza miktarına mı ilişkin olduğuna dair bir sorunun olduğunu belirtmiştir.

Bununla birlikte atıf yerine ilgili maddede açıkça cezanın belirtilmesi gerektiğinin önemine vurgu yapılmıştır.

Vergi mahremiyetiyle ilgili karşılaşılan bir başka sorun ise, mahremiyete uymak zorunda olanların görevlerinden ayrıldıktan sonra mahremiyete uyup uymadıklarına dair takibin zor olmasından kaynaklıdır. Çalışanların bir kısmı emekli olmakta bir kısmı da özel sektörde çalışmaya devam etmektedirler. Özellikle özel sektörde çalışanların ticari yaşam içerisinde mükellefler ile bir araya geldikleri bilinmektedir. Böyle bir durumda vergi mahremiyetinin ihlal edilip edilmediğinin takibinin yapılması oldukça güçtür (Ünsal, 2003).

SONUÇ

Vergi mahremiyetinin sağlanması devletin önemli bir görevidir. Bunun sağlanması için Vergi Usul Kanunu'nda hangi görevleri ifa edenlerin bundan sorumlu oldukları ifade edilmiştir. Önemli bir sorun; kamu görevinden çeşitli sebeplerle ayrılanların özellikle özel sektörde çalıştıkları zaman bilgileri ifşa etmeleri konusunda tereddütlerin olması ve buna çözüm bulunamaması durumudur. Burada kamuya düşen görev ayrılan personellerin takibini yapmak, vergi mahremiyetine aykırı bir davranışta bulunulması üzerine sürecin takipçisi olmaktır. Kişilerin çalıştıkları dönemde hangi bilgilere ulaştıkları kayıt altına alınarak yaşanacak olumsuz bir durumun önüne geçilebilir. Diğer önemli bir husus ise çalışmada belirtilen Türk Ceza Kanunu'na yapılan atıf ile ilgilidir. Bu hususta da atıf konusunda yapılan eksikliğin özellikle 239. maddenin tümüne mi yoksa ceza miktarına mı ilişkin olduğu konusu berraklaştırılmalıdır.

KAYNAKÇA

- Arslan, Ç. (2013). Vergi Mahremiyetini İhlal Suçu (VUK md. 362). Hacettepe Hukuk Fakültesi Dergisi, 3(2), 15-30. <https://dergipark.org.tr/en/download/article-file/701398> adresinden alındı
- Bayraklı, H. H. (2018). Vergi Suçları. Vergi Ceza Hukuku (s. 120-137). içinde Eskişehir: Anadolu Üniversitesi Yayınları. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/<https://ets.anadolu.edu.tr/storage/nfs/HUK405U/ebook/HUK405U-15VIS1-8-0-1-SV1-ebook.pdf> adresinden alındı
- Duman, B. (2016). Ceza Hukuku Bağlamında Vergi Mahremiyetinin İhlali Suçu Ve Atıf Problemi. Ankara Üniversitesi Hukuk Fakültesi Dergisi, 65(4), 1577-1601. <https://dergipark.org.tr/en/pub/auhfd/issue/42360/509939> adresinden alındı
- Durdu, M. (2019). Mükellef Verilerinin Korunması ve Vergi Mahremiyeti. Selçuk Üniversitesi Hukuk Fakültesi Dergisi, 27(3), 589-623. <https://dergipark.org.tr/en/pub/suhfd/article/578013> adresinden alındı
- Eker, A. (1999). Kamu Maliyesi. İzmir: Anadolu Matbaacılık.
- Küçükkaya, M. (2022). Vergi Mahremiyetini İhlal Suçu. Yıldırım Beyazıt Hukuk Dergisi , Prof. Dr. M. Fatih UŞAN'a Dekanlıkta 10. Yıl Anısına Teşekkür Armağanı, 582-624. <https://dergipark.org.tr/tr/pub/ybuhukuk/issue/72531/1104065> adresinden alındı
- Ünsal, H. (2003). Türk Vergi Hukukunda Vergi Mahremiyeti, Sağladığı Yararlar ve Uygulamada Karşılaşılan Güçlükler. Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 8(3), 27-48. <https://dergipark.org.tr/tr/pub/sduiibfd/issue/20844/223462> adresinden alındı
- Yüksel, M. (2003). Modernleşme ve mahremiyet. Kültür ve İletişim, 6(11), 75-108.
- Yüksel, M. (2009). Mahremiyet Hakkına Ve Bireysel Özgürlüklere Felsefi Yaklaşımlar. Ankara Üniversitesi SBF Dergisi, 64(01), 275-298. <https://dergipark.org.tr/en/pub/ausbf/article/42647> adresinden alındı
- 213 sayılı Vergi Usul Kanunu
- 5237 sayılı Türk Ceza Kanunu

**PAMUK (*Gossypium hirsutum* L.)’TA FARKLI GELİŞME DÖNEMLERİNDE
UYGULANAN YAPRAK DÖKTÜRÜCÜNÜN ETKİNLİĞİNİN BELİRLENMESİ**

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ÖZET

Bu çalışma pamukta makineli hasatta oldukça önemli olan yaprak döktürücü (Defoliant) kullanımını için en uygun zamanın belirlenmesi amacı ile yürütülmüştür. Çalışma 2021 yılında Diyarbakır ili Bismil ilçesinde tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak yürütülmüştür. Çalışmada bazı bitki izleme tekniği gözlemleri beyaz çiçek üstü boğum sayısı (NAWF), çatlamış koza üstü boğum sayısı (NACB) kullanılarak yaprak döktürücü uygulamasının etkisi de incelenmiştir. Çalışmada NAWF, NACB dışında yaprak döktürücü uygulanmayan kontrol parseli ile açılmış koza yüzdesi (kozaların %70’inin açılmış olduğu dönem), keskin bıçak tekniği kullanılarak yaprak döktürücü uygulanmıştır. Çalışma sonucunda farklı dönemlerde yaprak döktürücü uygulamaları yönünden incelenen özelliklerden lif verimi ve açmamış koza sayısı sonuçlarında istatistiksel olarak önemli farklılıklar elde edilmiştir. İncelenen diğer özellikler ve lif kalite özelliklerinde ise uygulamalar arasında istatistiksel olarak bir farklılık elde edilmemiştir.

Anahtar Kelimeler: NACB, NAWF, kalite, pamuk, verim, yaprak döktürücü,

DETERMINATION THE EFFECTIVENESS OF DEFOLIATION ON COTTON
(*Gossypium hirsutum* L.) AT DIFFERENT DEVELOPMENT PERIODS

ABSTRACT

This study was carried out with the aim of determining the most appropriate time for the use of defoliant, which is very important in machine harvesting in cotton. The study was carried out in Bismil district of Diyarbakır province in 2021 according to the randomized blocks design with 4 replications. In the study, the effect of defoliant application was also investigated by using some plant monitoring technique observations nodes above white flower (NAWF), Nodes above cracked boll (NACB). In the study, in addition to NAWF and NACB, also the percentage of bolls opened (the period when 70% of the bolls were opened) and sharp knife techniques were taken into account for defoliant application time. Any defoliant not applied to the control treatment. As a result of the study, statistically significant differences were obtained in the results of the fiber yield and the number of not opened bolls, which were examined in terms of defoliant applications in different periods. There was no statistically significant difference between the applications in terms of other examined properties and fiber quality properties.

Keywords: Cotton, defoliation, NACB, NAWF, quality, yield

GİRİŞ

Nüfus artışı, teknolojik gelişmeler ve yaşam seviyesinin yükselişi tarımsal üretimi ön plana çıkarmıştır. Alternatif değerlendirme alanlarına sahip olan pamuk bitkisi, başta tekstil endüstrisi olmak üzere birçok endüstri koluna hammadde sağladığı için dünya tarımında önemi her geçen gün artmaktadır. Güneydoğu Anadolu Bölgesi ülkemizde pamuk üretimi için en önemli bölgedir. Bölge içerisinde yer alan Diyarbakır ili pamuk üretimi bakımından önemli bir yere sahiptir. Güneydoğu Anadolu Projesi (GAP) kapsamına giren diğer illerde olduğu gibi Diyarbakır'da da üretim alanlarında su alanlarının genişlemesi ile pamuk toplama işçisi sayısında ciddi oranda azalmalar ortaya çıkmış, bunun sonucunda makineli hasat giderek önem kazanmıştır (Tuncer ve Işık,1999).

Son yıllarda pamuk tarımında yetiştiricilerin tercih edebilecekleri pamuk türleri oldukça fazladır. Çeşit seçimi, öncelikle verim ve lif kalitesi özelliklerine dayanmasına rağmen, dikkate alınması gereken diğer önemli faktörler; tohum boyutu, yaprak rengi, bitki boyu, fırtına direnci, çırcır verimi ve erkenciliğidir. Farklı olgunluk derecelerine sahip pamuk çeşitleri de büyüme özelliklerinde farklılık gösterir. Erken çeşitler daha uygun koza tutuşu ile daha düşük bitkiler oluşturma eğilimindeyken, geç çeşitler daha uzundur ve tohumlar üst boğumlarda, yani sezonun sonlarında tutulur. Geççi çeşitler genellikle erkenci çeşitlere kıyasla daha uzun bir büyüme periyodu gösterir. Bu nedenle ürünün olgunlaşması için daha fazla sıcaklık birimine, gündereceye gereksinim duyarlar. Ayrıca, bazı gruplar daha düzenli, daha hızlı koza gelişimi ve daha hızlı koza açılmasına sahip olduğundan, optimum yaprak dökümü zamanı ve hasat süresi erken gruplar arasında farklılık gösterir.

Pamuk hasat zamanı bölgelere, sonbahar yağışlarının başlamasına, pamuktan sonra ekilen ürünün cinsine, çeşitlere, uygulanan kültürel işlemlere, ekim zamanına ve toplama yöntemine göre farklılık göstermektedir. Çukurova bölgesinde 10 - 15 Ağustos arası, Eylül ayının ilk haftasından itibaren ; Harran Ovası'nda pamuk hasadı 10-15 Eylül'de başlamaktadır. Hasat, pamuk üretiminin maliyetinde her zaman en büyük paya sahip olmuştur. Önceki yıllarda toplam pamuk gelirlerinin %15-20'sini oluşturan el ile hasat maliyetleri, son yıllarda %25-30'a çıkararak önemini daha da artırmıştır. Bunun yanında maliyetleri en aza indirmenin yolu da makineli hasat olmuştur.

Ayrıca toplayıcıların temini ve istihdamında yaşanan sosyal zorluklar, zamanında ve kısa vadede yapılamayan hasadın neden olduğu kalite ve verim kaybı, makineli hasadı önemli kılan diğer faktörlerdir (Evcim, 1999). Ancak, makineli hasat denemelerinden olumlu sonuç

alabilmek için makineli hasat sorularına uygun bazı ürünlerin doğru zamanda ve yerde uygulanması gerekir.

Makineli hasatta lif kalitesini düşüren en önemli faktör kurumuş yaprak parçaları olup, toplamanın temiz olması ve hasat veriminin artırılması için pamuk yapraklarının açık kozalarda lifleri kirletmeden yani başka bir deyişle yapraklar hasattan önce bitkiden uzaklaştırılması gerekmektedir. Uzun vejetasyon süresi nedeniyle pamuk, genellikle sonbaharın ilk yağmurlarında olumsuz hava koşullarından zarar görür. Bu durum pamuğun üretimini ve kalitesini etkilemektedir.

Kozanın daha hızlı açılmasına ve hasat başlamadan yaprakların dökülmesini sağlamak; elle hasat edilen alanlarda pamuk hasadına yardımcı olmak, geç kozaların açılmasını teşvik etmek ve yağmur mevsimi gelmeden yaprakların erken açılmasını teşvik etmek için kimyasallara ihtiyaç duyulmaktadır. Pamuğun hasada hazırlanmasının son işlemi yaprak dökümüdür ve böylece tüm yapraklar pamuğun üzerine dökülür ve bitkinin gücü yeşil kısımdan kozayı açmaya yönlendirilir. Yaprak dökücü kimyasallar (defoliantlar) bitkilerde etilen sentezini artırır ve yaprak sapının dal veya ana gövdeye yapıştığı yerde ekstra bir doku geliştirir ve burada ayrı bir tabaka oluşumunu teşvik ederek yaprakların kırılmasına neden olmaktadır (Morgan ve ark., 1977; Oğlakçı ve Kaynak, 1992).

Kimyasal yaprak dökücüler, pamuk yapraklarının normalleşmeden önce dökülmesini teşvik eden kültürel bir uygulamadır (Cathey, 1986). Yaprak dökürme işlemi genellikle ethephon gibi koza açıcıların yanı sıra hormon veya bitkisel yaprak dökürücüler kullanılarak yapılmaktadır. Yaprak dökme, yüksek verimli ve kaliteli pamuk üretiminde standart bir uygulamadır. 40 yılı aşkın süredir hasat yardımcıları uygulanmış olmasına rağmen, istenen yaprak dökümünü elde etmek hala bir sorundur.

Bir yetiştiricinin vermesi gereken en önemli kararlardan biri, hasada yardımcı kimyasalların seçimi ve kullanımının zamanlamasıdır. Bitkiler, fizyolojik olgunluğa erişmeli ve uygulama için vejetatif olarak dormant olmalıdır. Erken yaprak dökümü olgunlaşmamış kozalarda verim kaybına ve lif kalitesinde düşüğe sebebiyet verebilmektedir. Geç uygulama erken hasada ve dolayısıyla beklenen lif kayıplarına yol açmaktadır. Erken yaprak dökümü mikroneri azaltacağından ve verimi düşüreceğinden, yaprak dökümü kararları zamanında hasat ile geç sezonda artan verim arasında bir denge gözetilerek verilmelidir. Yetiştiriciler bazen yaprak dökümü uygulamaya karar vermeden önce bitkiler olgunlaşana kadar bitkinin üst kısmında beklerler. Ancak, bu kozaların verime katkısı çok düşüktür (Robertson ve ark., 2003).

Gecikmeli yaprak dökürme uygulamaları, olumsuz hava şartlarından ötürü üretkenliği ve kaliteyi düşürebilir (Faircloth ve ark., 2004).

Hasat makine ile yapılacak işe, hasat başlamadan önce kozanın açılmasını ve yaprakların dökülmesini hızlandırmak için; hasadın elle yapıldığı alanlarda, pamuğu hasada hazırlamak, kozaların açılmasını ve yaprakların dökülmesini teşvik etmek için ve pamuğun yağmura kalmadan erken hasadı teşvik etmek için kimyasallara ihtiyaç vardır. Kimyasal yaprak dökümü ile ilgili temel sorun, bitkiye ne zaman uygulanacağını belirlemektir. Pamuk bitkisinin yapraklarının dökülmesi sadece hasada yardımcı olmakla kalmaz, aynı zamanda lifin lekesiz olarak toplanmasını sağlar, hastalık ve zararlıları önlemektedir. Bu nedenle, koza açma hızını artırmak, hasat kapasitesini artırmak, kütlü pamuğun nem içeriğini azaltmak, lif bulaşmasını ve zararlı böcek sayısını azaltmak için hasattan önce yaprak dökücülerin kullanılması gerekmektedir. Yaprak dökürme; bitkilerin alt bölgesindeki yaprakların dökülmesi, yalnızca yaşlı yaprakların dökülmesi ve tüm yaprakların dökülmesi şeklinde yapılmaktadır (Oğlakçı, 1992).

Son yıllarda Türkiye'de makineli hasat oranı önemli ölçüde artmıştır. Sağlıklı bir makineli hasat için yaprak dökücü uygulamasının vazgeçilmez koşullardan biri olduğu bilinmektedir. Yaprak dökücünün yanlış kullanımı pamuğun hem üretimine hem de kalitesine önemli ölçüde zarar verebilir. Bu nedenle, yaprak dökücü uygulamasının planlanması oldukça önem taşımaktadır. Defoliasyon (yaprak dökümü) fizyolojik olarak olgunluğa eriştiklerinde yaprakların bitki üzerinden doğal olarak yere düşmesidir. Yaprığın düşen (kopması) yaprak sapı, gövdenin birleştiği alanda bazı hücre bölünmelerini içeren faaliyetlerle sonuçlanması ile oluşan alana kopma alanı bölgesi denir. Hafif don, böcek zararı, hastalık, kuraklık veya bitki besin maddelerinin eksikliği nedeniyle yaprak dökümü meydana gelebilir. Bununla birlikte, hasat yaprak dökücü veya yardımcı kimyasallar yoluyla yapay olarak da sağlanabilir.

Defoliasyonun Faydaları;

- Yaprakları uzaklaştırması,
- Leke ve çepel kaynaklarını elemine etmek,
- Daha kaliteli lif elde etmek,
- Koza çürümelerini önlemek,
- Daha etkili ve daha hızlı bir toplama sağlamak,
- Olgunluğu yöneterek daha erken bir hasat sağlamak,
- Bitki kanopisinde havalanmayı artırarak daha hızlı bir kuruma sağlamak ve dolayısıyla daha erken bir saatte hasada olanak tanımak,

- Nemi azaltmak,
- Çenetlerin içerisindeki birikimi artırmak.

Erken yaprak dökümü, olgunlaşmamış kozalarda üretimde kayıplara ve lif kalitesinde düşüşe neden olabildiği gibi geç uygulama ise, erken hasat ve dolayısıyla beklenen lif kaybı ile sonuçlanmaktadır. Erken yaprak dökümü lif inceliğini ve lif üretimini olumsuz etkilediğinden, yapraksızlaştırma kararları, zamanında hasat ve geç sezon verim artışı arasında bir denge olarak görülmektedir. Yetiştiriciler bazen yaprak dökmeye karar vermeden önce bitkinin tepesindeki yaprakların olgunlaşmasını beklediklerinden, bu kozalar ürüne çok az katkıda bulunmaktadır (Robertson ve ark., 2003).

Pamukta yaprak dökümü genellikle tarladaki bitkilerin çoğu %50-60 oranında açıkken başlamaktadır. Ancak ürün geliştirmedeki değişkenlik bu tavsiyeyi farklı kılabilir. Pamuk bitkisinin sınırsız büyüme özelliğinden dolayı kozanın hasada yakın olgunlaşması farklı dönemlerde gerçekleşebilir (Stewart ve ark., 2000). Koza tutumunun çoğunun kısa sürede meydana geldiği alanlarda yaprak dökümü daha erken başlayabilir (%40-50 koza açılmasında), koza oluşumunun daha uzun bir süre boyunca gerçekleştiği alanlarda yaprak dökümü daha sonra (%70-80 koza açılması) başlar. Çiçeklenme süresi kısa ve bitki kompakt ise, tohumların açılmasının %60'ından önce yaprak dökümü başlatılmalıdır. Aksine, çiçeklenme süresinin daha uzun olduğu durumlarda, %60'ın üzerinde bir koza açıklığı ile yaprak dökümü daha etkili olabilir.

Koza açılması çevresel koşullara, çeşidin olgunlaşma grubuna, bitki büyüme düzenleyicilerinin kullanımına ve uygulama zamanına göre değişiklik göstermektedir. Zamanında yaprak dökümü ve koza açma ürünleri uygulamak kozaların açılmasını hızlandırır ve daha erken hasat yapılmasını sağlar (Supak, 1996). Geç hasat, liflerin kalite özelliklerini etkiler ve kalite seviyesini düşürür. Bu nedenle tüm kozalar açtıktan sonra pamuk hemen hasat edilmelidir. Ancak, açıcı veya yaprak dökücü kullanılsa dahi, bitki olgunluğuna ve hava koşullarına bağlı olarak kozaların açma oranları tarla ve çeşitler arasında farklılık gösterebilir. Faircloth (2002), yoğun verim kaybının 0,5 cm'nin üzerindeki yağışlarla ilişkili olduğunu belirtmektedir.

Bu çalışma, bitki izleme parametrelerinden [Beyaz Çiçek Üstü Boğum Sayısı (NAWF 5), Çatlamış Koza Üzeri Boğum Sayısı (NACB 4)] ile keskin bıçak tekniği, %70 koza açma döneminde uygulanan yaprak dökütürücünün yaprak dökütürücü uygulanmayan parsellerle karşılaştırılması ve en uygun yaprak dökütürücü zamanın tespit edilmesi amacıyla yürütülmüştür.

MATERYAL VE METOT

Deneme Diyarbakır ili Bismil ilçesine bağlı Köseli köyündeki üreticiye ait arazide 3 tekerrürlü olarak 2021 yılında yürütülmüştür. Araştırmada materyal olarak Progen Tohum A.Ş.'nin BA 1010 pamuk çeşidi materyal olarak kullanılmıştır. Çalışma alanında ekim yapılmadan önce toprak örneği alınarak toprak özellikleri belirlenmiştir. Deneme alanına ilişkin analiz sonuçları Tablo 1'de verilmiştir.

Tablo 1. Çalışma alanı toprak özellikleri

Toprak Özelliği	Değeri
Kil, %	44,51
Kum, %	47,79
Silt, %	8,59
pH	7,89
Elektriksel iletkenlik, mS/cm	453,00
Kireç, %	0,51
Organik madde, %	1,12
Alınan fosfor, P ₂ O ₅ kg/da	2,25
Alınan potasyum, K ₂ O kg/da	86,05

Tablo 1. incelendiğinde, alınan topraklarda yapılan analiz sonucunda; deneme alanı toprak örneklerinin kumlu-killi bünyeye sahip, nötr, tuzsuz, az kireçli, organik madde ve alınabilir fosfor bakımından düşük, potasyum bakımından ise yeterli olduğu belirlenmiştir.

Uzun yıllara ait iklim verilerine göre; il ortalama sıcaklığı 16,1°C, maksimum ortalama sıcaklık 21,8°C, minimum ortalama sıcaklık 11,1°C, ortalama yağış 692,0 mm, maksimum hava sıcaklığı 46,0°C, minimum hava sıcaklığı ise -15,6 °C olarak gerçekleşmiştir (Anonim, 2021b). Çalışmanın yapıldığı bölgede 2021 yılına ve uzun yıllara ait iklim verileri Tablo 2'de verilmiştir. 2021 yılı iklim verileri uzun yıllarla kıyaslandığında ortalama sıcaklığın, minimum ve maksimum sıcaklık değerlerinin uzun yıllar ortalamasının üzerinde seyrettiği izlenebilmektedir. Toplam yağış miktarı incelendiğinde ise denemenin yürütüldüğü Mayıs ve Ekim aylarındaki yağış miktarının uzun yılların üzerinde seyrettiği görülmektedir.

Tablo 2. Denemenin yürütüldüğü 2021 yılı ile uzun yıllara ait iklim verileri

<u>Aylar</u>	<u>Yıllar</u>	<u>Ortalama Sıcaklık (°C)</u>	<u>Ortalama Maksimum Sıcaklık (°C)</u>	<u>Ortalama Minimum Sıcaklık (°C)</u>	<u>Nispi Nem (%)</u>	<u>Toplam Yağış (mm)</u>
Nisan	2021	16,80	22,70	11,30	47,60	60,80
	Uzun Yıllar	13,80	19,30	9,10	50,40	104,30
Mayıs	2021	19,80	25,70	14,90	59,10	146,80
	Uzun Yıllar	19,30	25,20	13,50	41,50	62,0
Haziran	2021	27,40	33,40	21,00	31,70	3,00
	Uzun Yıllar	26,00	32,10	18,90	24,10	8,70
Temmuz	2021	32,30	38,70	25,40	20,10	0,60
	Uzun Yıllar	30,60	36,90	23,40	18,10	1,60
Ağustos	2021	32,10	38,60	25,50	21,40	1,60
	Uzun Yıllar	30,00	37,00	23,10	17,20	1,00
Eylül	2021	27,90	34,50	21,50	22,50	0,0
	Uzun Yıllar	25,00	32,30	18,70	24,00	5,20
Ekim	2021	20,40	26,20	15,60	46,30	134,00
	Uzun Yıllar	17,90	24,50	12,70	45,30	50,90
Kasım	2021	16,60	24,30	10,0	42,90	96,00
	Uzun Yıllar	10,20	15,40	6,30	57,10	55,60

Çalışmanın yapıldığı arazi sonbahar mevsiminde derin şekilde pulluk, ilkbahar mevsimlerinde ise yüzeysel olarak kùltivatör ile işlenmiş ve ekimden önce deneme alanı 3 kez tapan çekilerek ekime hazır hale getirilmiştir. Ekim işlemi mibzerle gerçekleştirilmiştir. Denemede ekim işlemleri 22 Nisan 2021 tarihinde deneme mibzeri ile yapılmıştır, ekimde her parsel 6 m uzunluğunda 4 sıradan oluşturulmuştur Sıra arası mesafe ekim esnasında 70 cm sabit tutulmuş, sıra üzeri mesafe ise 10-15 cm olacak şekilde seyreltme yapılarak oluşturulmuştur. Deneme alanından toprak örnekleri alınarak toprak analizleri yapılmış ve bitkinin ihtiyaç duyduğu gübre miktarı zamanında verilmiştir. Ekim esnasında ihtiyaç duyulan azotun yarısı ile fosforun tamamı uygulanmış, geriye kalan azotun ikinci yarısı ise ilk sulama öncesinde uygulanmıştır. Taban gübresi olarak ekimle birlikte 20-20-0 kompoze gübre kullanılmıştır. İlk sulama öncesinde ise üst gübre olarak üre gübresi kullanılmıştır. Deneme salma sulama sistemi ile sulanmıştır. Sulamaya çiçeklenme öncesi dönemde başlanmış ve %10 koza açma döneminde son verilmiştir.

Çalışmada defoliant (yaprak dökürücü) uygulanmayan parsel kontrol olmak üzere toplam 5 farklı uygulama yapılmıştır.

Uygulamalar

1. Kontrol: Kontrol parsellerine defoliant uygulanmamıştır.

2. Beyaz Çiçek Üzeri Boğum Sayısı [Nodes Above White Flower (NAWF 5)]: Pamukta 1.pozisyondaki beyaz çiçek üzeri boğum sayısı olgunlaşmanın bir ölçütü olarak kullanılmakta

ve gün derece ünitesi de göz önünde bulundurularak defoliant uygulamalarında kullanılmaktadır. Her parselden 10 bitkide 1. pozisyon beyaz çiçek üzeri boğumlar sayılarak ortalaması 5'e yakın olduğunda defoliant uygulanmıştır.

3. Açılmış Koza Yüzdesi (Percent Open Boll): Kozaların %70'i açıldığında defoliant uygulanmıştır.

4. Çatlamış Koza Üzeri Boğum Sayısı [Nodes Above Cracked Boll (NACB)]: Her parselden 10 bitkide 1.pozisyon çatlamış koza üzeri boğumlar ile en üstten hasat edilebilir koza arasındaki boğumlar sayılarak ortalaması 4'e yakın olduğunda defoliant uygulanmıştır.

5. Keskin Bıçak Tekniği (Sharp Knife Technique): Uygulama öncesinde en üstteki hedef koza belirlenmiştir. Bu kozalar keskin bir bıçak kullanılarak dikey olarak karpeller halinde kesilmiştir. Olgunlaşmamış tohum kabukları kesilirken oldukça kolay kesilirken, hasat olgunluğuna ulaşmış kozaların kesilmesi, tohum kabuğunun sertleşmesi nedeniyle zorlaşmıştır. Hedef kozaların bu yapıya ulaştığı belirlenince defoliant uygulanmıştır.

İncelenen özellikler

Bitkisel özellikler: Çalışmada incelenen bitkisel özellikler her parselden şansa bağlı olarak seçilen 10'ar bitkide sayımlar yapıldıktan sonra ortalamaları alınarak hesaplanmıştır. Kütlü pamuk verimi ile lif verimi her parselden elde edilen ürün tartılarak parsel veriminin kg/da' a oranlanması ile elde edilmiştir.

Lif teknolojik parametreler: Hasat sonrasında belirlenmiş olup, 50 kozadan elde edilen ürün lif analizlerinde kullanılmıştır. Analizler GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi Müdürlüğü lif kalite laboratuvarında HVI aleti yardımı ile yapılmıştır.

- Lif İnceliği (micronaire)
- Lif Uzunluğu (mm)
- Lif Kopma Dayanıklılığı (g/tex)
- Lif Kopma Uzaması (%)
- Lif Üniformite Oranı (%)
- Kısa Lif Oranı (%)

Hasat İşlemleri: Hasat elle yapılmıştır. Hasatta parsellerin orta kısmında yer alan iki sıra hasat edilmiştir.

İstatistik Analizler: Araştırmadan elde edilen sonuçlar JUMP istatistik paket program yardımı ile değerlendirilip, ortalamaların karşılaştırılmasında ise LSD_(0.05) testi kullanılmıştır.

BULGULAR VE TARTIŞMA

Kütlü pamuk verimi (kg/da): Kütlü pamuk verimine ait uygulamalara ilişkin ortalama değerler ve $LSD_{(0.05)}$ testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan uygulamalara bağlı olarak kütlü verimine ait ortalama değerlerin, 366,40 ile 483,20 kg/da arasında farklılık gösterdiği; denemenin genel ortalamasının 430,40 kg/da olduğu, en yüksek kütlü veriminin kontrol uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Karademir ve ark. (2007) 'in çalışmalarıyla paralellik arz ederken, Çiçek ve ark. (2003) ve Tülemen (2016)'in sonuçları ile örtüşmemektedir. Bu durumun farklı genotiplerin kullanılmasından kaynaklandığı düşünülmektedir.

Tablo 3. İncelenen bitkisel özelliklere ilişkin ortalama değerler ve oluşan gruplamalar

Uygulamalar	Kütlü Pamuk Verimi (Kg da ⁻¹)	Lif Verimi (Kg da ⁻¹)	Çırcır Randımanı (%)	Açmış Koza Sayısı (adet bitki ⁻¹)	Açmamış Koza Sayısı (adet bitki ⁻¹)	Koza Ağırlığı (g)	Koza Kütlü Ağırlığı (g)
1. Kontrol	483,20	217,99 a	45,14	15,60	1,60 a	7,73	6,20
2. NAWF 5	444,80	198,38 ab	44,70	14,13	0,35 c	7,13	5,87
3. %70 KOZA AÇMA	434,40	196,78 ab	45,38	13,73	0,97 b	7,13	5,73
4. NACB 4	423,20	189,57 bc	44,87	12,53	1,40 a	6,87	5,60
5. KESKİN BIÇAK	366,40	164,00 c	44,79	12,07	0,80 b	7,27	5,87
Ortalama	430,40	193,34	44,98	13,61	1,02	7,23	5,85
CV (%)	8,89	7,53	2,03	11,19	11,21	8,35	7,78
LSD_(0.05)	Ö.D	27,42	Ö.D.	Ö.D.	0,22 **	Ö.D.	Ö.D.

Lif verimi (kg /da): Lif verimine ait uygulamalara ilişkin ortalama değerler ve $LSD_{(0.05)}$ testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan lif verimi açısından uygulamalar arasında %5 önem düzeyinde istatistiksel değişikliklerin olduğu görülebilmektedir.

Tablo 3'ten, uygulamalara bağlı olarak lif verimine ait ortalama değerlerin, 217,99 ile 164,00 kg/da arasında farklılık gösterdiği; denemenin genel ortalamasının 193,34 kg/da olduğu, en yüksek lif veriminin kontrol uygulamasından elde edildiği görülmektedir. Bednarz ve ark. (2002) yürüttükleri çalışmada en yüksek lif veriminin %76 koza açma döneminde elde edildiğini bildirmişlerdir. Denemeden elde edilen sonuçlar Larson ve ark. (2002) ve Faircloth ve ark. (2004) 'in çalışmalarına paralellik arz ederken, Larson ve ark. (2005)'in sonuçları ile örtüşmemektedir. Bu durumun farklı çevresel faktörlerden kaynaklandığı düşünülmektedir.

Çırcır randımanı (%) : Tablo'dan bitki boyu (cm) açısından uygulamalar arasındaki değişikliklerin istatistiksel anlamda önemli olmadığı görülebilmektedir.

Tablo 3' te, uygulamalara bağlı olarak çırcır randımına ait ortalama değerlerin, %45,38 ile %44,70 arasında farklılık gösterdiği; denemenin genel ortalamasının %44,98 olduğu, en yüksek

çırçır randımanının %70 KOZA AÇMA uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Çiçek ve ark. (2003), Çopur ve ark., (2010) ve Karademir ve ark. (2007)'in çalışmalarıyla paralellik arz ederken, Sokat ve Gürel (2016) ve Larson ve ark. (2005)'in sonuçları ile örtüşmemektedir. Bu durumun kullanılan materyal, denemenin yürütüldüğü çevre koşullarından kaynaklandığı düşünülmektedir.

Açmış koza sayısı (adet/bitki): İlk meyve dalı boğum sayısı özelliğine ait uygulamalara ilişkin ortalama değerler ve $LSD_{(0.05)}$ testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan bu özellik bakımından uygulamalar arasındaki değişikliklerin istatistiksel anlamda önemli olmadığı görülebilmektedir. Uygulamalara bağlı olarak açmış koza sayısına ait ortalama değerlerin, 12,07 ile 15,60 adet/bitki arasında farklılık gösterdiği; denemenin genel ortalamasının 13,61 adet/bitki olduğu, en yüksek açmış koza sayısının kontrol uygulamasından elde edildiği görülmektedir.

Açmamış koza sayısı (adet/bitki): Tablo'dan açmamış koza sayısı açısından uygulamalar arasında %1 önem düzeyinde istatistiksel değişikliklerin olduğu görülebilmektedir. Tablo 3'te, uygulamalara bağlı olarak açmamış kozaya ait ortalama değerlerin, 0,35 ile 1,60 adet/bitki arasında farklılık gösterdiği; denemenin genel ortalamasının 1,02 adet/bitki olduğu, en yüksek açmamış kozanın kontrol uygulamasından elde edildiği görülmektedir.

Koza ağırlığı (g) : Tablo'dan koza ağırlığı açısından uygulamalar arasındaki değişikliklerin istatistiksel olarak önemli olmadığı görülebilmektedir. Uygulamalara bağlı olarak koza ağırlığına ait ortalama değerlerin, 6,87 ile 7,73 g arasında farklılık gösterdiği; denemenin genel ortalamasının 7,23 g olduğu, en yüksek koza ağırlığının Kontrol uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Haliloğlu ve ark. (2020)'in çalışmalarıyla paralellik arz ederken, Çiçek ve ark. (2003)'in sonuçları ile örtüşmemektedir. Bu durumun denemede kullanılan materyal ve bakım koşullarından kaynaklandığı düşünülmektedir.

Koza kütlü ağırlığı (g) : Tablo'dan koza kütlü ağırlığı açısından uygulamalar arasındaki değişikliklerin istatistiksel olarak önemli olmadığı görülebilmektedir. Tablodan uygulamalara bağlı olarak koza kütlü ağırlığına ait ortalama değerlerin, 5,60 ile 6,20 g arasında farklılık gösterdiği; denemenin genel ortalamasının 5,85 g olduğu, en yüksek koza kütlü ağırlığının kontrol uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Çiçek ve ark. (2003)'in sonuçları ile örtüşmemektedir. Bu durumun denemenin çevre ve bakım koşullarından kaynaklandığı düşünülmektedir.

Lif teknolojik özellikler: Lif teknolojik özelliklerine ait ortalama değerler ve oluşan gruplamalar Tablo 5’ te izlenebilmektedir. Tabloda da görüldüğü gibi uygulanan yaprak döktürücü’nün incelenen lif teknolojik özellikleri üzerine önemli bir etkisi olmamıştır.

Tablo 5. İncelenen lif kalite özelliklerine ilişkin ortalama değerler ve oluşan gruplamalar

Uygulamalar	Lif Uzunluğu (mm)	Lif İnc. (Mic.)	Lif Kop. Dayanıkl. (g/tex)	Lif Kop. Uzaması (%)	Üniformite (%)	Kısa Lif İçeriği (%)
1. Kontrol	31,50	4,59	33,73	5,87	84,90	6,03
2. NAWF 5	30,30	4,72	32,43	5,80	83,07	6,80
3. %70 KOZA AÇMA	29,82	4,80	32,43	5,87	83,80	7,70
4. NACB 4	30,04	5,00	33,50	6,50	84,47	6,70
5. KESKİN BIÇAK	30,39	4,99	31,10	6,20	83,70	7,70
Ortalama	30,41	4,82	32,64	6,05	83,99	6,99
CV (%)	0,91	4,71	5,29	6,36	1,35	19,81
LSD_(0.05)	Ö.D.	Ö.D.	Ö.D.	Ö.D.	Ö.D.	Ö.D.

Lif uzunluğu (mm): Tablo ’ dan, uygulamalara bağlı olarak lif uzunluğuna ait ortalama değerlerin, 29,82 ile 31,50 mm arasında farklılık gösterdiği; denemenin genel ortalamasının 3,41 mm olduğu, en yüksek lif uzunluğunun kontrol uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Özkan ve Görmüş (2002), Larson ve ark. (2002), Çiçek ve ark. (2003), Larson ve ark. (2005), Karademir ve ark. (2007) ve Raghavendra ve Reddy (2020) ’in çalışmalarıyla paralellik arz ederken, Bednarz ve ark. (2002), Sokat ve Gürel (2010) ve Görmüş ve ark. (2017)’in sonuçları ile örtüşmemektedir.

Lif inceliği (micronaire): Tablo 5’ te, uygulamalara bağlı olarak lif inceliği ait ortalama değerlerin, 4,59 ile 5,00 mic arasında farklılık gösterdiği; denemenin genel ortalamasının 4,82 mic olduğu, en yüksek lif inceliğinin NACB 4 uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Özkan ve Görmüş (2002) ve Karademir ve ark. (2007)’in çalışmalarıyla paralellik arz ederken, Larson ve ark. (2002), Tülemen (2016) ve Raghavendra ve Reddy (2020)’in sonuçları ile örtüşmemektedir. Bu durumun denemede kullanılan farklı materyal ve çevre koşullarından kaynaklandığı düşünülmektedir.

Lif kopma dayanıklılığı (g/tex): Tablo’ dan, uygulamalara bağlı olarak lif kopma dayanıklılığına ait ortalama değerlerin, 31,10 ile 33,73 g/tex arasında farklılık gösterdiği; denemenin genel ortalamasının 32,64 g/tex olduğu, en yüksek lif kopma dayanıklılığının kontrol uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Özkan ve Görmüş (2002), Çiçek ve ark. (2003), Larson ve ark. (2005) ve Karademir ve ark. (2007)’in

çalışmalarıyla paralellik arz ederken, Tülemen (2016)'in sonuçları ile örtüşmemektedir. Bu durumun denemede kullanılan genotiplerin farklı olmasından kaynaklandığı düşünülmektedir.

Lif kopma uzaması (%): Tablo 5' te görüldüğü gibi uygulamalara bağlı olarak lif kopma uzamasına ait ortalama değerlerin, %5,80 ile %6,50 arasında farklılık gösterdiği; denemenin genel ortalamasının %6,05 olduğu, en yüksek lif kopma uzamasının NACB 4 uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Özkan ve Görmüş (2002) ve Çiçek ve ark. (2003)'in çalışmalarıyla paralellik arz ettiği görülmektedir.

Üniformite (%): Anılan tablo incelendiğinde, uygulamalara bağlı olarak üniformite özelliğine ait ortalama değerlerin, %83,07 ile %84,90 arasında farklılık gösterdiği; denemenin genel ortalamasının %83,99 olduğu, en yüksek üniformite değerinin kontrol uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Özkan ve Görmüş (2002)'ün çalışmalarıyla paralellik arz ederken, Larson ve ark. (2002)'in sonuçları ile örtüşmemektedir. Bu durumun denemede kullanılan materyal ve çevre koşullarından kaynaklandığı düşünülmektedir.

Kısa lif içeriği (%): Tablodan uygulamalara bağlı olarak kısa lif içeriğine ait ortalama değerlerin, %6,03 ile %7,70 arasında farklılık gösterdiği; denemenin genel ortalamasının %6,99 olduğu, en yüksek kısa lif içeriğinin %70 KOZA AÇMA uygulamasından elde edildiği görülmektedir. Denemeden elde edilen sonuçlar Özkan ve Görmüş (2002) ve Çiçek ve ark. (2003)'in çalışmalarıyla paralellik arz ettiği görülmektedir.

SONUÇ VE ÖNERİLER

Sonuçlar

Bu çalışma pamukta bitki izleme tekniklerinde kullanılan bazı parametreler göz önünde bulundurularak yaprak döktürücü (defoliant) uygulamasının etkinliğini ortaya koymak için yürütülmüştür. Bu amaçla çalışma Güneydoğu Anadolu Bölgesinde pamuk ekiminin yoğun olduğu Diyarbakır ili Bismil ilçesinde üretici tarlasında pamukta bitki izleme tekniği bakımından sıklıkla kullanılmakta olan Beyaz Çiçek Üzeri Boğum Sayısı (NAWF), Çatlamış Koza Üzeri Boğum Sayısı (NACB), Keskin Bıçak Yöntemi (Sharp Knife Techniques) uygulamaları ile genel olarak uygulanmakta olan %70 Koza Açma döneminde defoliant uygulaması ve bu uygulamaların kıyaslanacağı defoliant uygulanmayan kontrol parselleri olmak üzere 5 uygulama yapılarak yürütülmüştür. Araştırmada materyal olarak özel sektörden temin edilen Progen 1010 çeşidi kullanılmıştır.

Çalışmada kütlü pamuk verimi, lif verimi, açmamış koza sayısı, açmış koza sayısı, çırcır randımanı, koza ağırlığı, koza kütlü ağırlığı gözlemlerinin yanı sıra pamukta kalite ölçütlerinden lif inceliği, lif uzunluğu, lif kopma dayanıklılığı, lif kopma uzaması, lif üniformite oranı, kısa lif oranı, lif sarılık değeri, lif parlaklık değeri, iplik olabilirlik indeksi, olgunluk ve nem değerleri incelenmiştir. İncelenen özelliklerin tümü bakımından yaprak döktürücü uygulamaları arasında önemli bir istatistiksel farklılık elde edilememiştir.

Yürütülen çalışmada elde edilen bulguların bir yıllık olması pamuk üretimi yapan üreticilere tavsiyede bulunmak için yeterli değildir. Bu tür çalışmaların birden çok yıl ve lokasyonda yürütüldükten sonra önerilebileceği düşünülmektedir.

Öneriler

Pamukta farklı dönemlerde uygulanan yaprak döktürücülerin incelenen özelliklerden lif verimi ile açmamış koza dışındaki diğer özellikler üzerine istatistiksel olarak önemli bir etkisi bulunmamıştır. Açmamış koza sayısı bakımından bir değerlendirme yapıldığında kontrol uygulamasında en yüksek açmamış koza sayısının elde edildiği, bu uygulamayı Çatlamış Koza Üzeri Boğum Sayısının (NACB) izlediği ve bu iki uygulamanın aynı istatistiksel grupta yer aldıkları, %70 Koza açma ile Keskin Bıçak Yöntemi (Sharp Knife Techniques) uygulamalarının sıralamayı izleyerek ikinci grupta yer aldıkları, Beyaz Çiçek Üzeri Boğum Sayısı (NAWF) yönteminin ise en düşük değeri göstererek açmamış koza sayısı bakımından son grupta yer aldığı belirlenmiştir. Bu durum açmamış koza sayısı bakımından kontrol ve Çatlamış Koza Üzeri Boğum sayısı yöntemi uygulamalarından kaçınılması gerektiği izlenimini oluşturmaktadır. Aynı gözlemde en düşük değer Beyaz Çiçek Üzeri Boğum Sayısından elde edilmiştir. Bu durumda en az açmamış koza sayısı elde edebilmek için defoliant uygulaması yapılırken Beyaz Çiçek Üzeri Boğum Sayısı dikkate alınarak yaprak döktürücünün uygulanabileceği önerilebilir. Kütlü verimi ve lif verimi yönünden ise Keskin Bıçak Yöntemi dışındaki diğer uygulamalar aynı grupta yer almış ancak keskin bıçak yöntemi istatistiksel olarak lif verimi yönünden diğer uygulamalardan farklı olarak ikinci grupta yer almıştır. Lif verimi özelliği sonuçları göz önünde bulundurulduğunda Beyaz Çiçek Üzeri Boğum Sayısı, Kontrol ve %70 Koza açma uygulaması ile aynı grupta yer almıştır.

Sonuç olarak bu çalışmadan elde edilen bir yıllık sonuçlara göre Beyaz Çiçek Üzeri Boğum Sayısı gözlemi göz önünde bulundurularak yaprak döktürücü kullanılabileceği önerilebilir. Ancak daha önce de değinildiği gibi bu tür çalışmaların birden çok yıl ve lokasyonda denemeler yapılarak önerilerde bulunulması daha sağlıklı olabilir.

KAYNAKLAR

- Anonim, 2014. İllerimize Ait İstatistik Veriler. T.C. Orman ve Su İşleri Bakanlığı Meteoroloji Genel Müdürlüğü. <http://www.mgm.gov.tr/veridegerlendirme/il-veilceler-istatistik.aspx?m=SIIRT#sfB> [Erişim Tarihi: 17 Ocak 2023].
- Anonim, 2021b. Diyarbakır İli İklim Verileri. T.C. Tarım ve Orman Bakanlığı, Meteoroloji Genel Müdürlüğü Kayıtları.
- Bednarz, C.W., Shurley, D.W., Anthony, W.S., 2002. Losses in yield, quality, and profitability of cotton from improper harvest timing, *Agronomy Journal*, 94, 1004-1011.
- Cathey, W. G., 1985. Conditioning cotton for increased response to defoliant chemicals, *Field Crops Research* 10, 347-353.
- Çiçek, B., Oğlakçı, M., Çopur, O., 2003. Pamukta yaprak döktürmenin verim ve kalite unsurlarına etkisi, *Harran Üniversitesi Ziraat Fakültesi Dergisi*, 7(1), 45-52.
- Çopur, O., Demirel, U., Polat, R., Gür, M. A., 2010. Effect of different defoliants and application times on the yield and quality components of cotton in semi-arid conditions, *African Journal of Biotechnology*, 9 (14), 2095- 2100.
- Evcim, H. Ü., 1999. Türkiye’de makineli Pamuk Hasadı: Uygulamalar, Sonuçlar, Pamukta Makinalı Hasat Semineri, İzmir Ticaret Borsası, (yayınlanmamış).
- Faircloth, Jr., Edmisten, K.I., Wells, R., Stewart, A.M., 2004. The influence of defoliation timing on yields and quality of two cotton cultivars, *Crop Science*, 44, 165-172.
- Görmüş, O., Kurt, F., El Sabagh, A., 2017. Impact of defoliation timings and leaf pubescence on yield and fiber quality of cotton, *Journal of Agricultural Science and Technology*, 19 (4), 903-915.
- Haliloğlu, H., Cevheri, C. İ., Beyyavaş, V., 2020. The effect of defoliant application on yield and yield components of some cotton (*Gossypium hirsutum* L.) cultivars at timely and late sowing, *International Journal of Agriculture, Environment and Food Sciences*, 4(2), 157-164.
- Karademir, E., Karademir, C., Basbag, S., 2007. Determination the effect of defoliation timing on cotton yield and quality, *Journal Central European Agriculture*, 8 (3), 357-362.
- Larson, J.A., Gwathmey, C.O., Hayes, R.M., 2005. Effects of defoliation timing and desiccation on net revenues from ultra-narrow-row cotton, *Journal of Cotton Science*, 9, 204-214.
- Larson, J.A., Gwathmey, C.O., Hayes, R.M., 2002. Cotton defoliation and harvest timing effects on yields, quality, and net revenues, *Journal of Cotton Science*, 6, 13-27.
- Morgan, P. W., Jordan, W. R., Davenport, T. L., Durham, J. I., 1977. Abscission responses to moisture stress, auxin transport inhibitors, and ethephon, *Plant Physiology*, 59, 710-712.
- Oğlakçı, M., 1992. Pamuk bitkisinde yaprak döktürme ve dökülme fizyolojisi, *Harran Üniversitesi Ziraat Fakültesi Dergisi*, 3 (4), 84-95.
- Oğlakçı, M. ve Kaynak, M. A., 1992. Pamuk tarımında hasata yardımcı kimyasal uygulamalar, *Harran Üniversitesi Ziraat Fakültesi Dergisi*, 3 (4), 74-78.
- Özkan, N. ve Görmüş, Ö. 2002. Haran ovası şartlarında, yaprak döktürücü uygulama dönemlerinin pamuğun (*Gossypium hirsutum* l.) bazı kalite özellikleri üzerine etkisi, *Çukurova Üniversitesi Ziraat Fakültesi Dergisi*, 7 (1-2), 27-38.

- Raghavendra, T. and Reddy, Y.R., 2020. Efficacy of defoliant on yield and fibre quality of american cotton in semi-arid conditions, *Indian Journal of Agricultural Research*, (54), 404-407.
- Robertson, R.J., Goss, F.L., Rutkowski, J., Lenz, B., Dixon, C., Timmer, J., Frazee, K., Dube, J., Andreacci, J., 2003. Concurrent validation of the OMNI perceived exertion scale for resistance exercise, *Psychobiology and Behavioral Sciences*, 35, 333-341.
- Sokat, Y. ve Gürel, A., 2008. İkinci ürün pamuk (*Gossypium hirsutum* L.) tarımında defoliant uygulamalarının verim, lif ve tohum kalitesi üzerine etkilerinin araştırılması, Doktora Tezi, Ege Üniversitesi Fen Bilimleri Enstitüsü, Bornova-İzmir, 188s.
- Stewart, A.M., Edmisten, K.L., Wells, R., 2000. Boll openers in cotton defoliant effectiveness and environmental influences, *Field Crops Research*, 67, 83-90.
- Supak, J. R., 1996. Overview of U.S.Regional cotton defoliation practices South West, *Beltwide Cotton Conferences*, Memphis, 88-91.
- Tuncer, K. ve Işık, A., 1999. Makinalı Pamuk Hasadı ve Türkiye'deki Gelişmeler. *Türk Dünyasında Pamuk Tarımı Lif Teknolojisi ve Tekstil I. Sempozyumu Bildiri Kitabı*, 28 Eylül-1 Ekim, Kahramanmaraş, s.209-216.
- Tülemen, A. S., 2016. İkinci ürün pamukta (*Gossypium hirsutum* L.) yaprak döktürücü kimyasalların verim ve kalite özellikleri üzerine etkisi, *Adnan Menderes Üniversitesi Ziraat Fakültesi Dergisi*, 13(1), 115-120.

**PAMUKTA KÜKÜRT UYGULAMASININ VERİM VE LİF KALİTE KRİTERLERİ
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ÖZET

Bu çalışma pamukta farklı kükürt dozlarının verim, verim komponentleri ve lif teknolojik özellikleri üzerine olan etkisini araştırmak amacı ile yürütülmüştür. Bu amaçla çalışma Güneydoğu Anadolu Bölgesinde pamuk ekiminin yoğun olduğu Diyarbakır ili Bismil ilçesinde üretici tarlasında pamukta 1, 2, 3, 4 L/da kükürt ve bu uygulamaların kıyaslanacağı kükürt uygulanmayan kontrol parselleri olmak üzere 5 uygulama yapılarak yürütülmüştür. İncelenen özelliklerden kütlü verimi, lif verimi, çırçır randımanı ve koza sayısı bakımından uygulamalar arasında %5 önem düzeyinde önemli farklılıklar elde edilmiştir. Ancak koza ağırlığı ve koza kütlü ağırlığı yönünden uygulamalar arasında istatistiksel olarak bir farklılık elde edilmemiştir. İncelenen kalite özelliklerinin tümü bakımından kükürt uygulamaları arasında önemli bir istatistiki farklılık elde edilememiştir. Yürütülen çalışmada elde edilen bulguların bir yıllık olması pamuk üretimi yapan üreticilere tavsiyede bulunmak için yeterli değildir. Bu tür çalışmaların birden çok yıl ve lokasyonda yürütüldükten sonra önerilebileceği düşünülmektedir.

Anahtar Kelimeler: Kükürt, kütlü pamuk verimi, lif kalite kriterleri, pamuk

**DETERMINATION EFFECTS OF SULFUR APPLICATION ON YIELD AND FIBER
QUALITY CRITERIA IN COTTON**

ABSTRACT

This study was carried out to investigate the effect of different sulfur doses on yield, yield components and fiber technological properties in cotton. For this purpose, the study was carried out by making 5 applications, 1, 2, 3, 4 L/da of sulfur in cotton and control plots without sulfur to compare these applications, in the producer's field in Bismil district of Diyarbakır province, where cotton cultivation is intense in the Southeastern Anatolia Region. Significant differences at the 5% significance level were obtained between the applications in terms of seed cotton yield, fiber yield, ginning yield and number of bolls. However, there was no statistical difference between the applications in terms of boll weight and boll seed weight. No statistically significant difference could be obtained between the sulfur applications in terms of all the investigated quality properties. The fact that the findings obtained in the study carried out are one year old is not enough to give advice to cotton producers. It is thought that such studies can be recommended after being conducted in multiple years and locations.

Keywords: Cotton, sulfur, seed cotton yield, fiber quality criteria

GİRİŞ

Pamuk ülkemizin en önemli endüstri bitkilerinden biri olup, tarımda ve sanayide yaygın olarak kullanılmaktadır. Ülkemizde 2021 yılında 4,322.790 da alandan 832,500 ton pamuk lifi üretimi gerçekleştirilmiştir. Güneydoğu Anadolu Bölgesinde ise, 2021 yılında pamuk ekimi yapılan 2,619,897 da alanda 489,880 ton pamuk lifi üretimi gerçekleştirilmiştir. Ülke üretiminin yaklaşık olarak %60'ı Güneydoğu Anadolu Bölgesinden karşılanmaktadır (Anonim, 2021a). Üretilen pamuk ülke ihtiyacına cevap verememekte ve yılda yaklaşık 800,000 ton lif pamuk ithalatı yapılmaktadır. Pamuk iklim özellikleri bakımından seçici bir bitki olması nedeni ile ülkemizde sınırlı yerlerde yetiştirilebilmektedir. Ülkemizde pamuk yetiştiriciliği Güneydoğu Anadolu Bölgesi, Ege ve Çukurova Bölgeleri olmak üzere 3 bölgede yapılmaktadır. Siirt ilinin de içinde bulunduğu Güneydoğu Anadolu Bölgesi pamuk yetiştiriciliği yönünden uygun ekolojiye sahiptir.

Pamuk, yaygın ve zorunlu kullanım alanıyla insanlık açısından, yarattığı katma değer ve istihdam olanaklarıyla da üretici ülkeler açısından büyük ekonomik öneme sahip bir üründür. Pamuk, işlenmesi açısından çırçır sanayisinin, lifi ile tekstil sanayisinin, çiğidi ile yağ ve yem sanayisinin, linteri ile de kâğıt sanayisinin hammaddesi durumundadır. Petrole alternatif olarak pamuğun çekirdeğinden elde edilen yağ, giderek artan miktarda biodizel üretiminde de hammadde olarak kullanılmaktadır. Pamuk tohumlarının en önemli kullanımı ise, insan ve hayvan beslenme (gıda) alanıdır (İnan, 1980).

Ülkemiz için stratejik bir öneme sahip olan pamukta mikro ve makro besin elementlerinin verim ve kalitesine olan etkisi ile ilgili birçok çalışma yürütülmüştür. Yürütülen çalışmaların büyük bir çoğunluğu azot ve fosfor içerikli bitki besin elementlerinin etkisi üzerine yoğunlaşmıştır. Bir makro besin elementi olan kükürt ile ilgili yapılan çalışmalar hem dünya genelinde hem de ülkemizde çok yaygın değildir. Bu nedenle kükürt bitki besin elementinin pamukta verim ve kaliteye olan etkisinin çalışılması gerekmektedir. Çoğu bitkide gerekli makro besin elementlerinden olan kükürt, toprakta farklı formlarda bulunmaktadır. Toprakta temel kükürt formları; organik kükürt bileşikleri ve inorganik kükürt bileşikleri olarak 2'ye ayrılır.

Bitki gelişimini olumsuz yönde belirgin biçimde etkileyerek gelişmeyi durduran kükürt noksanlığı ile bitki bodurlaşır, ince gövdeli ve çalimsı bir görünüm kazanır. Bu noksanlık belirtileri birçok bitkide azot noksanlığına benzer ve bu nedenle bu soruna ilişkin nedenlerin açıklanmasında yanlış yorumlar yapılabilir. Bununla birlikte noksanlık durumunda kükürt azotta olduğu gibi bitki yapısı içinde yaşlı bitki bölümlerinden genç bölümlere taşınamaz bu nedenle noksanlık belirtileri ilk önce en genç yapraklarda görülür (URL-1). Kükürt, aynı

zamanda proteinin yapısını inşa eder ve klorofilin yapısında anahtar rol oynayan önemli bir besin elementidir (Duke ve Reisenau, 1986).

Kükürt uygulaması ile klorofil miktarı arttırılabilir ve abiyotik stresin şiddeti hafifletilebilir (Jie ve ark., 2008). Pamuk bitkilerinin proteinleri ve enzimleri yapmak için gerekli olan amino asitleri üretmek için kükürt ihtiyacı vardır. Bitki dokusunun yaklaşık yüzde 3'ü kükürttten oluşur. Ekinlerin kükürtlü gübrelenmesi, optimum verim ve ürün kalitesi elde etmek için dengeli beslenmenin ayrılmaz bir bileşenidir. Tohumda yüksek protein bulunan pamuk gibi bitkiler, daha büyük bir miktarda kükürt'e ihtiyaç duyar. Normal bir verim için 20 ile 45 kg/ha kükürt'e ihtiyacı vardır (Aulakh ve ark., 1985). Bu nedenle pamuk üretiminde kükürt için gübre önerileri oldukça yüksektir. Pamuk bitkisinin ihtiyaç duyduğu kükürt miktarı kütlü pamuk verimi ile doğru orantılıdır. Kükürt ilavelerine yanıt olarak pamuğun önemli verim artışları yürütülen önceki çalışmalarda da rapor edilmiştir (Makhdam ve ark., 2001). Kütlü pamuk veriminin, bitki başına koza sayısının ve koza ağırlığının kükürtlü gübrelenmeye önemli bir tepki gösterdiği bildirilmiştir. Toprakta 10-15 mg/kg'den daha az SO₄-S bulunduğunda eksiklik belirtileri ortaya çıkar (Hearn, 1981). Pamuk üretimi yapılan bölgelerde sıcak ve kurak iklim ve muhtemelen aşırı sülfat sızıntısından dolayı toprakta yarayışlı Kükürt (S) genellikle düşüktür. Yüksek toprak pH'sı, hafif yapılı topraklar; pulluk tabanı gibi oluşumlar ürünler için kükürtün yarayışlılığını güçleştirir (Hue ve ark.,1984). Genellikle yağ bitkileri yüksek verim ve kalite için hemen hemen fosfor kadar veya daha fazla miktarda kükürt'e de gereksinim duymaktadır. Yağ bitkilerinin de içerisinde yer aldığı yoğun bitki rotasyon programlarında, özellikle bitki artıklarının topraktan uzaklaştırıldığı durumlarda, S alınımı oldukça yüksek olabilir. Bu durum eğer yeterli miktarda S gübreleme olarak ikame edilmez ise önemli derecede S yoksunluğuna neden olur. Kükürt kısıtlılığı sıklıkla protein sentezini engeller bu durum çözülebilir azot bileşiklerinin birikimini olumsuz yönde etkiler. Bunun sonucunda da yapraklarda büzölmeler ve diğer morfolojik anormalliklere neden olur (Tiwari ve ark., 1997). Pamuğun toplam S gereksinimi fosfor gereksinimi gibidir. Önceki çalışmalarda pamuğun 12-15 kg/ha kükürt tükettiği bildirilmiştir (Makdam ve ark., 2001). Messic (1992)'te yürüttüğü çalışmada 11 kg/ha S eklendiğinde pamukta verimin önemli düzeyde bir artış gösterdiğini bildirmiştir. Gün geçtikçe içerisinde yüksek düzeyde S bulunan gübreler yerini daha az S içerikli gübrelere terk etmeye başlamaktadır. Son yıllarda kükürtsüz gübre kullanımı, yüksek verimli bitkilerin topraktan çok miktarda S tüketmesi, atmosferden toprağa daha az S birikimi, ve S içerikli pestisit kullanımının azalması bitkilerde S eksikliğine neden olmaktadır (Yin ve ark., 2012). Kükürt azot, fosfor ve potasyumdan sonra dördüncü en önemli makro bitki besin elementidir.

Kükürt 'ün tarımdaki önemi birçok önceki çalışmada ortaya konmuş ve vurgulanmıştır (Scherer, 2009; Jamal ve ark., 2010).

Kükürt'ün pamuk büyümesi, verimi ve kalitesi üzerindeki etkileri hakkında çok az şey bilinmektedir bu nedenle bu araştırma, Kükürt uygulamasının pamuk büyümesi, pamuk verimi ve kalitesi üzerindeki etkilerini belirlemek amacıyla yürütülmüştür.

MATERYAL VE METOT

Deneme Diyarbakır ili Bismil ilçesine bağlı Köseli köyündeki üreticiye ait arazide 3 tekerrürlü olarak 2021 yılında yürütülmüştür. Araştırmada materyal olarak Progen Tohum A.Ş.'nin BA 1010 pamuk çeşidi materyal olarak kullanılmıştır. Çalışma alanında ekim yapılmadan önce toprak örneği alınarak toprak özellikleri belirlenmiştir. Deneme alanına ilişkin analiz sonuçları Tablo 1'de verilmiştir.

Tablo 1. Çalışma alanı toprak özellikleri

Toprak Özelliği	Değeri
Kil, %	44,51
Kum, %	47,79
Silt, %	8,59
pH	7,89
Elektriksel iletkenlik, mS/cm	453,00
Kireç, %	0,51
Organik madde, %	1,12
Alınan fosfor, P ₂ O ₅ kg/da	2,25
Alınan potasyum, K ₂ O kg/da	86,05

Tablo 1. incelendiğinde, alınan topraklarda yapılan analiz sonucunda; deneme alanı toprak örneklerinin kumlu-killi bünyeye sahip, nötr, tuzsuz, az kireçli, organik madde ve alınabilir fosfor bakımından düşük, potasyum bakımından ise yeterli olduğu belirlenmiştir.

Uzun yıllara ait iklim verilerine göre; il ortalama sıcaklığı 16,1°C, maksimum ortalama sıcaklık 21,8°C, minimum ortalama sıcaklık 11,1°C, ortalama yağış 692,0 mm, maksimum hava sıcaklığı 46,0°C, minimum hava sıcaklığı ise -15,6 °C olarak gerçekleşmiştir (Anonim, 2021b).

Çalışmanın yapıldığı bölgede 2021 yılına ve uzun yıllara ait iklim verileri Tablo 2'de verilmiştir. 2021 yılı iklim verileri uzun yıllarla kıyaslandığında ortalama sıcaklığın, minimum ve maksimum sıcaklık değerlerinin uzun yıllar ortalamasının üzerinde seyrettiği izlenebilmektedir. Toplam yağış miktarı incelendiğinde ise denemenin yürütüldüğü Mayıs ve Ekim aylarındaki yağış miktarının uzun yılların üzerinde seyrettiği görülmektedir.

Tablo 2. Denemenin yürütüldüğü 2021 yılı ile uzun yıllara ait iklim verileri

Aylar	Yıllar	Ortalama Sıcaklık (°C)	Ortalama Maksimum Sıcaklık (°C)	Ortalama Minimum Sıcaklık (°C)	Nispi Nem (%)	Toplam Yağış (mm)
Nisan	2021	16,80	22,70	11,30	47,60	60,80
	Uzun Yıllar	13,80	19,30	9,10	50,40	104,30
Mayıs	2021	19,80	25,70	14,90	59,10	146,80
	Uzun Yıllar	19,30	25,20	13,50	41,50	62,0
Haziran	2021	27,40	33,40	21,00	31,70	3,00
	Uzun Yıllar	26,00	32,10	18,90	24,10	8,70
Temmuz	2021	32,30	38,70	25,40	20,10	0,60
	Uzun Yıllar	30,60	36,90	23,40	18,10	1,60
Ağustos	2021	32,10	38,60	25,50	21,40	1,60
	Uzun Yıllar	30,00	37,00	23,10	17,20	1,00
Eylül	2021	27,90	34,50	21,50	22,50	0,0
	Uzun Yıllar	25,00	32,30	18,70	24,00	5,20
Ekim	2021	20,40	26,20	15,60	46,30	134,00
	Uzun Yıllar	17,90	24,50	12,70	45,30	50,90
Kasım	2021	16,60	24,30	10,0	42,90	96,00
	Uzun Yıllar	10,20	15,40	6,30	57,10	55,60

Çalışmanın yapıldığı arazi sonbahar mevsiminde derin şekilde pulluk, ilkbahar mevsimlerinde ise yüzeysel olarak kültivatör ile işlenmiş ve ekimden önce deneme alanı 3 kez tapan çekilerek ekime hazır hale getirilmiştir. Ekim işlemi mibzerle gerçekleştirilmiştir.

Denemede ekim işlemleri 22 Nisan 2021 tarihinde deneme mibzeri ile yapılmıştır, ekimde her parsel 6 m uzunluğunda 4 sıradan oluşturulmuştur Sıra arası mesafe ekim esnasında 70 cm sabit tutulmuş, sıra üzeri mesafe ise 10-15 cm olacak şekilde seyreltme yapılarak oluşturulmuştur. Deneme alanından toprak örnekleri alınarak toprak analizleri yapılmış ve bitkinin ihtiyaç duyduğu gübre miktarı zamanında verilmiştir. Ekim esnasında ihtiyaç duyulan azotun yarısı ile fosforun tamamı uygulanmış, geriye kalan azotun ikinci yarısı ise ilk sulama öncesinde uygulanmıştır. Taban gübresi olarak ekimle birlikte 20-20-0 kompoze gübre kullanılmıştır. İlk sulama öncesinde ise üst gübre olarak üre gübresi kullanılmıştır. Deneme salma sulama sistemi ile sulanmıştır. Sulamaya çiçeklenme öncesi dönemde başlanmış ve %10 koza açma döneminde son verilmiştir.

Çalışmada kükürt uygulanmayan parsel kontrol olmak üzere toplam 5 farklı uygulama yapılmıştır.

Uygulamalar

1. Kontrol (kükürt uygulaması yok)
2. Çiçeklenme Doruğunda Toprağa (1 L/da)
3. Çiçeklenme Doruğunda Toprağa (2 L/da)

4. Çiçeklenme Doruğunda Toprağa (3 L/da)
5. Çiçeklenme Doruğunda Toprağa (4 L/da)

İncelenen özellikler

Bitkisel özellikler: Çalışmada incelenen bitkisel özellikler her parselden şansa bağlı olarak seçilen 10'ar bitkide sayımlar yapıldıktan sonra ortalamaları alınarak hesaplanmıştır. Kütlü pamuk verimi ile lif verimi her parselden elde edilen ürün tartılarak parsel veriminin kg/da' a oranlanması ile elde edilmiştir.

Lif teknolojik parametreler: Hasat sonrasında belirlenmiş olup, 50 kozadan elde edilen ürün lif analizlerinde kullanılmıştır. Analizler GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi Müdürlüğü lif kalite laboratuvarında HVI aleti yardımı ile yapılmıştır.

- Lif İnceliği (micronaire)
- Lif Uzunluğu (mm)
- Lif Kopma Dayanıklılığı (g/tex)
- Lif Kopma Uzaması (%)
- Lif Üniiformite Oranı (%)
- Kısa Lif Oranı (%)
- Lif Parlaklık Değeri (%)
- Lif Sarılık Değeri (+b)
- İplik Olabilirlik İndeksi

Hasat İşlemleri: Hasat elle yapılmıştır. Hasatta parsellerin orta kısmında yer alan iki sıra hasat edilmiştir.

İstatistik Analizler: Araştırmadan elde edilen sonuçlar JUMP istatistik paket program yardımı ile değerlendirilip, ortalamaların karşılaştırılmasında ise LSD_(0.05) testi kullanılmıştır.

BULGULAR VE TARTIŞMA

Kütlü pamuk verimi (kg/da): Kütlü pamuk verimine ait uygulamalara ilişkin ortalama değerler ve LSD_(0.05) testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan kütlü pamuk verimi açısından uygulamalar arasında %5 önem düzeyinde istatistiksel değişikliklerin olduğu görülebilmektedir.

Tablo 3'ten, uygulamalara bağlı olarak kütlü verimine ait ortalama değerlerin, 370,40 ile 503,20 kg/da arasında farklılık gösterdiği; denemenin genel ortalamasının 417,44 kg/da olduğu, en yüksek kütlü pamuk veriminin Çiçeklenme Doruğunda 1 L/da uygulamasından elde edildiği

görülmektedir. En yüksek verimin elde edildiği Çiçeklenme Doruğunda 1 L/da uygulaması ile kontrol uygulaması arasında (503,20 - 409,60 = 93,6 kg/da)'lık bir verim artışı oluşmuştur.

Bu çalışmadan elde edilen sonuçlar daha önce yürütülen ve kükürt uygulamasının pamuk kütlü pamuk veriminde önemli artışlar elde eden Makhdum ve ark., (2001), Makhdum ve Malik (2004), Sharma ve Kumawat (2005), Bukarlı (2007), Gobi ve ark., (2010), Parmar ve ark. (2010), Yin ve ark. (2011), Görmüş (2014), Basavanepa ve ark., (2016), Geng ve ark., (2016), Ashmouny ve ark., (2017), Candemir ve Ödemiş (2018), Parlavar ve ark., (2018), Ibrahim (2022), Lad ve ark.,(2022)'nin sonuçları ile benzer sonuçlar göstermiştir, ancak Faircloth ve ark., (2004)'nin elde ettikleri sonuçlar ile örtüşmemektedir. Bazı sonuçların bir biri ile örtüşmemesi araştırmada kullanılan materyalden, iklim koşulları ve bakım koşulları farklılığından kaynaklanmış olabilir.

Tablo 3. Kütlü pamuk verimi, lif verimi, bitki boyu, ilk meyve dalı boğum sayısı, meyve dalı ve odun dalı sayısı özelliklerine ilişkin ortalama değerler ve oluşan gruplamalar

Treatment	Kütlü Pamuk Verimi (Kg da ⁻¹)	Lif Verimi (Kg da ⁻¹)	Bitki Boy (cm)	İlk Meyve Dalı Boğum Sayısı (adet bitki ⁻¹)	Meyve Dalı Sayısı (adet bitki ⁻¹)	Odun Dalı Sayısı (adet bitki ⁻¹)
1. Kontrol	409,60 b	185,58 b	79,06	4,00 b	9,86 ab	0,86 b
2. Çiçeklenme Doruğunda 1 L/da	503,20 a	229,67 a	81,60	3,93 b	11,53 a	0,73 b
3. Çiçeklenme Doruğunda 2 L/da	424,00 b	187,96 b	81,40	4,46 ab	11,53 a	1,00 b
4. Çiçeklenme Doruğunda 3 L/da	380,00 b	176,77 b	80,33	5,13 a	9,13 b	1,33 a
5. Çiçeklenme Doruğunda 4 L/da	370,40 b	168,78 b	80,66	4,53 ab	9,73 ab	0,86 b
Ortalama	417,44	189,75	80,61	4,41	10,35	0,95
CV (%)	9,48	9,07	7,48	8,74	11,71	18,44
LSD_(0.05)	74,51 *	32,39 *	11,34	0,72 *	2,28 *	0,33 *

Lif verimi (kg /da): Lif verimine ait uygulamalara ilişkin ortalama değerler ve LSD_(0.05) testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan lif verimi açısından uygulamalar arasında %5 önem düzeyinde istatistiksel değişikliklerin olduğu görülebilmektedir.

Tablo 3'ten, uygulamalara bağlı olarak lif verimine ait ortalama değerlerin, 168,78 ile 229,67 kg/da arasında farklılık gösterdiği; denemenin genel ortalamasının 189,75 kg/da olduğu, en yüksek lif veriminin Çiçeklenme Doruğunda 1 L/da uygulamasından elde edildiği görülmektedir. Bu çalışmadan elde edilen sonuçlar daha önce yürütülen ve kükürt uygulamasının lif veriminde önemli artışlar elde eden Makhdum ve ark.,(2001), Makhdum ve Malik (2004), Sharma ve Kumawat. (2005), Bukarlı (2007), Gobi ve ark., (2010), Parmar ve ark. (2010), Yin ve ark. (2011), Görmüş (2014), Basavanepa ve ark., (2016), Geng ve ark.,

(2016), Ashmouny ve ark., (2017), Candemir ve Ödemiş (2018), Parlawar ve ark., (2018), Ibrahim (2022), Lad ve ark.,(2022)'nin sonuçları ile benzer sonuçlar göstermiştir, ancak Faircloth ve ark., (2004)'ün elde ettikleri sonuçlar ile örtüşmemektedir. Bu çalışma ile önceki araştırma sonuçlarının örtüşmemesi araştırmada kullanılan materyalden, iklim koşulları ve bakım koşulları farklılığından kaynaklanmış olabilir.

Bitki boyu (cm): Tablo'dan bitki boyu (cm) açısından uygulamalar arasındaki değişikliklerin istatistiksel anlamda önemli olmadığı görülebilmektedir. Tablo 3' te, uygulamalara bağlı olarak bitki boyu değerine ait ortalama değerlerin, 79,06 ile 81,60 cm arasında farklılık gösterdiği; denemenin genel ortalamasının 80,61 cm olduğu, en yüksek bitki boyu değerinin Çiçeklenme Doruğunda 1 L/da elde edildiği görülmektedir.

İlk meyve dalı boğum sayısı (adet/bitki): İlk meyve dalı boğum sayısı özelliğine ait uygulamalara ilişkin ortalama değerler ve $LSD_{(0.05)}$ testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan bu özellik bakımından uygulamalar arasında %5 önem düzeyinde istatistiksel değişikliklerin olduğu görülebilmektedir. Tablo 3' te, uygulamalara bağlı olarak ilk meyve dalı boğum sayısı değerine ait ortalama değerlerin, 3,93 ile 5,13 adet/bitki arasında farklılık gösterdiği; denemenin genel ortalamasının 4,41 adet/bitki olduğu, en yüksek ilk meyve dalı boğum sayısı değerinin Çiçeklenme Doruğunda 3 L/da' dan elde edildiği görülmektedir.

Meyve dalı sayısı (adet/bitki): Meyve dalı sayısı özelliğine ait uygulamalara ilişkin ortalama değerler ve $LSD_{(0.05)}$ testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan bu özellik bakımından uygulamalar arasında %5 önem düzeyinde istatistiksel değişikliklerin olduğu görülebilmektedir. Tablo 3' te, uygulamalara bağlı olarak meyve dalı sayısına ait ortalama değerlerin, 9,13 ile 11,53 adet/bitki arasında farklılık gösterdiği; denemenin genel ortalamasının 10,35 adet/bitki olduğu, en yüksek meyve dalı sayısı değerinin Çiçeklenme Doruğunda 1 L/da ve 2 L/da'dan elde edildiği görülmektedir. Bu çalışmadan elde edilen sonuçlar daha önce yürütülen ve kükürt uygulamasının meyve dalı sayısında önemli bir etkisinin olmadığını tespit eden Bukarlı (2007)'nin sonuçları ile örtüşmemektedir, ancak kükürt uygulamasının pamukta meyve dalı sayısında önemli artışlar sağladığını bildiren Basavanappa ve ark., (2016), Ashmouny ve ark., (2017), Lad ve ark.,(2022)'in elde ettikleri sonuçlar ile paralellik göstermiştir.

Odun dalı sayısı (adet/bitki): Odun dalı sayısı özelliğine ait uygulamalara ilişkin ortalama değerler ve $LSD_{(0.05)}$ testine göre oluşan gruplamalar, Tablo 3'te belirtilmiştir. Tablo'dan bu

özelliik bakımından uygulamalar arasında %5 önem düzeyinde istatistiksel deęişikliklerin olduęu görülebilmektedir. Tablo 3' te, uygulamalara baęlı olarak odun dalı sayısı deęerine ait ortalama deęerlerin, 0,73 ile 1,33 adet/bitki arasında farklılık gösterdięi; denemenin genel ortalamasının 1,95 adet/bitki olduęu, en yüksek odun dalı sayısı deęerinin Çiçeklenme Doruęunda 3 L/da' dan elde edildięi görülmektedir. Bu çalıřmadan elde edilen sonuçlar daha önce yürütölen ve kükürt uygulamasının lif veriminde önemli artışlar elde eden Bukarlı (2007), Basavaneppa ve ark., (2016),'nin sonuçları ile benzer sonuçlar göstermiştir.

Tablo 4. Çırcır randımanı, koza sayısı, koza aęırlıęı ve koza kütlü aęırlıęı özelliklerine iliřkin ortalama deęerler ve oluřan gruplamalar

Uygulamalar	Çırcır Randımanı (%)	Koza Sayısı (Adet/Bitki)	Koza Aęırlıęı (g)	Koza Kütlü Aę. (g)
1. Kontrol	45,33 ab	13,93 ab	7,20	5,90
2. Çiçeklenme Doruęunda 1 L/da	45,66 ab	15,53 a	7,66	6,26
3. Çiçeklenme Doruęunda 2 L/da	44,33 b	13,86 ab	7,06	5,80
4. Çiçeklenme Doruęunda 3 L/da	46,66 a	12,20 bc	7,00	5,73
5. Çiçeklenme Doruęunda 4 L/da	45,66 ab	10,30 c	7,20	5,73
Ortalama	45,52	13,16	7,22	5,88
CV (%)	1,77	11,23	6,69	6,19
LSD (0,05)	1,51 *	2,78 *	Ö.D	Ö.D

Çırcır randımanı (%) (mm): Tablo' dan çırcır randımanı aısından uygulamalar arasında %5 önem düzeyinde istatistiksel deęişikliklerin olduęu görülebilmektedir.

Tablo 4'ten, uygulamalara baęlı olarak çırcır randımanına ait ortalama deęerlerin, %44,33 ile %46,66 arasında farklılık gösterdięi; denemenin genel ortalamasının %45,52 olduęu, en yüksek çırcır randımanının Çiçeklenme Doruęunda 3 L/da uygulamasından elde edildięi görülmektedir. Bu çalıřmadan elde edilen sonuçlar daha önce yürütölen ve kükürt uygulamasının çırcır randımanı deęerinde önemli bir etkisinin olmadığını tespit eden Bukarlı (2007)'nin sonuçları ile paralellik göstermiştir, ancak kükürt uygulamasının anılan özelliikte önemli artışlar sağladığını bildiren Gobi ve ark., (2010). Parmar ve ark. (2010)'in elde ettikleri sonuçlar ile örtüşmemektedir. Bu çalıřma ile önceki arařtırma sonuçlarının örtüşmemesi arařtırmada kullanılan materyalden, iklim kořulları ve bakım kořulları farklılıęından kaynaklanmış olabilir.

Koza sayısı (adet/bitki): Tablo' dan koza sayısı aısından uygulamalar arasında %5 önem düzeyinde istatistiksel deęişikliklerin olduęu görülebilmektedir. Tablodan, uygulamalara baęlı olarak koza sayısına ait ortalama deęerlerin, 10,30 ile 15,53 adet/bitki arasında farklılık gösterdięi; denemenin genel ortalamasının 13,16 adet/bitki olduęu, en yüksek koza sayısının

Çiçeklenme Doruğunda 1 L/da uygulamasından elde edildiği görülmektedir. Bu çalışmadan elde edilen sonuçlar daha önce yürütülen ve kükürt uygulamasının koza sayısı özelliğinde önemli artışlar elde eden Makhdum ve Malik (2004) , Faircloth ve ark. (2004), Parmar ve ark. (2010), Basavaneppa ve ark., (2016), Geng ve ark., (2016), Ashmouny ve ark., (2017), Parlawar ve ark., (2018) 'nin sonuçları ile benzer sonuçlar göstermiştir, ancak Bukarlı (2007), Yin ve ark. (2011), 'ün elde ettikleri sonuçlar ile örtüşmemektedir. Bu çalışma ile önceki araştırma sonuçlarının örtüşmemesi çalışmada kullanılan materyalden, iklim koşulları ve bakım koşulları farklılığından kaynaklanmış olabilir.

Koza ağırlığı (g): Tablo' dan koza ağırlığı açısından uygulamalar arasındaki değişikliklerin istatistiksel anlamda önemli olmadığı görülebilmektedir. Tablo 4' te, uygulamalara bağlı olarak koza ağırlığına ait ortalama değerlerin, 7,00 ile 7,66 g arasında farklılık gösterdiği; denemenin genel ortalamasının 7,19 g olduğu, en yüksek koza ağırlığının Çiçeklenme Doruğunda 1 L/da uygulamasından elde edildiği görülmektedir.

Koza kütlü ağırlığı (g): Tablo'dan koza kütlü ağırlığı açısından uygulamalar arasındaki değişikliklerin istatistiksel anlamda önemli olmadığı görülebilmektedir. Tablo 4' te, uygulamalara bağlı olarak koza kütlü ağırlığına ait ortalama değerlerin, 5,73 ile 6,26 g arasında farklılık gösterdiği; denemenin genel ortalamasının 5,88 g olduğu, en yüksek koza kütlü ağırlığının Çiçeklenme Doruğunda kontrol, 1 L/da uygulamasından elde edildiği görülmektedir.

Lif teknolojik özellikler: Lif teknolojik özelliklerine ait ortalama değerler ve oluşan gruplamalar Tablo 5' te izlenebilmektedir. Tabloda da görüldüğü gibi uygulanan kükürt'ün incelenen lif teknolojik özellikleri üzerine önemli bir etkisi olmamıştır.

Tablo 5. İncelenen lif kalite özelliklerine ilişkin ortalama değerler ve oluşan gruplamalar

Uygulamalar	Lif Uzunluğu (mm)	Lif İnc. (Mic.)	Lif Kop. Dayanıml. (g/tex)	Lif Kop. Uzaması (%)	Üniformite (%)	Kısa Lif İçeriği (%)
1. Kontrol	27,00	4,66	32,66	6,00	84,66	7,66
2. Çiçeklenme Doruğunda 1 L/da	30,33	4,00	33,66	6,00	83,33	7,33
3. Çiçeklenme Doruğunda 2 L/da	30,66	4,33	32,66	6,00	85,33	6,33
4. Çiçeklenme Doruğunda 3 L/da	30,00	4,66	33,33	5,66	85,00	6,33
5. Çiçeklenme Doruğunda 4 L/da	30,00	5,00	32,66	6,33	83,66	7,66
Ortalama	29,59	4,53	32,66	5,99	84,39	7,06
CV (%)	7,93	14,52	5,48	5,69	1,14	10,49
LSD (0.05)	Ö.D.	Ö.D.	Ö.D.	Ö.D.	Ö.D.	Ö.D.

Lif uzunluğu (mm): Tablo ' dan, uygulamalara bađlı olarak lif uzunluđu deđerine ait ortalama deđerlerin, 27,00 ile 30,66 mm arasında farklılık gösterdiđi; denemenin genel ortalamasının 29,59 mm olduđu, en yüksek lif uzunluđu deđerinin ieklenme Doruđunda 2 L/da' dan elde edildiđi grlmektedir.

Lif inceliđi (micronaire): Tablo 5' te, uygulamalara bađlı olarak lif inceliđine ait ortalama deđerlerin, 4,00 ile 5,00 mic. arasında farklılık gösterdiđi; denemenin genel ortalamasının 4,53 mic. olduđu, en yüksek lif inceliđinin ieklenme Doruđunda 4 L/da uygulamasından elde edildiđi grlmektedir.

Lif kopma dayanıklılıđı (g/tex): Tablo' dan, uygulamalara bađlı olarak lif kopma dayanıklılıđına ait ortalama deđerlerin, 32,66 ile 33,66 g/tex arasında farklılık gösterdiđi; denemenin genel ortalamasının 32,99 g/tex olduđu, en yüksek lif kopma dayanıklılıđının ieklenme Doruđunda 1 L/da uygulamasından elde edildiđi grlmektedir.

Lif kopma uzaması (%): Tablo 5' te grldđi gibi uygulamalara bađlı olarak lif kopma uzamasına ait ortalama deđerlerin, %5,66 ile %6,33 arasında farklılık gösterdiđi; denemenin genel ortalamasının %5,99 olduđu, en yüksek lif kopma uzamasının ieklenme Doruđunda 4 L/da uygulamasından elde edildiđi grlmektedir.

niformite (%): Anılan tablo incelendiđinde, uygulamalara bađlı olarak uniformiteye ait ortalama deđerlerin, %83,33 ile %85,33 arasında farklılık gösterdiđi; denemenin genel ortalamasının %84,39 olduđu, en yüksek lif niformite deđerinin ieklenme Doruđunda 2 L/da uygulamasından elde edildiđi grlmektedir.

Kısa lif ieriđi (%): Tablodan uygulamalara bađlı olarak kısa lif ieriđine ait ortalama deđerlerin, %6,33 ile %7,66 arasında farklılık gösterdiđi; denemenin genel ortalamasının %7,06 olduđu, en yüksek kısa lif ieriđinin Kontrol ve ieklenme Doruđunda 4 L/da uygulamasından elde edildiđi grlmektedir.

SONU VE NERİLER

Sonuçlar

Bu alıřma pamukta farklı kkrt dozlarının verim, verim bileřenleri ve lif teknolojik zellikleri zerine olan etkisini arařtırmak amacı ile yrtlmřtr. Bu amala alıřma Gneydođu Anadolu Blgesinde pamuk ekiminin yođun olduđu Diyarbakır ili Bismil ilesinde retici tarlasında pamukta 1, 2, 3, 4 L/da kkrt ve bu uygulamaların kıyaslanacađı kkrt

uygulanmayan kontrol parselleri olmak üzere 5 uygulama yapılarak yürütülmüştür. Araştırmada materyal olarak özel sektörden temin edilen Progen BA 1010 çeşidi kullanılmıştır. Çalışmada kütlü pamuk verimi, lif verimi, çırçır randımanı, koza sayısı, koza ağırlığı, koza kütlü ağırlığı, bitki boyu, ilk meyve dalı boğum sayısı, meyve dalı sayısı ve odun dalı sayısı incelenmiştir. İncelenen özelliklerden kütlü verimi, lif verimi, çırçır randımanı ve koza sayısı bakımından uygulamalar arasında %5 önem düzeyinde önemli farklılıklar elde edilmiştir. Ancak koza ağırlığı ve koza kütlü ağırlığı yönünden uygulamalar arasında istatistiksel olarak bir farklılık elde edilmemiştir. Pamukta kalite ölçütlerinden lif inceliği, lif uzunluğu, lif kopma dayanıklılığı, lif kopma uzaması, lif üniformite oranı, kısa lif oranı, lif sarılık değeri, lif parlaklık değeri, iplik olabirlik indeksi değerleri incelenmiştir. İncelenen özelliklerin tümü bakımından kükürt uygulamaları arasında önemli bir istatistiki farklılık elde edilememiştir. Yürütülen çalışmada elde edilen bulguların bir yıllık olması pamuk üretimi yapan üreticilere tavsiyede bulunmak için yeterli değildir. Bu tür çalışmaların birden çok yıl ve lokasyonda yürütüldükten sonra önerilebileceği düşünülmektedir.

Öneriler

Pamukta farklı dönemlerde uygulanan kükürt dozları bakımından başta verim olmak üzere incelenen özelliklerin çoğu arasında önemli farklılıklar elde edilmiştir. Kütlü verimi yönünden en yüksek verim 1 L/da kükürt uygulamasından elde edilmiştir. Aynı şekilde önemli çıkan özelliklerden lif verimi ve koza sayısı özelliklerinde de 1 L/da dozundan daha yüksek değerler elde edildiği, çırçır randımanı, ilk meyve dalı boğum sayısı, meyve dalı sayısı yönünden ise 1 L/da uygulamasının bu özellikler bakımından elde edilen en yüksek değerler ile aynı grubu paylaştığı görülmektedir. İstatistiksel olarak önemli olmamakla beraber koza ağırlığı ve koza kütlü ağırlığı değerlerinde de en yüksek değerler 1 L/da uygulamasından elde edilmiştir.

Sonuç olarak bu çalışmadan elde edilen bir yıllık sonuçlara göre dekara 1 litre kükürt uygulanması durumunda kontrole göre 94 kg/da lık bir verim farkı oluşmuştur. Bir sonraki doz olan 2 L/da uygulamasından da kontrolden daha yüksek verim elde edilmiş, ancak doz arttıkça diğer uygulamaların sonucu kontrol uygulamasının altında kalmıştır.

Tüm bu veriler ışığında pamukta 1 L/da kükürt uygulaması önerilebilir. Ancak daha önce de değinildiği gibi bu tür çalışmaların birden çok yıl ve lokasyonda denemeler yapılarak önerilerde bulunulması daha sağlıklı olabilir.

KAYNAKLAR

- Anonim, 2021a. Bitkisel üretim verileri İstatistikleri. www.tuik.gov.tr. Türkiye İstatistik Kurumu, Ankara. [Erişim Tarihi: 7 Mart 2023].
- Anonim, 2021b. Diyarbakır İli İklim Verileri. T.C. Tarım ve Orman Bakanlığı, Meteoroloji Genel Müdürlüğü Kayıtları.
- Ashmouny, A.A.E., Naqma K.A.E, Hendawy, A.A.E., 2017. Effect of pre-sowing application of nitrogen, potassium and sulfur and its relationship on egyptian cotton productivity, *International Journal of Environment, Agriculture and Biotechnology*, 2 (5), 2387-2393.
- Aulakh, M.S., Sidhu, B.S., Arora, B.R., Singh, B., 1985. Content and uptake of nutrients by pulses and oilseed crops, *Indian Journal of Ecology*, 12 (2), 238-242.
- Basavanneppa, M.A., Ajayakumar, M.Y., Chittapur, B.M., 2016. Response of Bt Cotton (*Gossypium hirsutum*) to foliar nutrition in irrigated ecosystem, *International Journal of Science and Nature*, 7 (2), 262-264.
- Bukarlı, M.N., 2007. Diyarbakır Koşullarında Kükürt Uygulamasının Pamuğun Verim ve Kalite Özelliklerine Etkisi, Yüksek lisans Tezi, *Çukurova Üniversitesi Fen Bilimleri Enstitüsü*, Adana, 90s.
- Candemir, K. D. ve Ödemiş B., 2018. Yapraktan uygulanan farklı kükürt dozlarının pamuk bitkisinin (*Gossypium hirsutum* L.) değişik gelişme dönemlerindeki su stresinin azaltılması üzerine etkileri, *Derim*, 35 (2), 161-172
- Duke, S.H., and Reisenauer, H.M., 1986. Roles and requirements of sulfur in plant nutrition. *In Sulfur in Agriculture*, M.A. Tabatabai (Ed.).
- Faircloth, W.H., Monks, C.D., Patterson, M.G., Wehtje, G.R., Delaney, D.P., Sanders, J. C., 2004, Cotton and weed response to glyphosate applied with sulfur-containing additives, *Weed Technology*, 18 (2), 404 - 411.
- Geng, J., Ma, Q., Chen, J., Zhang, M., Li, C., Yang, Y., Yang, X., Zhang, L., 2016. Effects of polymer coated urea and sülfür fertilization on yield, nitrogen use efficiency and leaf senescence of cotton, *Field Crops Research*, 187, 87-95.
- Gobi, V.R., Sriramachandrasekharan, M.V., Kalaiyarasan, C., 2010. Effect of sulfur fertilization on cotton seed yield and quality grown on clay loam soil deficient in sülfür, *Advances in Plant Sciences*, 23 (1), 335-336.
- Görmüş, Ö., 2014. Cotton yield response to sulfur as influenced by source and rate in the Çukurova region, Turkey, *Süleyman Demirel Üniversitesi Ziraat Fakültesi Dergisi*, 9 (1), 68-76.
- Hearn, A.B., 1981. Cotton nutrition, *Field Crop Abstracts*, 34, 11-34.
- Hue, N.V., Adams, F., Evans, C.E., 1984. Plant available sulphur as measured by soil solution sulphate and phosphate extractable sulphate in an ultisol, *Agronomy Journal*, 76, 726-30.
- İnan, Ö., 1980. Pamuk glandlerinin kimyasal bileşimi, Biyolojik aktivitesi ve genetiği, *Antalya Pamuk Araştırma Enstitüsü Raporları*, 1-15.
- Ibrahim, A.A., 2022. Effect of Soil Salinity Improvers on Cotton Productivity on Land Reclamation, *Egyptian Journal of Agronomy*, 44 (1), 19-31.

- Jamal, A., Moon, Y.S., Abdin M.Z., 2010. Enzyme activity assessment of peanut (*Arachis hypogea*) under slowrelease sulphur fertilization, *Australian Journal of Crop Science*, 4(3),169-174.
- Jie, X., Dong, Q., Li, Z., 2008. Effects of sulfur nutrition on the chlorophyll content of maize leaf under zinc and drought stress, *Agricultural Research in The Arid Areas*, 2, 33-37.
- Lad, H.S., Ramani, H.R., Pansuriya, N.B., 2022. Effect of different level of Sulphur on physiological characters of cotton (*Gossypium hirsutum* L.), *The Pharma Innovation Journal* , 11 (8), 1523-1526.
- Makhdum, M I., Din, S.U., Chaudhry, F.I., 2001. Multinutrient supersulphate - SG100 as a sulphur fertilizer for sustainable cotton production, *International Journal of Agriculture and Biology*, 3 (3), 298-300.
- Makhdum, M.I., Malik, M.N.A., Chaudhry, F.I., Din, S.U., 2001. Effects of Gypsum as a sulfur fertilizer in cotton (*G. hirsutum* L.) production, *International Journal of Agriculture and Biology*, 3 (3), 375–377.
- Makhdum, M.I., ve Malik, M.N.A., 2004. Response of a cotton Cultivar to sulphur fertilization, *Pakistan Journal of Scientific and Industrial Research*, 47 (2), 126-129.
- Messic, D.L., 1992. Soil test interpretation for sulphur in the United States an overview, *Sulphur in Agriculture*, 16, 24-25.
- Parlawar, N.D., Giri, M.D., Raut, R.S., Katkar , R.N., 2018. Response of Bt Cotton (*Gossypium hirsutum* L.) to Sulphur application under rainfed conditions. *Journal of Pharmacognosy and Phytochemistry*, 7(1), 1694-1698.
- Parmar, K.B., Hadiya, T.M., Babariya, N.B., Polara, K.B., 2010. Effect of potassium and sulphur on yield of cotton, *An Asian Journal of Soil Science*, 4 (2), 172-174.
- Scherer, H.W., 2009. Sulfur in soils, *Journal of Plant Nutrition and Soil Science*, 172, 326-335.
- Sharma, S.K., ve Kumawat, P.D., 2005. Production potential of cotton to growth regulators, sulphur fertilization and spacing, *Journal of Cotton Research and Development*, 19(2), 218-219.
- Tiwari, K.N., Tiwari, A., Sharma, H.L., Dagur, B.S., 1997. Soil sulphur status and crop response to sulphur application in Uttar Pardesh, India. *Sulphur in Agriculture*, 20, 60-70.
- Yin, X.H., Gwathmey, C.O., Main, C.L., 2011. Effects of Sulfur Application Rates and Foliar Zinc Fertilization on Cotton Lint Yields and Quality, *Agronomy Journal*, 103, 1794-1803.
- Yin X.H., Gwathmey, C.O., Main, C.L., 2012. Sulphur effects on cotton yield components. *Better Crops*, 96 (1), 27-28.

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ABSTRACT

The number of people who started a new life by joining the migration movement to live in another country other than their own with the desire and expectation of living a better life has been increasing remarkably in recent years. Migration in the 21st century is not a choice but a necessity. In other words, migration refers to displacement or displacement. The number of newcomers to the migration movement has increased significantly in recent years to live in the country they live in another country with the desire and hope of a better life. In the 21st century, migration has become a necessity rather than a choice. In other words, refugee means moving or relocating. The interdependence of migration and tourism has received little attention and is almost nonexistent in the academic literature. As migration continues to affect many communities, traditional forms of tourism, classified as leisure, business, and visiting friends and relatives for travel purposes, are becoming increasingly obsolete. Tourism experiences are often much more prosperous now, and tourists experience significant socio-economic exchanges with local communities. However, the tourism and immigration relationship can be more complex, among others, depending on the structures of the host society and the emerging trade patterns between the host country and the immigrant's country of origin. In this context, the study's primary purpose is to reveal the relationship between tourism and refugees, investigate the effect of refugee groups on the country's tourism, and investigate and evaluate previous studies in the literature on this and similar issues.

Keywords: Tourism, Refugees, Refugee crisis.

MÜLTECİLER VE TURİZM

ÖZET

Daha güzel bir yaşam sürdürme isteği ve beklentisiyle kendi ülkeleri dışında başka bir ülkede yaşamak üzere göç hareketine katılarak yeni bir hayata başlayan insanların sayısı son yıllarda dikkat çekici biçimde artmaktadır. 21. yüzyılda gerçekleşen göçler, bir tercih değil zorunluluk şeklinde ortaya çıkmaktadır. Başka bir ifadeyle göç, yerinden olmaya veya edilmeye karşılık gelmektedir. Yaşadığı ülkede başka bir ülkeye daha iyi bir yaşam arzusu ve umuduyla yaşamak için göç hareketine yeni katılanların sayısı son yıllarda önemli ölçüde artmaktadır. 21. Yüzyılda göç bir tercih halinden çıkarak zorunluluk halini almıştır. Başka bir deyişle mültecilik, taşınmak veya yer değiştirmek anlamına gelmektedir. Göç ve turizmin karşılıklı bağımlılığı, akademik literatürde tartışmalı bir şekilde çok az ilgi görmüştür ve neredeyse hiç rastlanmamaktadır. Göç, birçok topluluğu etkilemeye devam ettikçe, seyahat amaçlarının eğlence, iş ve arkadaş ve akraba ziyareti şeklinde geleneksel sınıflandırılmış turizm türleri giderek eskimiş hale gelmektedir. Turizm deneyimleri artık genellikle geçmişte olduğundan çok daha zengindir ve turistler yerel topluluklarla önemli sosyo-ekonomik değişimler yaşamaktadırlar. Bununla birlikte, turizm ve göçmenlik ilişkisi, ev sahibi toplumun yapılarına ve ev sahibi ülke ile göçmen kaynaklı ülke arasında ortaya çıkan ticaret modellerine bağlı olarak diğerlerinin yanı sıra daha karmaşık olabilmektedir. Bu bağlamda yapılmış olan çalışmanın temel amacı, Turizmle ve mülteciler arasındaki ilişkinin ortaya çıkarılması, mülteci gruplarının ülke turizmine etkisinin araştırılması ve ayrıca olarak bu ve benzeri konularda literatürde daha önceden yapılan çalışmaların araştırılarak değerlendirilmesidir.

Anahtar Kelimeler: Turizm, Mülteciler, Mülteci krizi

Introduction

In the last few years, geopolitical and economic changes have become potential causes of the increased flow of migrants and refugees to Western countries. According to many authors, refugees have fled their country due to armed conflict or persecution. The situation in their country is so dangerous that they often cross national borders and seek asylum for a safe life. On the other hand, immigrants mainly prefer to act to improve their lives by seeking employment and better living conditions. Immigrants are exempt from this restriction, unlike refugees who cannot return safely to their country of origin. The reasons behind migration include desperate economic and political situations, hunger, genocide, and ethnic and religious persecution in countries of origin. However, although most people go to countries with sound economics and living standards for work and reliable life, there are notable differences between the two. However, nationals do not distinguish between refugees and non-refugees. First, the refugee flow is typically a concerted movement of individuals fleeing en masse from persecution in their home country. Economic migrants, on the other hand, are individuals who take turns seeking better conditions of economic security and employability. This predominant refugee flow stems from poor economies, but the same may be different for immigrants.

From a mobility perspective, the complexity of modern societies is neither anarchic nor perfectly ordered. Wars and natural disasters can trigger systematic change and produce high population mobility. This situation may then result in a parallel exchange of cultures and lives. Contemporary social systems are so tightly interconnected that any logistical effort to separate groups such as migrants and refugees breaks down in the face of unpredictable formations. In addition, tourism and migration become intertwined as tourists turn themselves into immigrants while looking for a job in a destination country, ultimately creating a tourism-migration continuum.

Turkey has been a transit country for international migration for centuries due to its geographical and strategic location. The most important international migration towards Turkey resulted from the Syrian civil war, which began in Tunisia in 2010 as a continuation of the "Arab Spring." With the influence of the Arab Spring, the conflicts in Syria have created a general atmosphere of insecurity and unrest. Syrians have started to migrate to neighboring countries, especially Turkey, to save their lives. Turkey has responded to the Syrian migration process with an "open door" policy and accepted Syrian refugees into the country. As a result of the civil war, eleven million people have become needy to maintain their desire to live, and

about seven million people have been forced to flee Syria. Turkey has become one of the largest recipients of Syrian refugees in this context.

The migration of Syrians to Turkey started with the first mass popular movement on April 29, 2011. 252 Syrian citizens, who entered Turkey through the Chilvegözü border gate in the Yayladağı district of Hatay, formed the first refugee community and settled in Hatay for temporary residence. The Syrians, who initially saw Turkey as a bridge to Europe, eventually saw Turkey as a region where they could settle. The United Nations High Commissioner for Refugees used the expression "the largest migration wave in recent history" regarding this migration. As of May 1, 2023, the number of Syrians under temporary protection in Turkey is 3,410,410. These figures belong to registered Syrian refugees. Istanbul ranks first among Turkish provinces regarding the number of Syrian refugees (www.multeciler.org.tr).

As of August 2021, after the Taliban group took over the administration in Afghanistan, thousands of people fleeing the Taliban administration became refugees. Most of these refugees passed through Iran and took refuge in Turkey illegally. In order to prevent the migrant flow experienced, the Republic of Turkey has established barriers along the border, and it has been tried to prevent the created migrant flow. After the Russia-Ukraine war that started in March 2022, like many European countries, Turkey has become one of the countries where Ukrainian refugees take temporary shelter. Ukrainian refugees mostly take shelter in Turkey's Mediterranean, Aegean, and Marmara regions.

In light of the arguments, as mentioned earlier, it can be clearly stated that the Arab Spring and its aftermath had a visual impact on Turkey in many ways. However, especially tourism activities seem to be victims of this process. Additionally, as implied, the core of the Turkish tourism industry is the future threats of the Arab Spring. In this context, since Turkey has a direct border with Syria, the most critical threat originates from Syria. For this reason, developments in Syria directly threaten Turkey's economic, social, and tourism organizations. The Arab Spring triggered many economic, social, security, and political problems in Turkey. However, the refugee crisis is the most critical threat in this process. Therefore, while the refugee crisis creates permanent social, economic, cultural, demographic, and political problems, other conflicts temporarily affect neighboring countries regarding economy and security.

1. Literature Review

Williams and Hall (2000: 23) discussed the characteristics of return migration, labor migration, retirement migration, entrepreneurial migration, and second home and emphasized

that this study should include research on the relationship between tourism and refugeeism in broader social science discussions. The theoretical and methodological relations between refugees and tourism are examined. As a result, it has been determined that there is a link between people's lives, migration routes, and travel. Also, how many refugees take advantage of the gaps in the creation of tourism activities and the role of the government in this regard; He stated that there is a link between tourism and migration in the distribution and interaction of both tourism activities and the economic, cultural and environmental effects of tourism-related refugee migration, and in the creation of spatial and personal images.

Akgündüz et al. (2015: 18) analyzed the changes in housing prices, food prices, and employment rates in 10 cities under intense Syrian protection using the remaining 71 cities as control variables. After the research, it was concluded that real estate prices increased in these provinces due to Syrian migration; there was no significant change in food prices or employment.

Cengiz (2015:119) has examined how the migration caused by the war and the political crisis in Syria affects the city of Kilis in his study titled " Spatial Effects of Forced Migration and Perceptions of Local People: The Case of Kilis." In addition, to understand the attitudes of the local population towards migration and immigrants, it has also been aimed to determine how these migrations shape the city in a spatial sense. The attitudes of the local population towards immigrants and the cultural interactions following these effects were determined by considering the spatial effects of immigrants coming to Kilis. e changes in housing prices, food prices, and employment rates in 10 cities under intense Syrian protection using the remaining 71 cities as control variables. After the research, it was concluded that real estate prices increased in these provinces due to Syrian migration; there was no significant change in food prices or employment.

In his research, Harunoğulları (2016:394) examined the spatial and cultural adaptation of Syrian immigrants living in Kilis, the creation of space, and the effects of these immigrants on the economic and cultural structure of the city. Within the scope of the research, 140 Syrian migrants residing in some city neighborhoods were subjected to various data harvesting techniques. In this study, the researcher aims to highlight the differences and difficulties by evaluating the impact of refugee migration on the city from a social, spatial, cultural, and economic perspective.

Timcak et al. (2016:714) examined the possible Decoupling between tourism-related processes and the influx of Syrian refugees to the EU. He used a survey technique to analyze

the impact of immigration on expectations and the preliminary assessment of potential tourism customers. As a result, it has been found that migration harms traditional tourism and tends to reduce investment in migrant tourism infrastructure and create new services related to migrant tourism. Migration has also increased interest in some types of tourism, such as volunteering, dark tourism, and war tourism. On the other hand, they found that tourist interest decreased in the regions where migration occurred or was affected.

Provenzano (2020: 1388) examined the relationship between tourism and migration by choosing complex network analysis and attraction models in EU countries between 2000 and 2015. For each academic year, it has been tried to link the tourist flow with migration. As a result of the correlation analyses, it was found that tourism and migration networks have a very similar topological structure, as well as a significant and direct interaction between tourism and migration movements in the European Union. On the other hand, an indirect causality relationship has yet to be determined in the relationship between tourism and migration.

Pappas and Papathéodorou (2017:38) aimed to reveal the impact of the 2015-2016 refugee crisis on tourism from Syria, Afghanistan, and Iraq to Greece. In this direction, the effect of Greece on perception and the expected reaction of tourists were examined. At the same time, how refugees are viewed regarding security and culture, the relationship between refugees and host communities, and the choices made by the Greek tourism accommodation sector in the face of the crisis have been analyzed. This article applied the survey technique of 811 tourist accommodation managers in the country using fuzzy cluster-qualitative comparative analysis. The results showed that the participants' choices were decoupled into three groups, which explained the refugee orientation, the emphasis on the relationship between the visitor and the local community, and the impact of host communities on tourism behavior.

Pappas and Papathéodorou, Musaro, and Moralli (2019:168) stated in their study that tourism and migration are two sides of the same coin in a world where the free movement has become an essential element of social stratification, and there are usually events associated with contrasting and contradictory images, stereotypes and emotions. By highlighting the economic benefits of immigrants, asylum seekers, and tourists, he emphasizes how people who have become public property can create alternative stories about migration and tourism. He has analyzed how alternative narratives related to migration and tourism are adopted, reconstructed, and implemented. Orou (2017:38) aimed to reveal the impact of the 2015-2016 refugee crisis on tourism from Syria, Afghanistan, and Iraq to Greece. In this direction, the effect of Greece on perception and the expected reaction of tourists were examined. At the same time, how

refugees are viewed regarding security and culture, the relationship between refugees and host communities, and the choices made by the Greek tourism accommodation sector in the face of the crisis have been analyzed. This article applied the survey technique of 811 tourist accommodation managers in the country using fuzzy cluster-qualitative comparative analysis. The results showed that the participants' choices were decoupled into three groups, which explained the refugee orientation, the emphasis on the relationship between the visitor and the local community, and the impact of host communities on tourism behavior.

Gümüş (2018: 78) tried to identify the problems faced by Syrian citizens who settled in Gaziantep with the survey application in his master's thesis on "Socio-Economic and Cultural Reflections of Migration from Syria to Turkey (Gaziantep Example)." In addition, in the second stage of the research, interviews were conducted with the local people of Gaziantep. The problems of the Syrian refugees and local people were determined, and solutions were offered.

Santos et al. (2019: 16) used the example of Portugal to examine whether immigrant expectations and perceptions lead to participatory planning to promote sustainable tourism and rural development. After the survey technique was applied to 5157 Portuguese immigrant individuals, it was determined that the immigrants who are young in the field of tourism in the country and who own a house in the countryside are more likely to invest in their tendency to return and find a job. At the same time, it has been revealed that these immigrants have more education and work experience in this field. Similarly, given the experiences and migration characteristics of these immigrants, it is assumed, using the example of Portugal, that the return of immigrants from southern European countries will stimulate tourism in the rural areas of these countries.

2. The Concept of Refugees and Immigration

Migration is a term as Decepreit as human history, defined as the voluntary or compulsory migration of people from one region to another individually or collectively for economic, social, cultural, political, and military reasons, among the leading natural or human factors. Millions worldwide have suffered from conflicts, natural disasters, persecution, violence, or human rights violations. These events force people to move away from home and take refuge in other countries. Asylum seekers and refugees, evaluated in the category of forced migration, are events that force people to leave their countries due to the pressures they are subjected to for various reasons. Refugees and asylum seekers who have left their home countries have various reasons that trigger them to face this situation. We can cite these as

threats to human life and freedom, judicial prosecution, misery, poverty, war, internal turmoil, and natural disasters as examples (Ergül, 2012:219).

Although "refugee" and "asylum seeker" are used interchangeably in the relevant literature, they are different concepts. The term "refugee" used in international law is translated into Turkish as "refugee," and the term "asylum seeker" is translated as "refugee" (Özdemir, 2017:119).

An asylum seeker has escaped from persecution in his country to ensure his safety or can prove that he has a justified fear of being persecuted. An asylum seeker is a person who has left his country for various reasons and whose asylum request is still under investigation by the country authorities from which he fled/ took refuge; that is, he has not been able to gain refugee status. The person applying for asylum is an asylum seeker until a decision is made. Asylum seekers cannot benefit from the laws of the country they take refuge in, like refugees (Salur, 2018:35).

Let us look at the definition of the legal meaning of the refugee concept. It is seen that the essential definition is in the second paragraph of Article 1A of the 1951 Geneva Convention. He defined the concept of refugee as follows; "A person who is outside his country of origin and is unable or unwilling to benefit from the protection of that country because of fear of persecution on account of his race, religion, nationality, origin or political opinion, is outside the country of residence due to such events, is unable or unwilling to return. Turkey only recognizes the refugee status of those who come to Turkey from European countries. Status of refugees coming to Turkey from other regions outside of Europe not recognized as a refugee. Due to its geographical location, Turkey has been under severe pressure to lift restrictions, especially recently. However, Turkey does not resist this stance (Magba, 2017: 11).

Geographers have defined all kinds of movements and flow due to human activities as spatial interaction. At the same time, it is also important not to think independently of the places and people who are the most influential actors in the world. Because this is the place where people interact and share. Spatial perception; therefore, the perception of space needs to be more complex to be explained either by the mind alone or by the impressions we receive from the environment. On the contrary, historical, social, conceptual, cognitive, and biological processes together constitute the perception of space (Cengiz, 2015:107). Lefebvre (1991) conceptualized space as a dialectical social production process and stated that space is produced dialectically through three fundamental or formative points: perceived, imagined, and

experienced. Within the geography of behavior, the perception of space is seen as deciphering the parts of mental maps between people in various ways (Cengiz, 2015:107).

Displacement; This is usually the forced removal of a person from his homeland or country due to an armed conflict or natural disaster and sending him to other regions (Çiçekli, 2009: 66).

An immigrant is generally defined as a person who leaves his or her country to settle or work and moves to another country or anywhere in his or her country. The concept of the migrant is mainly realized voluntarily in the hope of “improving living conditions,” and the request for this specific preparatory process is formalized as an immigration decision (Cengiz, 2015:107). Asylum seekers; are the people who want to be accepted as a refugee in the country based on the relevant national or international documents and are waiting for the result of their refugee status application (Çiçekli, 2009: 49).

3. Refugees in the World and in Turkey

The “Winds of Democracy” that began on December 18, 2010, when a Tunisian marketing graduate burned himself to death in protest at confiscating the stand, dealt a heavy blow to Syria and cost people dearly. Due to the impact of civil war, poverty, terrorism, and political repression, many people, especially in Europe, fled the country and set out for the Mediterranean Sea in danger of death (Akdoğan and Sarioğlu., 2017: 147).

Syria's uprising against the regime, which started with the "Arab Spring" in 2011, became a conflict. In recent years, the problems caused by the conflict in Syria have become one of the most critical issues of the international media. The uprising against the regime 2011 increased its violence and caused many problems, especially the refugee crisis. As a result, almost all countries worldwide are affected by migration. Especially in the second half of the 20th century, intense population movements were observed. More than 175 million people have been forced to emigrate in the last 50 years. According to the United Nations (UN) Global Migration Data 2013, 232 million people, or 3.2% of the world's population, are immigrants (Sürme, 2019: 6).

Regarding refugee mobility, Turkey is one of the countries exposed to very intensive migration. Due to the escalation of the humanitarian crisis in Syria, the movement of 300-400 Syrian citizens to the Chilvegözü border crossing in the Yayladağı region of Hatay on April 29, 2011, was the first step in the mass migration of people from Syria to Turkey. Since April 2011, Turkey has faced a sudden influx of people forced to flee Syria. Given the seriousness of the situation in Syria and the lack of conditions for refugees to return safely to their home countries,

eligible refugees are provided with temporary protection without preconditions. According to the Directorate of Migration Department of the Ministry of Interior, as of May 23, 2019, there were 3 million 608 thousand 49 Syrian refugees in Turkey. Most of these refugees, about 435,087, settle in Gaziantep (Sürme, 2019:6). Gaziantep is one of the provinces where Syrians are concentrated. Overall, when Turkey is considered, Gaziantep is the third city with the highest number of Syrian refugees after Istanbul and Şanlıurfa. Syrians prefer Gaziantep because it is a neighboring city, and its economic potential is high (Sürme, 2019: 7).

4. Refugees and Tourism

In recent years, the international bibliography has paid increasing attention to the relationship between migration and tourism, analyzing migration's positive and negative effects on a destination's tourism development. Tourism watchers fall into two opposing groups, as research on tourism and migration shows. On the one hand, it is thought that migration and tourism deter and destroy the cultural integrity and environmental wealth of the host society; on the other hand, both tourism and migration show significant economic benefits (Tsartas et al., 2019: 2).

According to the World Tourism Organization, refugees and migration contribute to the target countries to enrich societies culturally, develop the tourism product and create significant social and economic results by providing a workforce in the travel, tourism, accommodation, and tourism sectors. However, some adverse effects, such as decreased tax revenues in the countries of origin, wage deflation in the host countries, and social upheavals, have also been observed in this relationship. The tourist beaches of the Canary Islands have faced a negative impact due to the constant flow of migrants from Africa. More recently, the increasing refugee flows towards Europe have negatively affected tourists' choice of tourism destinations among Mediterranean countries, especially since tourists in the Mediterranean meet with refugees and migrants who decamp to coastal areas during their holidays (www.theguardian.com).

The impact on the countries or regions that offer asylum to refugees is becoming significant. While refugees were a temporary phenomenon in every region in the past, today, millions of refugees have been displaced for extended periods. By living in camps, these refugees are promised a stable future, and depending on the region's resources, they cause changes in both civilizations. Migration creates negative stereotypes and prejudices, especially regarding cultural differences and ethnic minority groups that offer a different lifestyle from the local population. The flow of refugees also harms tourist activity. For example, when refugees settle in tourist areas, the social dynamics can differ. Despite any initial expressions

of humanitarianism, the local community may eventually become uncomfortable and aggressive due to the fear of losing tourism jobs and income due to the hostile environment. The apparent presence of many refugees in a tourist destination can negatively affect the attitudes and behaviors of tourists, as well as the perceived security and image of the destination (Ivanov and Stavrinoudis, 2018:216).

"Stranger" highlights the need for an inclusive understanding of "refugees" with regard to tourism, which has the potential to promote tolerance and openness in increasingly complex and unwelcome societies. Anchoring these debates in the literature on tourism and marginalized communities, it can be emphasized that such groups tend to be "exploited" for their cultural capital, used to promote an area and provide various visitor experiences, but often not directly benefit. Although tourism is seen as an interpretative tool of "othering," the importance of encouraging migrants and refugees to interpret and use their cultural heritage through tourism experiences is emphasized. Tourism can promote "participatory cultural self-expression," which means supporting the inclusion of refugees by helping to develop mutual understanding between refugees and the community that receives them. Encounters between different cultures create hybrid spaces that can become centers of cultural production and "emerging belonging" for marginalized people (Burrai et al., 2022: 5).

In order to harmoniously integrate the different cultural identities of refugees, it is vital to consider their intangible aspects, such as their traditions and the cultural heritage they carry with them from their place of origin. These forcibly displaced migrants in the tourism and accommodation sectors can become an integrative part of their host societies rather than suffering further from socio-cultural exclusion. Indeed, it is argued that immigrants and such marginalized groups should be included in the production and consumption of tourism to create more inclusive and fair tourism. Inclusiveness requires self-representation, challenges pervasive power relationships, involves a broader range of people in decision-making, and provides opportunities to include new places on tourism maps. The inclusiveness of those who are decried as "foreigners" also means learning from different cultures and meaningful exchanges between hosts and guests. However, the inclusion/exclusion of immigrants or "foreigners" in tourism takes place differently, depending on the scale considered. This means that those with an immigrant background on a macro scale (i.e., at the national level) are more likely to face exclusion and hostility. At the same time, inclusive (bottom-up, grassroots) practices are more likely at a micro level (i.e., local or regional) (Burrai et al., 2022: 6).

In contemporary Western European societies, migrants are often subjected to exclusionary and repressive practices that dominate public discourse about migration. In order to solve the difficulties of forcibly displaced people, the concept of "unfamiliarity" should be a helpful term. A postmodern explanation of how political and socio-cultural changes in Western European societies have influenced "the foreigner to begin to symbolize the ambiguity that the will of the order of modernity is trying to suppress" is presented. A refugee can never be an insider in the host country, and there will always be people responsible for disrupting the system of social order they have entered. It is suggested that the relationship between "us and them" is socially constructed based on a form of collective identity (Pietsch and Marotta Dec, 2009:188).

7. Conclusion

Today, civil wars and terrorist incidents, especially in Muslim countries, have brought the refugee problem to the agenda. However, since it is known that a refugee is not under the protection of his own country as a migrant, he may be exposed to various human rights violations. On the other hand, this situation includes legal problems and economic opportunities and problems that arise due to various social, political, health, education, tourism, population and settlement, harmonization of refugees, and regulation of their legal status. In this context, according to the 2017 Global Threats Report published by the World Economic Forum, in 2016, risk took first place for the first time in the list of possible global risks, followed by large-scale unintentional migration, which was the second threat. In parallel, according to the Global Trends 2015 report prepared by the United Nations High Commissioner for Refugees (UNHCR), at the end of 2015, the number of people forcibly displaced worldwide due to violence, conflict, and human rights violations reached 65.3 billion. Of this number, 21.3 million are refugees, 40.8 million are internally displaced, and 3.2 million are asylum seekers. According to the data from the end of 2015, among the 2,754,540 people who came to Turkey, 2,541,352 were refugees, and 212,408 sought asylum.

Turkey is a country that accepts or deals with refugees who have been displaced or forced to migrate for many years due to political crises or wars. It will remain so in the future as well. However, reflecting on this in the next step sometimes leads to irreversible situations. Turkey often faces socio-economic problems due to incidents near a migration stop or transit road/bridge in the west. Faced with these developments, people living in rural areas react differently to these problems. Therefore, Turkey must address current or future migration flows as soon as possible. In this context, it is necessary to create ways /perspectives that can direct

these migration flows and discuss migration problems and solutions with other developed countries such as Turkey.

Undoubtedly, every migration movement brings with it socio-cultural and economic interactions and exchanges. Frequent migrations, for whatever reason, leave painful histories behind. This migration movement may be a hope for immigrants or a door to a new life. However, behind this door, the immigrant sometimes has to face many painful truths about his region. Sometimes it also allows you to achieve the life you hoped for. This situation is closely related to the immigration and anti-immigration policies of the target country and the economic development of the country.

Foreigners who discover Turkey and get to know it as tourists mainly migrate to the Aegean and Mediterranean coastal regions. In Turkey, foreigners mainly live in Istanbul, followed by Ankara and Antalya. The reasons why foreigners come to the capital Istanbul and the capital Ankara, the duration of their stay, and the type of accommodation differ from the migrants who come to the tourist city Antalya. Antalya is one of the most exemplary regions of the world, which is mainly preferred by elderly pensioners who migrate from North America to South America or from Northern European countries to the Southern European coasts during such holidays. Foreigners who come to these regions temporarily or permanently settle as second homeowners or rent a house for rest here. Short-term stays become permanent settlements after a certain period and become an international migration movement. Even a type of migration has emerged that has changed Turkey's position in international migration. Especially with the accession process to the European Union and the changes in the rules for foreigners to acquire property, it has become a host country for migration from developed countries. It has started to change its position as a migrant or transit country.

REFERENCES

- Akdoğan, M., & Sağıroğlu, C. (2017). İtalya ve Suriyeli Mülteciler: Avrupa'nın Zorlu Sınavı. *Ekonomi, Politika ve Finans Araştırmaları Dergisi*, 2(2), 146-161.
- Akgündüz, Y. E., Van Den Berg, M., & Hassink, W. (2015). The Impact of Refugee Crises on Host Labor Markets: The Case of the Syrian Refugee Crisis in Turkey. *Iza Discussion Paper No. 8841*.
- Burrai, E., Buda, D.-M., & Stevenson, E. (2022). Tourism and Refugee-Crisis Intersections: Co-Creating Tour Guide Experiences In Leeds, England. *Journal of Sustainable Tourism*, 1-18.
- Cengiz, D. (2015). Zorunlu Göçün Mekânsal Etkileri ve Yerel Halkın Algılar: Kilis Örneği. *Electronic Turkish Studies*, 10(2), 102-122.
- Çiçekli, B. (2009). Göç Terimleri Sözlüğü. *Cenevre, İsviçre: Uluslararası Göç Örgütü (IOM)*, 18.
- Ergül, E. (2012). Uluslararası Hukuk Ve Türk Mevzuatında Yabancı Kavramı ve Türleri. *Türk İdare Dergisi*, 213-228.
- Gümüş, A. K. (2018). *Suriye'den Türkiye'ye Göçün Sosyo-Ekonomik ve Kültürel Yansımaları (Gaziantep Örneği)*. Niğde: Niğde Ömer Halisdemir Üniversitesi.
- Harunoğulları, M. (2016). Suriyeli Sığınmacıların Kilis Şehrindeki Mekânsal, Kültürel ve Ekonomik Etkileri. *Uluslararası Sosyal Araştırmalar*, 9(45), 373-396.
- Ivanov, S., & Stavrinoudis, T. (2018). Impacts Of The Refugee Crisis On The Hotel Industry: Evidence From Four Greek Islands. *Tourism Management*, 67, 214-223.
- Lardies, R. (1999). Migration and Tourism Entrepreneurship: North-European Immigrants in Cataluña and Languedoc. *International Journal of Population Geography*, 5(6), 477-491.
- Leitao, N. C., & Shahbaz, M. (2012). Migration and Tourism Demand. *Theoretical and Applied Economics*, 39-48.
- Lundmark, L. (2006). Mobility, Migration And Seasonal Tourism Employment: Evidence From Swedish Mountain Municipalities. *Scandinavian Journal of Hospitality and Tourism*, 6(3), 197-213.
- Magba, M. H. (2017). *Avrupa Dışındaki Ülkelerden Gelen Mültecilerin Türk Hukukunda Sığınma Başvurularına İlişkin Usul ve Sonuçları*. Ankara: Gazi Üniversitesi Sosyal Bilimler Enstitüsü.
- Musarò, P., & Moralli, M. (2019). De-Bordering Narratives on Tourism and Migration. A Participatory Action-Research on Two Innovative Italian Practices. *Italian Journal of Sociology of Education*, 11(2), 147-173.
- O'Reilly, K. (2003). When is a tourist? The articulation of tourism and migration in Spain's Costa del Sol. *Tourist Studies*, 3(3), 301-317.
- Özdemir, E. (2017). Suriyeli Mülteciler Krizinin Türkiye'ye Etkileri. *Uluslararası Kriz ve Siyaset Araştırmaları Dergisi*, 1(3), 114-140.
- Pappas, N., & Papatheodorou, A. (2017). Tourism and The Refugee Crisis In Greece: Perceptions And Decision-Making Of Accommodation Providers. *Tourism Management*, 63, 31-41.
- Pietsch, J., & Marotta, V. (2009). Bauman, Strangerhood and Attitudes Towards Immigrants Among The Australian Population. *Journal of Sociology*(45), 187-200.
- Provenzano, D. (2020). The Migration-Tourism Nexus In The EU28. *Tourism Economics*, 26(8), 1374-1393.
- Salur, M. (2018). *Eğitim Ve İlahiyat Fakültesi Öğrencilerinin Perspektifinden Göç Ve Mülteci Meselesi*. Malatya: İnönü Üniversitesi Eğitim Bilimleri.
- Santos, R., Castanho, R. A., & Lousada, S. (2019). Return Migration and Tourism Sustainability in Portugal: Extracting Opportunities for Sustainable Common Planning In Southern Europe. *Sustainability*, 11(22).
- Sürme, M. (2019). *Destinasyonlarda Mültecilere Yönelik Algıların Destinasyona Yönelik Kişilik, İmaj, Tutum, Memnuniyet ve Davranışsal Niyete Etkisi*. Gaziantep: Gaziantep Üniversitesi Sosyal Bilimler Enstitüsü.
- Timcak, G., Jablonská, J., & Ondrejová, B. (2016). Migration and Tourism. *Journal of Environmental Management & Tourism*, 7(4), 706-716.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Tsartas, P., Kyriakaki, A., Stavrinoudis, T., Despotaki, G., Doumi, M., Sarantakou, E., (2019). Refugees and tourism: a case study from the islands of Chios and Lesbos, Greece. *Current Issues in Tourism*, 1-17.

Williams, A. M., & Hall, M. C. (2000). Tourism and Migration: New Relationships Between Production and Consumption. *Tourism Geographies*, 2(1), 5-27.

<https://www.theguardian.com/world/2015/jul/03/mediterranean-crisis-tunisia-greece-france-italy-migration-tourists-summer-holiday>. (E.T. 21.06.2022).

<https://multeciler.org.tr/turkiyedeki-suriyeli-sayisi/> (E.T. 01.05.2023)

**TOURISM SECTOR IN THE PROCESS OF ADAPTATION TO THE EUROPEAN
GREEN DEAL**

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ABSTRACT

Human beings have lived by consuming the resources offered by the world more and faster with each passing time since the first day of existence. In particular, the dimensions of consumption that emerged after the industrial revolution have been much higher than the world's self-renewal rate. The enormous difference between human consumption and nature's self-renewal rate has revealed critical environmental problems. Although these environmental problems were initially evaluated as belonging to a regional and specific country, they have been recognized to have harmed all humanity over the years. After this acceptance, national, international, and global applications have been implemented. The European Green Deal action plan, one of these practices, aims to reduce environmental pollution by restoring ecological diversity while ensuring more efficient use of resources in a circular and clean economy. Some elements should be implemented in tourism activities and accommodation businesses within the European Green Deal framework. In the transportation sector, the most critical part of the tourism industry and where carbon emissions occur in the highest amounts, basic strategies such as reducing transportation by plane and vehicle as much as possible and developing applications with higher energy efficiency in accommodation enterprises are targeted. According to the European Green Deal criteria, tourism enterprises should have a long-term management system based on continuous improvement in a context appropriate for their size and scope and addressing the environment, sociology, culture, economy, health, and safety issues. This study offers suggestions to the tourism sector stakeholders, especially the tourism enterprises in Turkey, on what they should implement in the harmonization process within the scope of the Green Deal.

Keywords: European Green Deal, Tourism sector, Sustainability, Carbon footprint

AVRUPA YEŞİL MUTABAKATI'NA UYUM SÜRECİNDE TURİZM SEKTÖRÜ

ÖZET

İnsanoğlu var olduğu ilk günden bugüne kadar dünyanın sunmuş olduğu kaynakları her geçen zamanda daha fazla ve hızlı bir şekilde tüketerek yaşamını sürdürmüştür. Bilhassa sanayi devriminden sonra ortaya çıkan tüketimin boyutları dünyanın kendini yenileme hızının çok üzerinde olmuştur. İnsanoğlunun tüketimi ile doğanın kendini yenileme hızı arasındaki muazzam fark önemli çevre sorunlarını ortaya çıkarmıştır. Bu çevre sorunları ilk zamanlarda bölgesel ve belirli bir ülkeye ait gibi değerlendirilse de yıllar geçtikçe bu sorunların tüm insanlığı olumsuz etkilediği kabul edilmiştir. Bu kabul sonrasında ulusal, uluslararası ve küresel çapta uygulamalar hayata geçirilmiştir. Bu uygulamalardan birisi olan Avrupa Yeşil Mutabakatı eylem planında döngüsel ve temiz bir ekonomide kaynakların daha verimli kullanımı sağlanırken ekolojik çeşitliliğin de eski hâline getirilerek çevre kirliliğini azaltma hedefleri yer almaktadır. Avrupa Yeşil Mutabakatı çerçevesinde turizm faaliyetlerinde ve konaklama işletmelerinde uygulanması gereken bazı unsurlar bulunmaktadır. Turizm endüstrisinin en önemli ve karbon salınımının en yüksek miktarlarda gerçekleştiği bölümü olan ulaşım sektöründe uçak ve araç ile ulaşımı mümkün olduğunca azaltma, konaklama işletmelerinde enerji verimliliği daha yüksek uygulamalar geliştirme gibi temel stratejileri hedeflenmektedir. Avrupa Yeşil mutabakatı kriterlerine göre, turizm işletmelerinin büyüklüklerine ve kapsamlarına uygun, çevre, sosyoloji, kültür, ekonomi, sağlık ve güvenlik konularını ele alan bir kapsamda ve sürekli iyileştirme temelli uzun vadeli bir yönetim sistemine sahip olmaları gerekmektedir. Bu çalışmanın amacı başta Türkiye'deki turizm işletmeleri olmak üzere, turizm sektörü paydaşlarına yeşil mutabakat kapsamındaki uyumlaşma sürecinde uygulamaları gereken konusunda öneriler sunmaktır.

Anahtar Kelimeler: Avrupa Yeşil Mutabakatı, Turizm sektörü, Sürdürülebilirlik, Karbon ayakizi

Introduction

Climate change, which is the world's biggest problem today, has emerged due to the unconscious use and consumption of natural resources and our world. With the increasing population after the Second World War and especially after the industrial revolution, everyone, male and female, they have entered a busy working life. In parallel, obtaining the right to weekly and annual holidays and social rights, such as remuneration for work done outside of eight hours per day, have strengthened economically and revealed the need for individuals to take holidays. In this context, people's trips and travels in masses have increased, and natural resources have been used unconsciously. In the 1980s, with the emergence of the ozone layer depletion issue, many ecological problems emerged.

The extreme warming caused by global climate changes and the melting of ice masses in the north of the earth has brought many disasters, including floods, an excessive rise in ocean water levels, excessive rains, tornadoes, drought, and famine. With the acceleration of industrialization and technological advances globally, energy consumption has become excessive. As a result of increasing tourism activity, the excessive use of cars and motorcycles, especially airplanes, has increased carbon gas emissions, especially in the transportation part of the tourism sector. A security threat has emerged for our planet, as factors such as the transition rate to non-recyclable disposable applications and their high preference by people triggered the global climate crisis.

The European Commission implemented the "European Green Deal" in Jul 2019, intending to create a more livable, healthy world by acting under the roof of sustainability and creating a clean, healthy, and reliable planet where ecological balance can be achieved by passing this on to future generations. The "European Green Deal" which aims to reduce carbon to zero by 2050, to prevent excessive energy consumption, or, in other words, to adopt a carbon-neutral approach, also aims to make significant and major positive transformations in the economy and industry.

1. The Effects of Tourism on the Environment

It is stated that tourism, one of the most important driving forces of economic prosperity at the global level, is associated with many areas of the economy, such as accommodation services, transportation services, communication, trade, souvenir production and sale, medical services, agricultural activities, food and beverage services and has the characteristics of supporting the development of these areas. Tourism is one of the most critical industries that ensure the increase of a country's economic and social well-being (Voronkova, 2021: 366).

While the World Tourism Organization expects tourist arrivals to reach 1.8 billion people by 2030, it expresses the importance of keeping the tourism sector, which is developing very rapidly, away from the unconscious use of natural resources (UNWTO, 2022a).

The tourism sector, the world's largest and one of the most influential sectors in economic development, is directly related to the environment in terms of the capital on which it is based. For this reason, the environment and environmental quality, including natural, historical, and cultural elements, are the most important factors affecting tourism. While the extent of the environmental quality of a destination is practical on the tourism demand for that destination, it also shapes the region's tourism development (Wang, 2018: 824). Along with being one of the largest and priority industries that make up the world economy, tourism provides positive benefits to support economic development and ensure social well-being in underdeveloped to developed countries. Although it has such a positive impact, lack of good planning in the tourism development process, lack of inclusion of local people in this development, and lack of awareness of natural resource use, which is one of the main elements of tourism, can have adverse destructive effects on biodiversity, wetlands, forest vegetation, marine life, and primarily coral reefs. However, when tourism development is managed well, it can prevent the host society in the destination from being negatively affected (GhulamRabbany et al., 2013: 117; Ehigiamusoe, 2020: 1175).

1.1. Positive Effects of Tourism on the Environment

After the industrial revolution, increasing employment, improving incomes, granting the right to education to every individual, especially women's participation in working life, intensive working life, and recognition of social rights belonging to individuals, such as annual and weekend holidays, have led to an increase in tourism activities globally. As a result of this increase, "Mass Tourism" movements made in masses and primarily focused on sea, sun, and sand have increased. Since the beginning of the 1980s, the growing awareness of the damage caused by mass tourism has caused alternative tourism varieties to attract more attention and develop. Accordingly, the developing environmental and nature conservation awareness has enabled tourism activities to be carried out with a protectionist attitude towards natural and ecological life.

The tourism sector, which is one of the most compelling sectors in the development of countries, makes positive contributions in many areas socially, economically, culturally, and environmentally, especially when its development is well planned in the destinations where it takes place, especially ensuring ecological protection, increasing employment in the region and,

accordingly, causing an increase in the incomes of residents, improving social well-being. Especially as a result of tourism activities realized within the framework of sustainability (GulamRabbany et al., 2013: 118; Türker, 2020: 1482):

- The protection of natural resource riches is ensured,
- Infrastructure and superstructure arrangements are developing further,
- More recreational areas are being created for residents and visitors to carry out activities such as recreation, entertainment, and sports activities,
- It is in a leading position in maintaining and renovating historical and cultural structures and provides individuals with awareness about protecting ecological balance and nature.

1.2. Negative Effects of Tourism on the Environment

Living things interact with other living things and the environment to meet their vital needs, especially nutrition. For this, biodiversity, an indicator of a healthy environment, is known as the most crucial requirement for the survival of living things. While the bond between man and nature continues harmoniously without interference, technology has begun to be negatively affected by factors such as industrialization, intense population growth, and urbanization. Unconsciously excessive use of many resources and fossil fuels to facilitate human life causes severe damage to the environment. Threats such as decreased biodiversity occur (Deniz, 2019: 326).

Even if the elements necessary for a destination to gain the characteristics of a tourism region consist of the natural, historical, and socio-cultural characteristics of the region, the most influential factor is expressed as the planned implementation of investments that will ensure tourism mobility in the region and the realization of tourism demand for the region (Voronkova, 2021: 326). However, since the tourism sector has a direct impact on nature, which is the area where all living beings, including humans, live their lives, it is necessary to protect nature in order to ensure the sustainability of life, especially when planning tourism in tourism destinations (Örki and Ağireseven, 2016:98).

The purpose of tourism, a service sector, consists of elements such as providing individuals entertainment, recreation, and happiness. The destination's natural environment and tourist resources are seriously damaged, especially in tourism activities where unconscious and excessive consumption occurs in dense human communities (Karakaş and Güngör, 2015: 4-5). Tourism activities carried out primarily in more rural and smaller destinations, together with excessive population density, can cause the people of the region to suffer both sociologically

and psychologically with the unconscious consumption of cultural and historical resources, especially the natural environment, and thus the host community to create an adverse reaction to tourism (Dumitru, 2012: 160-161). Developing touristic construction in rural areas and realized tourism activities:

- Endangerment or direct extinction of plant and animal existence in the region,
- Sound and noise pollution resulting from the increase in the number of people living due to tourism and touristic activities,
- Damage or destruction of habitat areas of animals as a result of recreational touristic activities such as off-road (Buckley, 2011: 401),
- Inflation increase,
- Local identity degeneration,
- The security problem and crime increase in the region with the increase in population,
- Collecting wood from forest areas for fuel use by visitors who carry out camping tourism, and therefore damage to forest vegetation,
- Deforestation due to tourist facilities or other construction and construction,
- Changes in animal behavior due to human intervention,
- Damage and ugly appearance caused by garbage piles in the tourist destination due to overcrowding,
- The crowded traffic flow brought by the dense population causes the local people to have transportation difficulties, and the resulting uneasiness and the exhaust gases produced by the vehicles cause air pollution (Sharpley, 2009: 46).
- Deterioration of the quality of water resources due to incorrect planning and practices in the discharge of toilets, septic waste, and solid waste, which are designed in an unsuitable way for nature (Chishti et al., 2020: 27722),
- As a result of intense touristic activities in the destination causes, problems such as erosion occur with soil erosion (Prasad and Kumar, 2022: 3).
- Negative results from tourism activities will improve the environment, especially in sustainable tourism practices (Solmaz, 2019: 1177). What needs to be done in order to ensure sustainability in the tourism sector and to protect the richness of tourist resources;
- To raise awareness about resource richness and the protection of these riches,

- Putting the natural and historical, and cultural richness of the destination into service,
- Correct planning for strong tourism development in tourism regions,
- To ensure that the local people and visitors have information about resource richness and the waste amount and to raise awareness,
- To carry out research and studies that will contribute to the development of tourism related to tourism activities in the destination,
- It is expressed as taking the ideas and opinions of the local people and giving them the right to speak about the tourism development to be realized in the region, ensuring their participation in this development and providing support for sustainability (Karakaş and Güngör, 2015: 5).
- Along with the environmental damage that occurs as a result of the mobility in the tourism sector, employment opportunities, workforce efficiency, production efficiency, and especially in developing countries, national income, and social welfare are negatively affected (Mishra, 2019: 1180).

2. Sustainability and Green Tourism Concepts

Sustainability, which has been used in tourism planning, development, and management since the 1980s, is often defined as a conservation-based movement associated with green tourism and ecotourism. The primary purpose of sustainability and sustainable tourism is to protect the environment (Mason, 2003: 165).

The concepts of “Sustainable Development” and “Sustainable Tourism,” which have developed over the past forty years, first became globally recognized in 1980 with the World Union for Conservation of Nature (IUCN) and the Brundtland Report in 1987 (WCED {World Environment and Development Commission: Our Common Future}, but have not started to be widely used. However, in 1990, the sustainability movement began to be implemented, especially considering the damage caused to nature by “Mass Tourism,” which arose due to excessive demand for the trio of sea, sun, and sand (Sharpley, 2009:12). However, the “2030 Sustainable Development Goals”, which the United Nations realized with 193 member countries in 2015, entered into force in January 2016 as a call for a global sustainability movement (Ticaret Bakanlığı, 2022: 6). The goals consisting of 17 essential items can be classified as follows; globally, it has been determined as eliminating hunger, eliminating poverty, combating climate change, ensuring gender equality, increasing employment, developing and implementing a high-quality education approach, using renewable and clean

energy, protecting water resources and ensuring sanitation, developing industrial entrepreneurship and infrastructure services, building sustainable cities and societies, protecting life in the oceans. In addition, sustainability has been defined as the protection of life in terrestrial areas and sustainability, peaceful and just institutions, promoting participation in shared goals, responsible production and consumption, increasing ecological, socio-October, and economic well-being, and reducing inequality to the lowest levels. The Covid-19 pandemic process, which started in 2020 and the effects of which are still ongoing, has created a global awareness of sustainability, and the importance of sustainability has gained universal priority (Ticaret Bakanlığı, 2022: 6; UNDP {Birleşmiş Milletler Kalkınma Programı}, 2022).

Table 1 Countries Making Strong Political Efforts in Environmental Sustainability Globally

Rank	Country Name	Sustainability Score
1	Switzerland	88.2
2	Sweden	86.3
3	Uruguay	85.4
4	Norway	84.4
5	Panama	83.7
6	Brazil	83.4
7	Denmark	82.9
8	France	82.7
9	Albania	82.5
10	United Kingdom	81.3

Source: WE Trilemma Index, 2022

Switzerland ranks first in the list of countries that make solid political efforts in the dimension of environmental sustainability globally, while Sweden ranks second and Uruguay third. The countries on the list have developed various energy systems supported by solid strategic tools to decarbonize and reduce their impact since 2000. When greenhouse gas emissions are combined with energy efficiency measures, they have demonstrated high performance in terms of environmental sustainability. In particular, Denmark, included in the list found in Table 1, has joined among the countries showing the best Deceleration in sustainability by providing half of its electricity consumption from wind energy, with a significant increase in renewable energy use. Apart from that, Azerbaijan has improved its energy and emission intensities, and China, which today has the title of the world's largest investor in renewable energy investment and is a leader in wind and solar energy production, has partially balanced its decarbonization efforts with a rapid increase in energy consumption. However, four out of the five renewable energy agreements concluded in 2016 were carried out by Chinese companies. It is stated that five of the six largest solar module manufacturing

companies in the world in 2017, and the largest wind turbine manufacturer in the world are China (Chiu, 2017: 3-4; WE Trilemma Index {Dünya Enerji Endeksi Üçlemesi}, 2022).

It is defined as the necessity of evaluating all the details related to sustainability when planning for tourism development, which is one of the elements that all countries experiencing development in the tourism industry should pay attention to. In order to ensure sustainability, especially in underdeveloped countries that have not achieved much development in the tourism sector, it is necessary to create a controlled tourism planning that can prevent negative situations that may arise to ensure the education of all stakeholders involved in the tourism movement by developing and implementing interrelated policies and to act from a long-term perspective. On the other hand, many developed countries that are rich in tourism resources have gained awareness of the ecological environment and acted more sensitively as a result of the damages caused by mass tourism for more than twenty years, achieved development in sustainable tourism, and experienced economic development (Riasi and Pourmiri, 2016:83).

Sustainable tourism, which is based on nature and nature conservation, is ecologically and culturally sensitive and can be easily applied economically. However, it causes negative consequences when it needs to be managed correctly. Sustainable tourism is defined as the essential element of sustainable development and, at the same time, the most effective conservation movement applied to the protection of biodiversity (Soleimanpour, 2012:17; Hall, 2019:1045).

Which is currently a leading online travel website Booking.com the Sustainable Travel Report, obtained from the results of research conducted by Un with more than 29,000 travelers in 30 countries and published in 2021, reveals the degree to which the concept of sustainability creates awareness among individuals globally and how sustainable travel goals can be transformed into practical action. Accordingly, 83% of the travelers stated that sustainable travel is of vital importance, 61% stated that they want to travel more sustainably in the future due to the Covid-19 pandemic, while 49%, which constitutes almost half of the total participants, will still pursue sustainable travel in 2021. 53% of them state that they do not have the option to travel and that their desire to travel is blocked because recycling is not provided in the businesses they stay in (Booking.com Sustainable Travel Report, 2022).

The concept of sustainability has integrated with the concept of green and has developed and implemented the green movement in all areas. Green tourism, one of the green practices, is gaining momentum under the umbrella of sustainability day by day and is expressed as an

encouraging factor in developing individuals' awareness of nature and environmental protection.

3. Ecological Protection and Climate Changes

Since the industrial revolution, there has been an increasing interest and demand for the tourism sector, which includes the historical, cultural, social, and economic structure as a whole, together with the progress and developments in many areas on a global scale. Today, with the world population reaching 7.931 billion people, it is stated that climate change is the beginning of the most significant environmental problem (Popescu, 2021: 111; The World Counts, 2022).

As stated in the fifth evaluation report of the "Intergovernmental Panel on Climate Change" (IPCC), it is stated that the main source of warming examined for climate change since 1950 is 100% caused by human-induced emissions and activities (CarbonBrief, 2022).

Table 2 Agreements to Combat Climate Change

Rank	Name of The Agreement	Date	Aim
1	Vienna Convention on the Protection of the Ozone Layer	1985	It was carried out to reduce the substances that are effective in the depletion of the ozone layer.
2	Montreal Convention on Substances that Deplete the Ozone Layer	1987	It was carried out to control the use and production of substances that deplete the Ozone Layer.
3	United Nations Environmental Convention on Climate Change	A joint venture was made in 1988, opened for signature in 1992, and entered into force in 1994.	It was realized with the joint participation of the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) to reduce greenhouse gas emissions and enable countries to collaborate on this issue.
4	Kyoto Protocol	It was adopted in 1997 and entered into force in 2005.	It was carried out with the principle that developed countries have significant responsibilities to participate in this movement within the scope of combating Climate Change.
5	Paris Agreement	2015	To increase the resilience of the global social and economic platforms against this threat, together with the necessity for developed and developing countries to take responsibility for the threat of climate change.
6	European Green Deal	2019	It was realized to be the first continent to achieve carbon neutrality in the climate until 2050 in Europe.

Source: (Ticaret Bakanlığı, 2021; Dışişleri Bakanlığı, 2022a; 2022b; 2022c; 2022d).

The various agreements and agreements made until today in order to protect the ecological balance under the roof of sustainability and to prevent the situations and events causing climate changes are stated in Table 2; when climate change started to become an issue on the agenda with the ozone layer drilling in the early 1980s, and with this date.

The use of fossil fuels is one of the essential factors in the global climate crisis, environmental pollution, and the deterioration of ecological life. The idea that these fossil fuels used are infinite reveals the biggest misconception. Greenhouse gas emissions caused by such an unconscious use of fossil fuels cause significant damage to the earth and ecological life (Karabağ et al., 2021: 231). When the volume and heat capacity of the world's enormous oceans are examined, a large amount of heat energy is required to increase the annual average surface temperature of the world even slightly. A slight increase in global average surface temperature of about 2 degrees Fahrenheit from pre-industrial times to the present means a significant increase in accumulated heat. This change in temperature causes regional and seasonal temperatures to increase and the melting of snow cover and mass icing in the seas. While there is an increase in precipitation due to the melting of these ice masses, changes such as shrinkage or expansion occur in the habitat areas of flora and fauna (NOAA {Ulusal Okyanus ve Atmosfer Dairesi}, 2022). The tourism sector also called the “Chimney-less Industry” globally, is defined as one of the industries that produce the most greenhouse gases and harm ecological balance and climate change by making intensive energy use with its activities when evaluated at the global level due to intensive travel and tourism movements, in contrast to this definition. With the intense population growth and technological developments, travel and tourism activity, which gained speed in the 21st century, contributes to global warming by causing the greenhouse gas emission rates spreading all over the world to increase rapidly day by day. The highest increase in carbon emissions in the tourism sector consists of mobility based on transportation. It is stated that three-quarters of the carbon emissions from tourism originating from global tourism originate from transportation. (Mishra et al., 2019: 1180; UNWTO, 2022b). There are two solutions proposed by the World Tourism Organization regarding this issue. First, the second recommendation is to reduce air transportation by using public vehicles on short-distance journeys and thus contribute to the reduction of carbon ratio and to provide incentive support to tourism operators for energy efficiency and carbon improvements (Lenzen et al., 2018: 526). The fact that the tourism sector operating in developed and developing countries acts as the most critical catalyst for economic development supports the increase of sustainability efforts. Globalization is becoming an essential element in these countries, accelerating the realization of cultural and technological developments. The speed with which cultural and technological transformations are spreading globally ensures the simultaneous development of the tourism industry. One of the most correct ways for the tourism sector to support sustainable development is defined as ecological tourism. The methods and sanctions

that the government managers of these developed and developing countries will apply to improve and protect ecological tourism and environmental quality ensure the reduction of energy consumption and carbon emissions along with the preservation of ecological balance (Balsalobre-Lorente et al., 2020: 7132). However, the measurement and reduction of greenhouse gas emissions and the initiation of the climate movement, which develops the power to ensure resilience to climate-related impacts, are also crucial for the sustainability of the tourism sector (UNWTO, 2022b).

4. The Green Deal and Principles

The climate crisis is one of the biggest problems that the world has to deal with today. In December 2019, to combat climate change, the European Union launched a movement under the name of the "European Green Deal" with a budget of one trillion euros to make Europe carbon neutral by 2050. The aim of this movement is stated as to establish more modern energy systems by replacing traditional energy systems, initiate waste management, prevent water and food waste, minimize carbon emissions, protect the ecological environment and biodiversity, start applying new methods within the framework of climate change, and at the same time improve industry and economy by protecting employment (Siddi, 2020: 6; Avrupa Parlamentosu, 2020; Ticaret Bakanlığı, 2021: 6; Popescu et al., 2021: 111). The "Green Deal", which started in Europe as a climate action plan, also aims to create a significant change in the economy (Catuti et al., 2020: 1). Benefits of the "European Green Deal" (Avrupa Komisyonu, 2022):

- Ensuring the continuation of biological diversity, researching clean air, clean water, healthy and fertile soils,
- To build renovated and energy-efficient structures,
- Developing a policy to sell affordable food that protects and supports health,
- Increasing public transportation and thus minimizing the amount of carbon footprint,
- To manufacture products that can be recycled,
- Developing education and providing a transition to a more conscious and safe future,
- It is expressed as cleaner energy and technological innovations developed with the latest technology.

The fact that the principles of the "European Green Deal" are aimed at zero carbon in Europe by 2050 has provided a global impetus to this carbon zero movement and 52 regions,

1103 cities, 7126 companies, 1103 educational institutions, 541 financial companies, 60 health institutions, more than 3000 hospitals, and 24 various companies have voluntarily participated in this cooperation with the support of the United Nations (UNFCCC {Birleşmiş Milletler İklim Değişikliği Çerçeve Sözleşmesi}, 2022). Within the scope of the "European Green Deal," targets such as a 50% reduction in pesticides and excess nutrients, a 20% fertilizer reduction, a 25% increase in organic agricultural land and landscape land, and land and soil fertility preservation have been determined with policies such as "Biodiversity Strategy," "Soil to Fork" "understanding and" "Importance of Climate" (Montanarella and Panagos, 2021:1). Following the aim of the "European Green Deal" published by the European Commission in 2019, depending on the research and assessments conducted, it is stated that it is necessary to reduce greenhouse gas emissions by 45% at least by 2030 in order to prevent overheating, climate changes and negative situations that develop and are likely to develop accordingly. However, in response to this assessment, only 41 of the 250 corporate companies producing the most significant greenhouse gas emissions in the world, that is, only 16%, have started new initiatives to reduce their emission production without taking any year as a basis (Murugaboopathy and Jessop, 2021).

5. Green Deal and Affected Sectors

The "European Green Deal," implemented with the carbon neutral target until 2050, primarily aims to create a healthier world by getting rid of all the negativities arising in climate and ecological life, and in addition, aims to initiate various regulations and preventive initiatives to minimize the emission of greenhouse gas emissions in the energy, transportation, industry, finance, construction, iron and steel and agriculture sectors. Accordingly, it is stated that significant transformations are planned in the industry and economy by protecting employment (Ticaret Bakanlığı, 2021: 6). An annual investment of 260 million Euros is required to attempt to reduce temporary greenhouse gas emissions by at least 40% by 2030. Per the Paris Agreement and the Green Deal, the European Union aims to reduce its greenhouse gas emissions by at least 50% and reach the carbon zero level by 2050 (Avrupa Paramentosu, 2020; UNWTO, 2022c).

6. The Green Deal and the Tourism Sector

In order for people to live in a more livable world and for the continuation of our planet, rapid action should be taken to prevent ecological pollution, and maximum beneficial results should be revealed. Changes and new applications have been initiated in many areas to leave a cleaner world for future generations Jul. It is necessary to ensure the adaptation of the "Green

Agreement” to the tourism sector more actively by starting applications such as installing filters on factory chimneys, applying deterrent penalties to prevent environmental damage, setting an example and encouraging recycling practices, ensuring the installation of wastewater treatment systems, especially in accommodation establishments, installing renewable energy systems (Örki and Ağireseven, 2016:98). Arrangements should be made, especially in the transportation activities of the tourism sector. In addition, it is stated that the government's implementation of sanctions such as carbon tax on tourism enterprises will significantly reduce the rate of tourism-related carbon emissions (Eşitti and Duran, 2018: 606). “Feynan Ecolodge,” which operates in Jordan as a hotel known for its sustainable formation among accommodation establishments in the Middle East, is an example. The panels placed in the ceiling section of the hotel operate with solar energy using a naturally used ventilation system and water. The revenues from the hotel business are used for nature conservation and sustainability studies in the “Dana” region, which covers an area of 320 square kilometers and contains a rich ecological diversity (Bakhtiyar and Kasalak, 2017: 370). In addition, following the "European Green Deal," Iber Hotel Sarigerme Park, located in the Sarigerme District of Muğla Province, is stated as one of the leading accommodation enterprises in our country in waste management and recycling strategy (Deste et al., 2018: 226). Natural, political, social, cultural, Etc., especially the climate and climatic conditions, are of great importance for the tourism industry, which is in a susceptible structure in the face of all kinds of fluctuations. Today, climate changes experienced on a global scale have positive and negative effects on the tourism sector. Sea flooding caused by excessive accumulation of water in the seas as a result of melting glaciers, especially in coastal tourism destinations, destruction of the coastline and coasts with these floods, flooding disasters caused by excessive precipitation in the region, drought with abnormal temperature rates experienced is mentioned as negative examples that prevent tourism activities. In the regions where seasonal tourism takes place, the temperature change is caused by climate changes; for example, if the unseasonal temperature continues, the continuation of tourism activities in the destination can be an example of the positive effects caused by climate changes, especially as a result of the improvements it has made in the economy (Sevim, 2009:44). Popescu et al., as a result of the Covid-19 global pandemic (2021), examined the extent of digitalization trends that started in the tourism sector and especially in accommodation businesses, with the feature that Romania is a tourist destination and a smart city and the sustainability goal of digitalization activities in hotels in the Cluj-Napoca region, which is in a leading position in Europe. According to the results of the survey conducted with 38 hotels

located in the region, they stated that the “European Green Deal” is also effective in the tourism sector; it is necessary to increase digital applications due to the importance of reducing carbon gas emissions caused by the tourism sector and the preventive and harmful effects of the resulting environmental pollution. Wolf et al. in Tonga and Solomon Islands, which are located in the Pacific Ocean and where the source of livelihood is the tourism sector., (2021) examined the extent of the effects of climate change on tourism. In the study, the sensitivity of the tourism sector to climate change and what kind of measures should be taken for these islands in sustainability adaptation efforts were investigated. According to the results of the research, the requirements for the development of infrastructure for air and sea transportation in these islands, where the tourism sector is heavily active, to be able to create a more resistant island structure to the damage that climate changes can cause with low-capital engineering solutions and to make the use of renewable energy systems more widespread in tourism enterprises have been stated. In 2018, when Fang et al.'s studies investigating the relationship between climate change and tourism between 1990 and 2015 were examined, it was stated that there were more studies on this subject in Australia, the United States, Canada, New Zealand, and European countries and there were studies aiming to improve sustainability. However, against the adverse effects of climate changes on tourism, they examined the practices and global trends to reduce greenhouse gas emissions in tourism to minimize anthropogenic effects. Noting that climate changes play a remarkable role in tourism and the travel industry, Weir examined the history of tourism in connection with this relationship in his study conducted in 2017. According to the results of the study, it is stated that not only taking measures against the climate crisis is sufficient, but also it is necessary to carry out studies to raise the awareness of societies about sustainability and environmental protection and to implement them. Alizadeh et al. (2021) conducted a study in the Mazandaran region of Iran to investigate the extent of the effects of future predicted climate changes on tourism movements and tourism demand. Accordingly, they concluded that the winter season would be preferable for holidays because the summer season temperatures will increase in this important tourist region of Iran. They stated that indoor facility requirements would increase in case of excessive heat increase in the summer. They stated that tourism demand should be directed to seasons other than summer.

7. Conclusion

The climate crisis is one of the biggest global problems that have started to appear since the early 1980s. Many adverse developments occur at the natural, economic, and socio-cultural levels due to the climate crisis. The fact that the concept of sustainability has become more

comprehensive and that such a crisis has developed with an awareness of sustainability creates a significant contrast. The European Union, which set out with the goal of "a carbon-neutral Europe by 2050", aims to intervene in the climate crisis, increase energy efficiency and provide a more livable world by activating sustainable practices and sanctions. With the strategy of "From Soil to Fork," it is not only the European Union and its member countries to protect biological diversity, clean the soil and air from carbon gas emissions, control excessive energy consumption, and minimize the damage to the ecological balance and natural resources; all countries must act globally sensitively and consciously. Within the framework of the "European Green Deal," some elements need to be implemented in tourism activities and accommodation enterprises. A strategy should be developed to reduce transportation by aircraft and vehicles as much as possible in the transportation sector, which is an essential part of the tourism industry and where carbon emissions occur to the highest degree. In this context, it is necessary to use transportation means such as public transport, tram, or bicycle for long distances by rail or sea route and short distances. It is necessary to create and implement systems that will ensure the utilization of natural resources for all lighting, heating, and electricity activities, especially accommodation enterprises within the sector. However, the supply of products such as food and personal care supplies used in accommodation establishments should be provided by the region's people, and an economic contribution to the destination should be created. Using energy-saving devices in rooms, laundry, kitchen, and restaurant departments should be preferred in accommodation establishments. The application of sensor systems in rooms should also prevent excessive energy loss by using the insulated door and window systems. Ecological awareness should be developed by spreading recycling bins in places such as accommodation establishments, airports, museums, and recreation areas. In addition, the use of recycled products should be preferred throughout tourist services. For these practices to become widespread, support such as government incentives and tax reductions should be provided to enterprises. Initiatives such as making use of rainwater, establishing and implementing wastewater recycling systems, constructing energy-efficient buildings in the tourism sector, organizing infrastructure systems necessary for waste management, improving social awareness of sustainability, and expanding and developing green areas will make a significant contribution to sustainability while producing results following the purpose of the "European Green Deal".

REFERENCES

- Alizadeh, M., Mirzaei, R., Dittmann, A. (2021). Climate Change and Its Potential Impacts on Sustainable Tourism Development. *Anatolia*, 32(3), 443-455. <https://doi.org/10.1080/13032917.2021.1886130>
- Balsalobre-Lorente, D., Driha, O., Shahbaz, M., Sinha, A. (2020). The Effects of Tourism and Globalization Over Environmental Degradation in Developed Countries. *Environmental Science and Pollution Research*, 27(7), 7130-7144. <https://doi.org/10.1007/s11356-019-07372-4>
- Booking.com, Booking.com's 2021 Sustainable Travel Report Affirms Potential Watershed Moment for Industry and Consumers. [https://globalnews.booking.com/bookingcoms-2021-sustainable-travel-report-affirms-potential-watershed-moment-for-industry-and-consumers/\(E.T: 09.05.2022\)](https://globalnews.booking.com/bookingcoms-2021-sustainable-travel-report-affirms-potential-watershed-moment-for-industry-and-consumers/(E.T: 09.05.2022)).
- Buckley, R. (2011). Tourism and Environment. *Annual Review of Environment and Resources*, 36: 397-416. doi: 10.1146/annurev-environ-041210-132637
- Carbon Brief Clear on Climate, Analysis: Why Scientists think %100 of Global Warming is Due to Human?. [https://www.carbonbrief.org/analysis-why-scientists-think-100-of-global-warming-is-due-to-humans/\(E.T: 31.05.2022\)](https://www.carbonbrief.org/analysis-why-scientists-think-100-of-global-warming-is-due-to-humans/(E.T: 31.05.2022)).
- Catuti, M., Kustova, I., Egenhofer, C. (2020). Delivering the European Green Deal for southeast Europe: Do We Need a Regional Approach? CEPS Research Paper 17 Jun 2020.
- Chishty, M.Z., Ullah, S., Öztürk, I., Usman, A. (2020). Examining the Asymmetric Effects of Globalization and Tourism on Pollution Emission in South Asia. *Environmental Science and Pollution Research*, 27(22), 27721-27737. <https://doi.org/10.1007/s11356-020-09057-9>
- Chiu, D. (2017). The East is Green: China's Global Leadership in Renewable Energy. *New Perspectives in Foreign Policy*, 13, 3-12.
- Deniz, T., (2019). Turizm ve Biyoçeşitlilik. *Safran Kültür ve Turizm Araştırmaları Dergisi*, 2(3), 323-339.
- Deste, M., Binbaşoğlu, H., Türk, M. (2018). Konaklama İşletmelerinde Atık Yönetimi ve Geri Dönüşüm: İnönü Üniversitesi Kale Göl Otel Örneği. *Anemon Muş Alpaslan Üniversitesi Sosyal Bilimler Dergisi*, 6(2), 225-234.
- Dumitru, T. (2012). The Impact of Tourism Development on Urban Environment. *Studies in Business and Economics*, 7(3), 160-164.
- Ecer, K., Güner, O., Çetin, M. (2021). Avrupa Yeşil Mutabakatı ve Türkiye Ekonomisinin Uyum Politikaları. *İşletme ve İktisat Çalışmaları Dergisi*, 9(2), 125-144.
- Ehigiamusoe, K.U. (2020). Tourism, Growth and Environment: Analysis of Non-Linear and Moderating Effects. *Journal of Sustainable Tourism*, 28(8), 1174-1192. <https://doi.org/10.1080/09669582.2020.1729164>
- Eşitti, B., Duran, E. (2018). Çanakkale Turizminin Karbon Ayak İzi Üzerine Bir Araştırma. *Journal of Awaneress*, 3(5), 597- 608.
- European Commission, A European Green Deal. [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en\(E.T: 20.03.2022\)](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en(E.T: 20.03.2022)).
- European Parliament, (2020). Europe's One Trillion Climate Finance Plan. [https://www.europarl.europa.eu/news/en/headlines/society/20200109STO69927/europe-s-one-trillion-climate-finance-plan\(E.T: 01.06.2022\)](https://www.europarl.europa.eu/news/en/headlines/society/20200109STO69927/europe-s-one-trillion-climate-finance-plan(E.T: 01.06.2022)).
- Fang, Y., Yin, J., Wu, B. (2018). Climate Change and Tourism: A scientometric Analysis Using CiteSpace. *Journal of Sustainable Tourism*, 26(1), 108-126. <https://doi.org/10.1080/09669582.2017.1329310>
- GhulamRabbany, M., Afrin, S., Rahman, A., Islam, F., Hoque, F. (2013). Environmental Effects of Tourism. *American Journal of Environment, Energy and Power Research*, 1(7), 117-130.
- Hall, C.M. (2019). Constructing Sustainable Tourism Development: The 2030 Agenda and The Managerial Ecology of Sustainable Tourism. *Journal of Sustainable Tourism*, 27(7), 1044-1060. <https://doi.org/10.1080/09669582.2018.1560456>
- Karabağ, N., Kayıkçı, C.B.Ç., Öngen, A. (2021). %100 Yenilenebilir Enerjiye Geçiş Yolunda Dünya ve Türkiye. *Avrupa Bilim ve Teknoloji Dergisi*, (21),230-240.Doi: 10.31590/ejosat.780856

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- Karakaş, A., Güngör, H. (2015). Turizm Faaliyetlerinin Çevreye Etkisi. Güneydoğu Anadolu Bölgesi Çevre Sorunları Sempozyumu, 24-25.
- Kasalak, M.A., Bahtiyar, D. (2017). Ekolojik Otellerin Etkilerinin Değerlendirilmesi: Dünya ve Türkiye'deki Örnek Ekolojik Oteller. *Kesit Akademi Dergisi*, (10), 362-381.
- Lenzen, M., Sun, Y.Y., Faturay, F., Ting, Y.P., Geschke, A., Malik, A. (2018). The Carbon Footprint of Global Tourism. *Nature Climate Change*, 8(6), 522-528. <https://doi.org/10.1038/s41558-018-0141-x>
- Mason, P. (2003). Butterworth-Heinemann Publishing. Chapter 17. Tourism Planning and Management and Sustainability.
- Mishra, P.K., Rout, H.B., Kestwal, A.K. (2019). Tourism-Energy-Environment-Growth Nexus: Evidence from India. *Journal of Environmental Management and Tourism*, 5(37): 1179-1190. DOI:10.14505/jemt.v10.5(37).25
- Montanarella, L., Panagos, P. (2021). The Relevance of Sustainable Soil Management within the European Green Deal. *Land Use Policy*, 100, 104950.
- Murugaboopathy, P., Jessop, S. (2021). What's the Plan? Corporate Polluters Lag on Setting Climate Goals. *Reuters*. <https://www.reuters.com/business/sustainable-business/whats-plan-corporate-polluters-lag-setting-climate-goals-2021-06-21/> (E.T: 31.05.2022).
- NASA, Global Climate Change, Vital Signs of the Planet, Update: Sea Level. [https://climate.nasa.gov/newsletters/80/\(E.T: 25.05.2022\)](https://climate.nasa.gov/newsletters/80/(E.T: 25.05.2022)).
- NOAA Climate.gov, Climate Change, Global Temperature. [https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature\(E.T: 04.05.2022\)](https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature(E.T: 04.05.2022)).
- Örki, A., Ağırseven, N. (2016). Sustainable Environment in Tourism Policies: The Case Of Turkey. *Uluslararası Türk Dünyası Turizm Araştırmaları Dergisi*, 1(2), 97-106.
- Popescu, D., Coroş, M.M., Pop, J., Bolog, C. (2021). The Green Deal- Dynamizer of Digitalization in Tourism: The Case of Cluj-Napoca Smart City. *Amfiteatru Economic*, 24(59), 110-127. DOI: 10.24818/EA/2022/59/110
- Prasad, N.S., Kumar, N.N. (2022). Resident Perceptions of Environment and Economic Impacts of Tourism in Fiji. *Sustainability*, 14(9): 1-20. <https://doi.org/10.3390/su14094989>
- Riasi, A., Pourmiri, S. (2016). Examples of Unsustainable Tourism in Middle East. *Environmental Management and Sustainable Development*, 5(1), 69-85.
- Soleimanpour, H. (2012). Legal Implications for Nature-Based Tourism. Jaime A. Seba (Ed.), *Ecotourism and Sustainable Tourism. New Perspectives and Studies içinde* (s.17-29) Washington: Apple Academic Press.
- Sevim, B. (2009). İklim Değişikliğinin Turizme Etkileri: Konaklama İşletmelerinde Bir Uygulama. Doktora Tezi. Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Turizm İşletmeciliği ABD. Ankara.
- Sharpley, R. (2009). *Tourism Development and the Environment: Beyond Sustainability*. Earthscan Publishing, London.
- Siddi, M. 2020. The European Green Deal: Assessing Its Current State and Future Implementation. *Climate Policy*, 16(5), 543-547.
- Solmaz, A.S. (2019). Sürdürülebilir Turizm ve Türkiye'de Çevre Politikaları. *Uluslararası Sosyal Araştırmalar Dergisi*, 12(66), 1175-1186.
- T.C Dışişleri Bakanlığı, 2022a, Viyana Sözleşmesi ve Montreal Protokolü. [https://www.mfa.gov.tr/viyana-sozlesmesi-ve-montreal-protokolu.tr.mfa\(E.T: 29.05.2022\)](https://www.mfa.gov.tr/viyana-sozlesmesi-ve-montreal-protokolu.tr.mfa(E.T: 29.05.2022)).
- T.C Dışişleri Bakanlığı, 2022b, BM İklim Değişikliği Çerçeve Sözleşmesi [https://www.mfa.gov.tr/bm-iklim-degisikligi-cerceve-sozlesmesi.tr.mfa\(E.T: 29.05.2022\)](https://www.mfa.gov.tr/bm-iklim-degisikligi-cerceve-sozlesmesi.tr.mfa(E.T: 29.05.2022)).
- T.C Dışişleri Bakanlığı, 2022c, Kyoto Protokolü. [https://www.mfa.gov.tr/kyoto-protokolu.tr.mfa\(E.T:29.05.2022\)](https://www.mfa.gov.tr/kyoto-protokolu.tr.mfa(E.T:29.05.2022)).
- T.C Dışişleri Bakanlığı, 2022d Paris Anlaşması. [https://www.mfa.gov.tr/paris-anlasmasi.tr.mfa\(E.T: 29.05.2022\)](https://www.mfa.gov.tr/paris-anlasmasi.tr.mfa(E.T: 29.05.2022)).

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- T.C Ticaret Bakanlığı, Yeşil Mutabakat Eylem Planı, 2021. <https://ticaret.gov.tr/data/60f1200013b876eb28421b23/MUTABAKAT%20YE%C5%9E%C4%B0L.pdf>(E.T: 29.05.2022).
- The World Count, World Population. <https://www.theworldcounts.com/populations>(E.T: 02.05.2022).
- Türker, G.Ö. (2020). Turizmin Etkileri Olumlu mu, Olumsuz mu? Türkiye’de Yapılmış Çalışmalara Yönelik Bir İnceleme. *Türk Turizm Araştırmaları Dergisi*, 4(2), 1477-1492. DOI: 10.26677/TR1010.2020.407
- UNDP, Sustainable Development Goals. https://www1.undp.org/content/project-rev-blueprint/en/home/sustainable-development-goals.html?utm_source=EN&utm_medium=GSR&utm_content=US_UNDP_PaidSearch_Brand_English&utm_campaign=CENTRAL&c_src=CENTRAL&c_src2=GSR&gclid=CjwKCAjw9-KTBhBcEiwAr19ig0Tntqs4rFyIkVc8Z5P8u7xDzLWGeRgpi0mZiern-n2L6tahDBIINhoC6-wQAvD_BwE(E.T: 09.05.2022)
- UNFCCC, Race to Zero Campaign. <https://unfccc.int/climate-action/race-to-zero-campaign>(E.T: 29.05.2022).
- UNWTO, (2022a), Sustainable Development, Resource Efficiency in Tourism. <https://www.unwto.org/sustainable-development/resource-efficiency-in-tourism> (E.T: 24.05.2022).
- UNWTO, (2022b), Transport-Related CO₂ Emissions of the Tourism Sector, Modelling Results. <https://www.e-unwto.org/doi/pdf/10.18111/9789284416660> (E.T: 27.05.2022).
- UNWTO, (2022c), Transforming Tourism for Climate Action. <https://www.unwto.org/sustainable-development/climate-action> (E.T: 09.05.2022).
- Voronkova, O.Y., Akhmedhanova, S.T., Nikiforov, S.A., Tolmachev, A.V., Vakhrushev, I.B., Sergin, A.A. (2021). Tourism Market Relies Heavily on Environmental and Natural Factors. *Caspian Journal of Environmental Sciences*,9(2), 365-374.
- Wang, M.C., Wang, C.S. (2018). Tourism, The Environment and Energy Policies. *Tourism Economics*, 24(7), 821-838.
- Weir, B. (2017). Climate Change and Tourism- Are We Forgetting Lessons from The Past?. *Journal of Hospitality and Tourism Management*, 32, 108-114. <https://doi.org/10.1016/j.jhtm.2017.05.002>
- Wolf, F., Filho, W., Singh, P., Scherle, N., Telesford, J., Kovaleva, M. (2021). Influences of Climate Change on Tourism Development in Small Pacific Island States. *Sustainability*, 13(8), 4223. <https://doi.org/10.3390/su13084223>
- World Energy Trilemma Index 2021. https://www.worldenergy.org/assets/downloads/WE_Trilemma_Index_2021.pdf?v=1634811254(E.T: 05.05.2022).

**YÜKSEKOVA HAVZASINDA DOĞAL OLARAK YETİŞEN VE TEHLİKE
ALTINDA BULUNAN BAZI BİTKİLER**

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Özet

İklim ve coğrafi özellikler bakımından oldukça değişken olan ve farklı floristik bölgelerin kesişim noktasında yer alan Türkiye, bitki çeşitliliği açısından oldukça zengindir. Küresel ölçekte sorun oluşturan iklimsel değişimlerin yanı sıra insan faaliyetleri nedeniyle oluşan ekolojik baskı bitki tür çeşitliliğini tehdit etmektedir. Bitki tür çeşitliliği bakımından Türkiye'nin en zengin havzalarından biri olan Yüksekova havzasında artan kuraklık ile beraber, arazi kullanım değişimleri bitki tür çeşitliliği üzerinde önemli bir baskı oluşturmaktadır. Bu çalışma kapsamında belirtilen nedenlerin Yüksekova ovasında yer alan ve doğal olarak yetişen bitki türlerinin bu gün ve gelecekteki tehlike kategorilerine etkileri araştırılmıştır. Bunun için farklı arazi kullanımlarını temsil edecek şekilde 232 ayrı noktada vejetasyon çalışmaları yürütülmüştür. Yapılan çalışmalar sonucunda Yüksekova Havzasında doğal olarak yetişen bitki taksonlarından 10 tanesinin farklı tehlike kategorilerinde değerlendirildiği tespit edilmiştir (1'i "EN" Tehlikede; 1'i "CD" Korumaya tabi; 1'i "NT" Tehdide yakın; 4'ü "VU" Duyarlı; ve 3'ü "LC" Düşük riskli). Özellikle çalışma alanında arazi kullanım değişimleri (Sulak alanların tarım arazisine dönüştürülmesi) bu bitki taksonlarının daha fazla risk altına girmesine neden olmuştur. Ayrıca iklimsel değişimlerin yanı sıra antropojenik baskılar Yüksekova Havzasında başta endemik türler olmak üzere birçok bitki tür ve çeşitliliğini önemli derecede tehdit etmektedir. Bölgedeki biyolojik çeşitliliğin korunması ve sürdürülebilirliğinin sağlanması adına gerekli önlemlerin alınması gelecek kuşakların gıda ve gen kaynakların devamlılığına katkı sağlaması açısından da önem arz etmektedir.

Anahtar Kelime: Biyolojik çeşitlilik, IUCN, koruma, Yüksekova, Hakkari

**SOME ENDANGERED PLANT SPECIES NATURALLY GROWING IN
YÜKSEKOVA BASIN**

Abstarct

Turkey is endowed with diverse climate and geographical characteristics, and is situated at the confluence of various floristic zones, thereby exhibiting abundant plant diversity. The diversity of plant species is threataened by global climatic changes and ecological pressure due to anthropogenic activities. Yüksekova is one of the richest basins in Turkey in terms of plant diversity, which is now being threatened by increasing drought and rapid land use changes. This study determined natural plant plant species growing in Yüksekova plain and theri possible danger categories. For this, 232 locations representing different land uses in the basin were surveyed during the study. The resukts revealed that 10 of the plant taxa naturally growing in the basin were evaluated in different danger categories (1 “EN” endangered; 1 “CD” subject to protection; 1 “NT” near threatened; 4 “VU” ” susceptible; and 3 “LC” low risk). Land use changes (conversion of wetlands to agricultural land) have put these plant taxa at risk in the study area. In addition to climatic changes, anthropogenic pressures threatens many plant species and diversity, particularly endemic species in the basin. Necessary measures are needed in order to protect and sustain the biodiversity in the region and to contribute towards food supply and gene resources for future generations.

Keywords: Biodiversity, IUCN, Protection, Yüksekova, Hakkari

GİRİŞ

Dünya genelinde tanımlanmış bitki tür sayısı yaklaşık 374.000 olarak bilinmektedir. Bu bitkilerin 295.383'ü çiçekli bitki olup 284.281'i ise kapalı tohumludur. Kapalı tohumlu bitkilerden 210.008'ini dikotilodon, 74.273'ünü ise monokotiledon taksonlar oluşturmaktadır (Christenhusz ve Byng, 2016; Pınar ve ark., 2021). Türkiye'nin coğrafi konumu nedeniyle Asya ile Avrupa kıtaları arasında yer alması ve topografik yapısının kısa mesafelerde değişmesi, iklim ve toprak özellikleri açısından değişkenlik göstermesinin yanı sıra Akdeniz, Avrupa-Sibirya ve İran-Turan gibi üç önemli fitocoğrafik bölgelerinin keşişim noktasında bulunması farklı habitat alanları ve zengin bir flora oluşmasını sağlamıştır. Nitekim Türkiye'de bugüne kadar kaydedilmiş 12.000 üstünde bir bitki taksonunun bulunduğu ve bu taksonların yaklaşık 1/3'nin endemik türlerden oluştuğu rapor edilmiştir (Güner ve ark., 2012).

Hakkâri ili ise endemizm açısından en zengin fitocoğrafik bölgelerden bir olan İran-Turan elementinde yer almasının yanı sıra yüksek rakımlı dağları ve kendine özgü iklim ve toprak özellikleri nedeniyle bitki florası açısından en gözde habitatlardan biridir. Nitekim bölgede 2019 yılında yapılan florastik bir çalışmada yayılış gösteren bitki takson sayısının 1150 olduğu bildirilmiştir (Ünal ve Demir, 2019). Bu taksonlar içerisinde 102 tür endemik tür olmak üzere Türkiye'deki endemik türlerin yaklaşık %3.3'nü oluşturmaktadır. Ancak bölgede kayıt altına alınmamış bitki türleri de dahil edildiğinde bu sayıların çok daha üstünde bir bitki tür sayısının yayılım gösterdiği düşünülmektedir. Aynı şekilde bölgenin bitki çeşitliliğinde olduğu gibi diğer canlı türleri açısından da zengin bir yaşam alanı olduğu bilinmektedir (Güner ve ark., 2012; Anonim, 2015).

Bölgede canlı çeşitliliği açısından en zengin alanlardan birisi de Yüksekova Havzasıdır. Havza içerisinde yer alan farklı habitat alanları hem flora hem de fauna tür çeşitliliği açısından oldukça önemli bir ekosisteme sahiptir. Ayrıca havzanın göç yolu üstünde olması ve sulak alan ekosistemi içerisinde bulundurması önemli kuş cennetlerinden biri olmasını sağlamıştır. Biyolojik çeşitlilik belirli bir habitatta tür ve gen çeşitliliği olarak değerlendirilse de, insanoğlunun ekonomik ve sosyal hayatının devamlılığı için gerekli olan temel ekosistem hizmetlerini de sağlamaktadır. Ayrıca biyolojik çeşitlilik aynı zamanda, tozlaşma, iklimsel düzenlenme, selden koruma, toprak verimliliği ve gıda, yakıt, lif ve ilaç üretimi gibi ekosistem hizmetleri için de oldukça önemlidir.

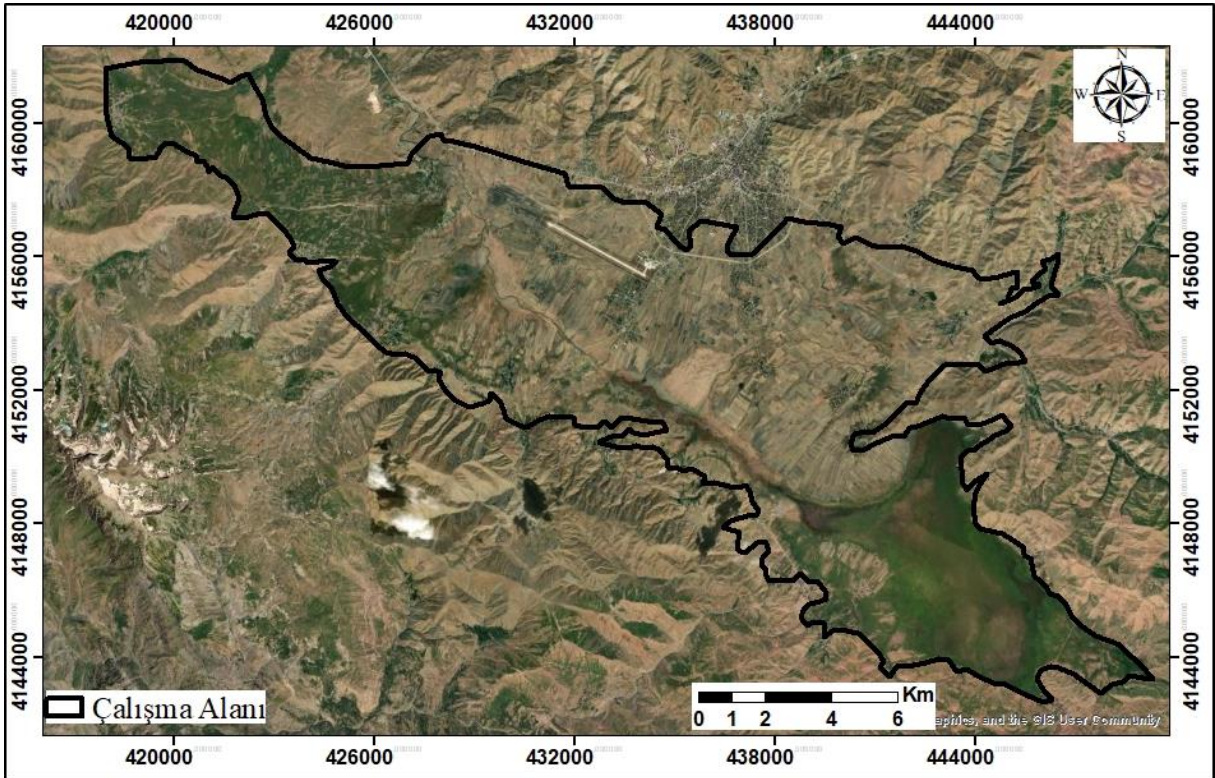
Bu çerçevede özelde Yüksekova havzası genelde ise Türkiye'nin biyolojik çeşitliliği için önemli olan ve nesli tehdit altında bulunan bitki türlerinin korunması ve sürdürülebilirliği,

gelecekte ortaya çıkabilecek gıda ihtiyacının karşılanmasında birer gen kaynağı olduğu unutulmamalıdır.

2. Materyal ve Metot

2.1. Çalışma Alanı

Çalışma alanı, 37°25'49" - 37°36'32" K enlemleri ile 44°04'21" - 44°22'56" D boylamları arasında yer almaktadır. Yaklaşık 19.5 bin ha'dan oluşan çalışma alanı etrafı yüksek dağlarla çevrili bir çöküntü ovasıdır (Şekil 1). Yirminci yüzyılın ortalarına kadar büyük çoğunluğu sulak alanlardan oluşan Yüksekova ovasında yağışların azalması ve antropojenik baskılardan dolayı sulak alanlar önemli miktarda azalmıştır. Tarım ve Orman Bakanlığı tarafından 2015 yılında havzanın tamamı (21.533 ha) ulusal öneme haiz sulak alan olarak kabul edilen alanda (Anonim, 2019) 2021 yılı itibari ile 3.203 ha'lık sulak alan kaldığı görülmektedir. Ancak yıllık yağış miktarına ve mevsime göre bu alan yaklaşık 2.700 ha ile 3.500 arasında değişmektedir.



2.2. Çalışma Alanının İklim Özellikleri

Uzun yıllar (1979-2018) ortalama yıllık yağış miktarı 762 mm, ortalama yıllık buharlaşma ise 850 mm'dir. Yıllık ortalama sıcaklık 6.9 °C olup en düşük ortalama sıcaklık Ocak (-9.3°C) ve en yüksek ortalama sıcaklık Temmuz (21.3 °C) ayında görülmektedir. Yüksekova'da yaz mevsimi çok kısa kış mevsimi ise oldukça uzundur. Son 40 yıllık iklim verilerine göre yıllık

ortalama 96 gün yağışlı geçmekte olup bunun 43 gününde kar yağışı görülmektedir. Yaklaşık 1 m'lik kar örtüsünün görüldüğü çalışma alanı ortalama 120 gün kar ile kaplı kalmaktadır (Anonim, 2019)

2.3. Çalışma Alanının Jeolojik Yapısı

Çalışma alanı'nın batısında Cilo dağı, kuzeyde Mor dağı doğusunda İran sınır dağları ve güneyinde ise Cilo dağlarının uzantısı olan Sibiriz sıra dağları bulunmaktadır. Alanda Kuzeybatı-Kuzeydoğu hattı boyunca Bitlis Metamorfileri (Ultra bazik kayaç, serpantin), Sekse Formasyonu (konglomera, kumtaşı, kil taşı ve kireçtaşı) ve Kırkgeçit Formasyonu (kumtaşı, marn ve şeyl türü kayaçlar) özellikli jeolojik materyaller yer almaktadır. Çalışma alanının Güneybatı-Güneydoğu hattı boyunca ise Urşe Formasyonu (kireç taşı, kumtaşı ve şeyl), Kandilli Kireçtaşı ve Yüksekova Karmaşığı (volkano-sedimenter kayaçlar ve kireçtaşı) özellikli materyaller bulunmaktadır (Sançar, 2018).

2.4. Sürvey Çalışmaları

Çalışmada bölgede yayılım gösteren bitki taksonları belirlemek amacıyla 2020-2021 yıllarında sürvey çalışmaları yapılmıştır. Sürvey çalışmaları bitkilerin çiçeklenme dönemleri dikkate alınarak Mayıs-Haziran ve Ağustos-Eylül ayları olmak üzere farklı dönemde ve bölgeyi temsil edecek şekilde belirlenmiş toplam 232 noktada yürütülmüştür. Her lokasyonda yayılım gösteren bitki türleri incelenmiş ve herbaryum alınmıştır. Arazide teşhisleri yapılmayan bitki taksonları laboratuvarında incelenmiş ve teşhisleri yapılmıştır (Davis, 1965-1985). Ayrıca bitkilerin Türkçe bilimsel isimlendirmesi Türkiye Bitkileri Listesi'deki (Damarlı Bitkiler) isimlendirme baz alınarak yapılmıştır (Güner ve ark., 2012).

3. BULGULAR

Bölgede yapılan bitki sürvey çalışmaları sonucunda toplam 232 lokasyonda farklı familyalara ait toplam 404 bitki taksonu tespit edilmiştir. Bu türler dünya genelinde yayılım olan kozmopolit türlerin yanı sıra sadece Türkiye florasında yayılım gösteren endemik türlerde olduğu tespit edilmiştir. Ayrıca çalışmada havzada yayılım göstere ve nesli tehlike altında olan 10 bitki taksonu da saptanmıştır. Örneklem noktalarında tespit edilen bitki taksonları Tablo 1'de verilmiştir.

Çalışmada 232 lokasyonda yapılan sürvey çalışmaları sonucunda bölge florasında yayılım gösteren 404 taksonun 10'u nadir olan türler olarak belirlenmiştir. Ayrıca bu türlerin 3 tanesinin (*Achillea nobilis*, *Inula helenium* ve *Alyssum huetii*) endemik olduğu tespit edilmiştir (Güner

ve ark., 2012; Pınar ve ark., 2018). Nitekim havzada 2015 yılında yapılan bir çalışmada benzer bitki türlerinde dahil olduğu 17 endemik bitki türünün yayılım gösterdiği ve IUCN tehlike kategorilerine göre 2'si "CR" kategorisinde 1'i "EN" kategorisinde, 2'si "VU" kategorisinde ve 11'i ise "LC" kategorisinde yer aldığı belirtilmiştir. Aynı çalışmada bölgede yayılım gösteren ve endemik olmayan ancak nadir tür olan 11 bitki taksonu doğal olarak yetiştiği tespit edilmiştir. Bu türlerin 8'i "VU" kategorisinde (*Eryngium thyrsoideum*, *Trigonosciadium viscidulum*, *Trachydium depressum*, *Centaurea gigantea*, *Centaurea nemecii*, *Centaurea persica*, *Isatis cappadocica* subsp. *macrocarpa* ve *Ranunculus crymophilus*), 1'i "LC" kategorisinde (*Allium shatakiense*), 2'si ise "DD" kategorisinde (*Artemisia haussknechtii* ve *Echinops tournefortii*) yer aldığı belirtilmiştir (Anonim, 2015). Ayrıca Türkiye florasında bu güne kadar kayıtlı bitki türleri içerisinde 2221 taksonun farklı tehlike kategorilerine göre tehdit altında olduğu belirtilmiştir (Güner ve ark., 2012). Dünya genelinde ise "THE IUCN RED LIST OF THREATENED SPECIES" in 2000-2022 verilerine göre bitkiler dahil olmak üzere 150.388 canlı türünün tehlike altında olduğunu rapor edilmiştir (Anonim 2023).

Tablo 1. Yüksekova Havzası doğal olarak yetişen ve tehdit altında bulunan bitki taksonları

Takson Adı	Türkçe Adı	Tespit Şekli*	Fitocoğrafik Bölge	IUCN**	Endemizm
APIACEAE					
<i>Bunium paucifolium</i> DC.	Koç kuzu	A+L	İran-Turan elementi	LC	
ASPARAGACEAE					
<i>Muscari botryoides</i> (L.) Mill.		A+L	Akdeniz elementi	VU	
ASTERACEAE					
<i>Achillea nobilis</i> L. subsp. <i>kurdica</i> Hub.-Mor.	Bayır pelini	A+L	İran-Turan elementi	CD	Endemik
<i>Inula helenium</i> L. subsp. <i>vanensis</i> Grierson	Van andız otu	A+L	İran-Turan elementi	NT	Endemik
<i>Centaurea gigantea</i> Sch. Bip. ex Boiss	Daldakdiken	A+L		VU	
<i>Centaurea nemecii</i> Nábělek	Delikavgalaz	A+L	İran-Turan elementi	VU	
<i>Centaurea persica</i> Boiss.	Acemkavgalazı	A+L	İran-Turan elementi	VU	
BRASSICACEAE					
<i>Alyssum huetii</i> Boiss.	Tortum kuduzotu	A+L	İran-Turan elementi	LC	Endemik
CYPERACEAE					
<i>Blysmus compressus</i> (L.) Panz. ex Link subsp. <i>compressus</i>	Yassı hasırotu	A+L		EN	
LAMIACEAE					
<i>Phlomis armeniaca</i> Willd.	Bozşavlak	A+L	İran-Turan elementi	LC	

*A+L (Arazi+Literatür) **EN (Endangered-Tehlikede), CD (Least Concern-Korumaya tabi), NT (Near Threatened- Tehlide açık), VU (Vulnerable-Duyarlı), LC (Least Concern-Düşük riskli)



Şekil 1. Yüksekova Havzası doğal olarak yetişen ve tehdit altında bulunan bazı bitki taksonlara ait görseller

Türkiye dahil olmak üzere küresel düzeyde iklim değişikliği ve antropojenik baskılar nedeniyle ekosistemdeki birçok canlı türünün nesli tehdit altındadır. Özellikle son yıllarda etkisi daha fazla hissedilen küresel ısınmanın sulak ekosistemleri daha fazla etkilediği bilinmektedir. Bununla beraber sulak ve çayırılık alanlarının tarım arazilerine dönüştürülmesi yayılım gösteren bitki türlerin yok olmasına neden olmaktadır. Bu yönüyle Yüksekova havzasında yer alan “Nehil Sazlığı” drenaj faaliyetleri ve alanı kurutma çalışmaları, bölgedeki biyolojik çeşitliliği (özelliklede sucul ve geofit türlerin) açısından tehdit oluşturmaktadır. Bu yönüyle bölgede hem doğal ekosistemin hem de tarım ekosistemin sürdürülebilirliği açısından plansız ve geliş güzel açılan drenaj kanallarının açılmasının önlenmesi biyoçeşitliliğin korunması ve sürdürülebilirliğinin sağlanması açısından önemli olacaktır. Ayrıca ovada çarpık kentleşme, çevre etki değerlendirme (ÇED) raporu dikkate alınmadan maden sahalarının açılması, yol çalışmalarının yürütülmesi ve şehir atıklarının geliş güzel doğaya bırakılması gibi faktörlerin doğal ve çevre bozulmalarına neden olmayacak şekilde planlanması ve uygulanması gerekmektedir. Endemik türler başta olmak üzere doğal floradaki bitkilerin aşırı ve bilinçsiz toplanması gibi faaliyetlerinin de önlenmesi bölgenin doğal ekosistemdeki bitki tür çeşitliliğinin geleceği açısından oldukça önemli olacaktır.

Teşekkür

Bu çalışmada elde edilen veriler **1190947** nolu **TÜBİTAK** projesi kapsamında elde edilmiştir. TÜBİTAK’a desteklerinden dolayı teşekkür ederiz.

Kaynaklar

- Anonim (2015). Yüksekova nehil sazlığı biyolojik çeşitliliği, <https://bolge14.tarimorman.gov.tr/Menu/24/Hakkari-Sube-Mudurlugu> ((Erişim:14.01.2022).
- Anonim (2018). Yüksekova İklim Verileri. T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı. Meteoroloji Genel Müdürlüğü. Ankara. (Erişim Tarihi 03.05.2023).
- Anonim (2019). Tarım ve Orman Bakanlığı, Su Yönetimi Genel Müdürlüğü, Su kalitesi yönetimi hizmet içi eğitim kitabı. 03-05. Nisan 2019 S: 10 <https://www.tarimorman.gov.tr/SYGM/Belgeler/Su%20Kalitesi%20H%C4%B0E%20Haber%202019/Sulak%20Alanlar%20ve%20Onemi.pdf> (Erişim Tarihi: 03.05.2023).
- Anonim (2023). The Iucn Red List Of Threatened Species (<http://www.iucnredlist.org>) (Erişim:03.05.2023).
- Christenhusz, M.J., Byng, J.W. (2016). The number of known plants species in the world and its annual increase. *Phytotaxa*, 261(3), 201-217. <https://doi.org/10.11646/phytotaxa.261.3.1>
- Davis, P.H. (ed.) (1965-1985). *Flora of Turkey and the East Aegean Islands*, Vol. 1-9. Edinburgh, Edinburgh University Press.
- Güner, A., Aslan, S., Ekim, T., Vural, M., Babaç, M.T. (2012). *Türkiye Bitkileri Listesi (Damarlı Bitkiler)*. İstanbul, Türkiye, Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını, 1290 pp.
- Pınar, S. M., Fidan, M., Eroğlu, H. (2018). *Muscari botryoides (L.) Mill.: A new record for the family Asparagaceae from Turkey*. *Türkiye Tarımsal Araştırmalar Dergisi*, 5(2), 116-119.
- Pınar, S. M., Fidan, M., Eroğlu, H. (2021). *Siirt İli Florasına Genel Bir Bakış*. *Commagene Journal of Biology*, 5(2), 99-125.
- Sançar, T. (2018). *Investigation of Uplift Rate History of the Yüksekova Basin (Southeast Turkey)*. *Türkiye Jeoloji Bülteni/Geological Bulletin of Turkey*, 61(2), 207-240.
- Ünal, M., Demir, i. (2019). *Hakkari İli Tüm Yüzölçüm Alanı için Karasal ve İç Su Ekosistemleri Biyolojik Çeşitlilik Envanteri ve İzleme Projesi*. Hakkari Çalışmayı. Basılmamış.

**FARKLI ARAZİ KULLANIMLARI ALTINDAKİ YÜKSEKOVA TOPRAKLARININ
KALİTE GÖSTERGESİ OLARAK ORTALAMA AĞIRLIK ÇAP'IN MEKÂNSAL
DEĞİŞİMİ**

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Özet

Toprak strüktürünün göstergelerinden biri olan ortalama ağırlık çapı (OAÇ), toprakta suya dayanıklı agregatların stabilitesini ve aynı zamanda toprakların erozyona karşı direncini ölçmek için yaygın olarak kullanılan bir indekstir. Bu nedenle de birçok araştırmacı tarafından MWD, toprak kalitesinin önemli göstergeleri arasında tanımlanmaktadır. Bu çalışmanın amaçları, farklı arazi kullanımları altındaki Yüksekova ovasında yer alan arazilerde toprakların OAÇ değerlerini belirlemek, AOÇ değerlerinin çalışma alanındaki mekânsal değişkenliğini modellemek ve haritalamaktır. Çalışma alanında oluşturulan 800x800 m'lik kare gridlerin yaklaşık köşe noktalarında 0-20 cm toprak derinliğinden toplam 232 farklı noktadan toprak örnekleri alınmış ve OAÇ değerleri belirlenmiştir. Çalışma alanında, OAÇ değerleri 0.08 mm ile 3.95 mm arasında değişim göstermiştir. Çalışma alanının çayır-mera bölgelerinde OAÇ değerleri ortalama 1.82 mm iken tarım arazilerinde AOÇ değeri yaklaşık %55 daha düşük (0.82 mm) idi. Alanda toprak işlemenin yoğun yapıldığı alanlarda organik karbon içeriğinin azalmasına bağlı olarak OAÇ değerleri önemli derecede azalmaktadır ve bunun sonucunda da ova toprakları erozyona karşı daha hassas duruma gelerek toprak kalitesinin düşmesine neden olmaktadır. Bulgular yarı-kurak ve sulama imkânlarının sınırlı olduğu Yüksekova ovasında geleneksel toprak işleme yöntemleri yerine, anızın en az %30 ve daha fazlasının arazinin yüzeyinde bırakıldığı azaltılmış toprak işleme uygulamalarının adaptasyonunun, organik karbon kaybını azaltarak OAÇ değerlerinin ve nihayetinde de toprak kalitesini iyileştirmesine katkı sağlayacaktır.

Anahtar Kelimeler: Toprak Kalitesi, Ortalama Ağırlık Çap, Agregat, Mekânsal Değişim,

**SPATIAL VARIABILITY OF MEAN WEIGHT DIAMETER AS A QUALITY
INDICATOR OF YUKSEKOVA SOILS UNDER DIFFERENT LAND USES**

Abstract

Mean weight diameter (MWD), an indicator of soil structure, is a commonly used indicator to assess the water-resistant aggregate stability in soils and also to evaluate the resilience of soils to erosion. Therefore, the MWD is identified as an important indicator of soil quality by many researchers. The objectives of this study were to i.) determine the MWD values of soils in the lands, located in the Yüksekova plain, under different land uses, and ii.) model and map the spatial variability of MWD values in the study area. Soil samples were collected from a total of 232 different points at 0-20 cm soil depth in approximately the corners of the 800x800 m square grids created in the study area and MWD values were determined. The MWD values in the study area varied between 0.08 mm and 3.95 mm. The average MWD value in meadow-pasture lands was 1.82 mm, while the MWD value was approximately 55% lower (0.82 mm) in agricultural lands. The results suggested that the implementation of reduced tillage practices, in which at least 30% or more of the stubble is left on the land surface, rather than conventional tillage in the semi-arid and restricted irrigation areas of the Yüksekova plain will contribute to the improvement of MWD values and ultimately soil quality by reducing organic carbon loss.

Keywords: Soil Quality, Mean Weight Diameter, Agregatte, Spatial Analysis

Giriş

Ortalama ağırlık çapı (OAÇ), toprakta agregatların büyüklüğüne bağlı olarak bir toprak örneğinin ortalama parçacık boyutunu tanımlamak için kullanılan bir indekstir. Ortalama ağırlık çapı, bir kısım fiziksel (infiltrasyon, hidrolik iletkenlik, boşluk oranı ve erozyona karşı direnç gösterme yeteneği gibi), kimyasal (organik maddenin parçalanma düzeyi, C/N dinamikleri ve besin döngüsü gibi) ve biyolojik (bitki kök gelişimi, mikrobiyal çeşitlilik ve aktivite gibi) toprak özelliklerine etkisi nedeni ile birçok araştırmacı tarafından toprak kalitesinin bir göstergesi olarak kullanılmıştır (Souza ve ark., 2014; Çelik ve ark., 2021; Franzluebbbers, 2022).

Agregat oluşumu ve dayanıklılığı, organik madde, kil, kireç, demir-alüminyum oksitler gibi çeşitli bağlayıcı maddelerin topraktaki miktarına bağlı olarak değişebilmektedir. Toprakta agregatlar ıslanma/kuruma, donma/çözülme ve kök büyümesi gibi faktörlerin etkisi ile bir araya gelerek farklı büyüklükte doğal yapılar oluştururlar. Oluşan bu doğal yapılar, makro ve mikro agregatlar olmak üzere 2 ayrı sınıfa ayrılırlar. Makro agregatlar, çıplak gözle görülebilen ve tipik olarak 0.25 mm'den daha büyük agregat birimleridir ve bitki büyümesi ve mikrobiyal aktivite için gerekli olan suyun tutulması, toprak profiline suyun girişi ve profil içerisindeki suyun hareketi ve hava değişimi için boşluk alanlarını sağlarlar. Mikro agregatlar ise 0.25 mm'den daha küçük olan agregat birimleridir ve toprak yapısı ve besin döngüsü için önemlidirler. Mikro agregatlar, toprak mikroorganizmaları için yaşam yeri ve gelişimleri için gerekli su ve karbon kaynağının tutulduğu geniş bir yüzey alanı sağladığından besin elementlerinin döngüsünün artmasına ve toprak verimliliğinin korunmasına da yardımcı olurlar (Wang ve ark., 2016). Toprakta makro ve mikro agregatların bir arada bulunması ve kararlı bir yapı oluşturması toprak kalitesi açısından oldukça önemlidir (Nichols ve Toro, 2011). Nitekim çok sayıda mikro agregatların bir araya gelerek oluşturduğu makro agregatların varlığı, su tutma kapasitesi, hidrolik iletkenlik, infiltrasyon, havalanma karbon/azot dinamikleri, mikrobiyal çeşitlilik ve aktivitesi üzerine önemli olumlu etkiler oluşturmaktadır.

Toprakta agregatlarının büyüklüğünü önemli kılan diğer önemli bir konu, karbon (C) dinamikleri üzerine olan etkileridir. Genel olarak, makro agregatlar mikro agregatlara kıyasla C açısından daha zengindir (Six ve ark., 2000). Ancak mikro agregatlarda yer alan toprak organik karbonu (TOK), makro agregalardaki TOK'nuna kıyasla ayrışmaya karşı daha dirençli olduğundan, toprak için rezerv C olarak nitelendirilebilir (Yılmaz ve ark., 2019). Bu nedenle, toprakta hem makro hem de mikro agregatların oluşumu, C döngüsü üzerine önemli bir etkiye sahiptir. Yudina ve ark. (2022), mikro agregatların bir araya gelerek makro agregatları oluşturduğu ve ıslanmaya karşı daha kararlı bir yapı sergilemesinin, toprakların su ve rüzgar

erozyonuna karşı direnç göstermesini sağladığını beyan etmişlerdir. Bu nedenle, agregatların su ile teması (ıslanması) sonucunda kararlı/stabil yapı sergileyip sergilemediğinin ortaya konulmasında OAÇ, önemli bir gösterge olarak kabul edilmektedir. Agregatların ıslanma sonucunda kararlı bir yapı göstermesi, mikro agregatların parçalanmaması veya diğer bir ifade ile erozyona maruz kalmaması hem kararlı karbon miktarının toprakta tutulması hem de besin döngüsü ve su depolaması açısından önemlidir.

Toprağın OAÇ değeri ne kadar büyük olursa, toprak yapısının o denli kararlı kabul edilir (Zhou ve ark., 2020). Bugüne kadar yapılan birçok çalışmada, OAÇ'nın toprak organik madde içeriği ile ilişkili olduğu bildirilmiştir (Das ve ark., 2014; Zhou ve ark., 2020). Çalışmaların çoğunda, OAÇ ve TOK arasındaki güçlü ilişki, toprak agregatlarının kararlılığına neden olduğu şeklinde yorumlanmıştır (Das ve ark., 2014). Toprak agregatlarının oluşumu, büyüklüğü ve kararlılığı toprak oluşum faktörlerinin yanı sıra toprak yönetim sistemlerine bağlı olarak önemli düzeyde değişkenlik göstermektedir (Çelik ve ark., 2021). Bu çalışmada, yarı kurak bir iklime sahip olan Yüksekova ovasında mera/biçenek ve tarım arazisi altındaki arazilerde, toprakların OAÇ değerlerinin belirlenmesi, ve jeostatistiksel yöntemler ile mesafeye bağlı değişkenliklerinin modellenmesi ve haritalanması amaçlanmıştır.

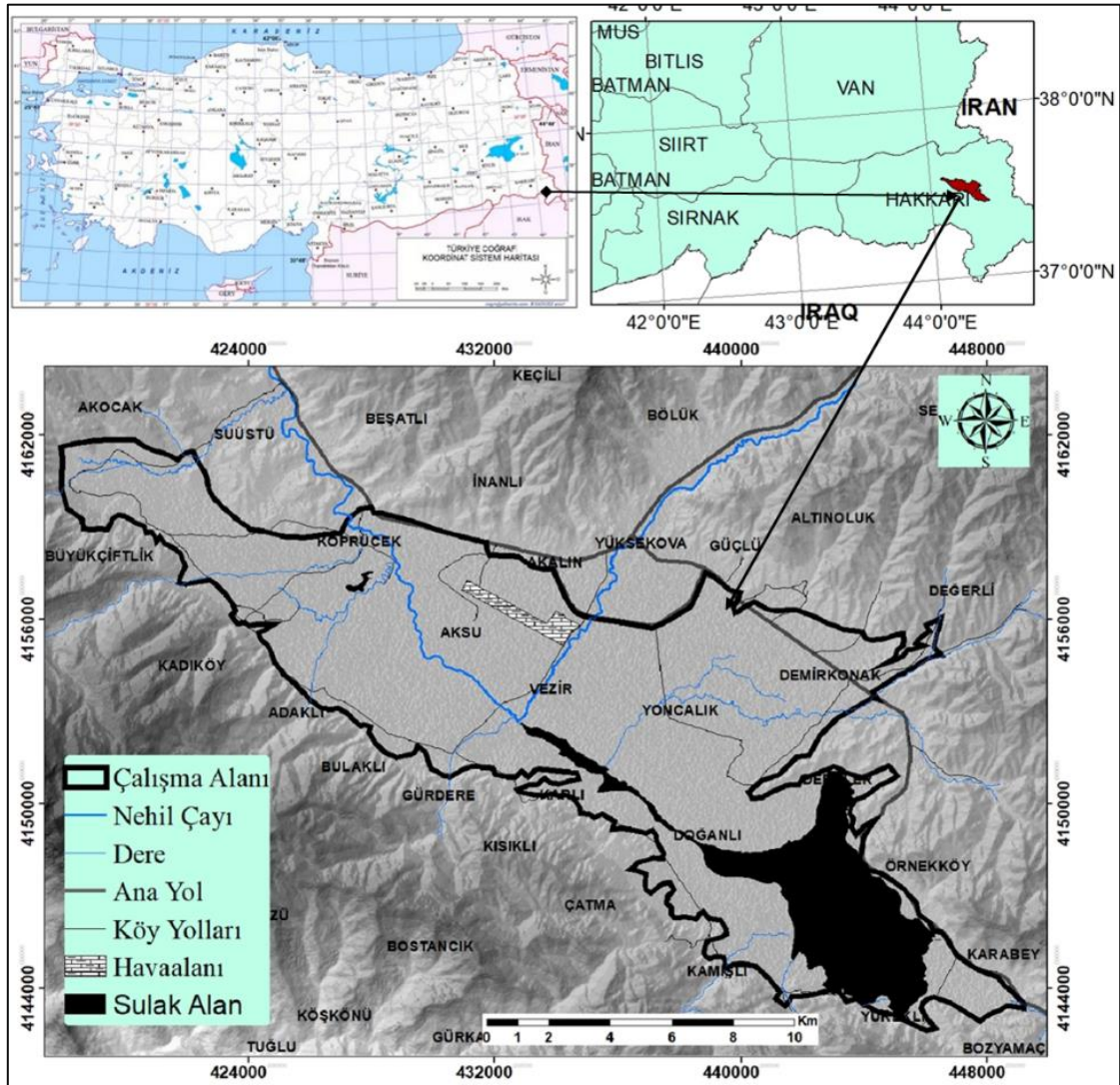
Materyal Metod

Çalışma alanı

Çalışma alanı, 37°25'49" - 37°36'32" K enlemleri ile 44°04'21" - 44°22'56" D boylamları arasında yer almaktadır. Yaklaşık 17.5 bin ha'dan oluşan çalışma alanı etrafı yüksek dağlarla çevrili bir çöküntü ovasıdır (Şekil 1). Yirminci yüzyılın ortalarına kadar büyük çoğunluğu sulak alanlardan oluşan Yüksekova ovasında yağışların azalması, ovadaki yerleşim ve tarımsal üretim için yeni arazi arayışı gibi insan etkisi nedeniyle sulak alanlar önemli miktarda azalmıştır. Uzun yıllar (1979-2018) ortalama yıllık yağış miktarı 762 mm, ortalama yıllık buharlaşma ise 850 mm'dir. Yıllık ortalama sıcaklık 6.9 °C olup en düşük ortalama sıcaklık Ocak (-9.3°C) ve en yüksek ortalama sıcaklık Temmuz (21.3 °C) ayında gerçekleşmektedir. Yüksekova'da yaz mevsimi çok kısa ve kış mevsimi ise oldukça uzundur. Son 40 yıllık iklim verilerine göre yıllık ortalama 96 gün yağışlı geçmekte olup bunun 43 gününde kar yağışı görülmektedir. Yaklaşık 1 m'lik kar örtüsünün görüldüğü çalışma alanı ortalama 120 gün kar ile kaplı kalmaktadır (Anonim, 2019).

Yüksekova ovasındaki arazilerin önemli bir kısmında tarla tarımı yapılmakla beraber büyük çoğunluğu sulak alanların kurumasından sonra oluşan çayır-mera (büyük çoğunluğu biçenek olarak kullanılmaktadır) alanlarından oluşmaktadır. Zira toprak örnekleme noktalarından 130'u

çayır/mera alanlarına, geriye kalan 102'si ise ekili alanlara denk gelmiştir. Ekili tarım arazilerine dönüştürülen alanlarda yoğunlukla buğday ve yonca olmak üzere nohut ve fiğ yetiştiriciliği yapılmaktadır. Çayır-mera olarak kullanılan alanlarda ise çoğunlukla saz çimi (*Calamagrostis pseudophragmites* (Haller) Koeler), çayır it kuyruğu (*Phleum pratense* L.), eres çimi (*Lolium persicum* Boiss. & Hohen.) yumrulu salkım (*Poa bulbosa* L.), sina ayak otu (*Carex* spp), seyrek saz (*Eleocharis* spp.), yonca (*Medicago sativa* L. subsp. sativa), ak üçgül (*Trifolium repens* L. var. repens), at kuyruğu (*Equisetum arvense* L.), çayır üçgülü (*Trifolium pratense* var. pratense L.), dere nanesi (*Mentha longifolia* (L.) subsp. typhoides (Briq.) Harley), kırk damar otu (*Plantago lagopus* L.), ibubuk otu (*Bromus danthoniae* Trin. subsp. *Danthoniae*), cilo düğün çiçeği (*Ranunculus arvensis* L.) ve çınarcık (*Ranunculus sericeus* Banks & Sol.) bitkileri bulunmaktadır.



Şekil 1. Çalışma alanının konumu

çapraz değerlendirme yöntemi ile toprak örneği alınan noktaların AOÇ değerleri kullanılarak, elde edilen model kullanılarak örneklenmeyen noktaların OAÇ değerlerinin tahmin değerleri arasındaki ilişki düzeyi belirlenmiştir. Semivariogram elde edilmesi ve çapraz değerlendirme işlemleri ile elde edilen parametreler (nugget, sill, range, aktif lag değeri ve komşu sayısı) kullanılarak, ArcGIS 10.8 paket programının jeostatistik modülünde yer alan ordinary kriging yöntemi ile mekânsal değişim haritası hazırlanmıştır.

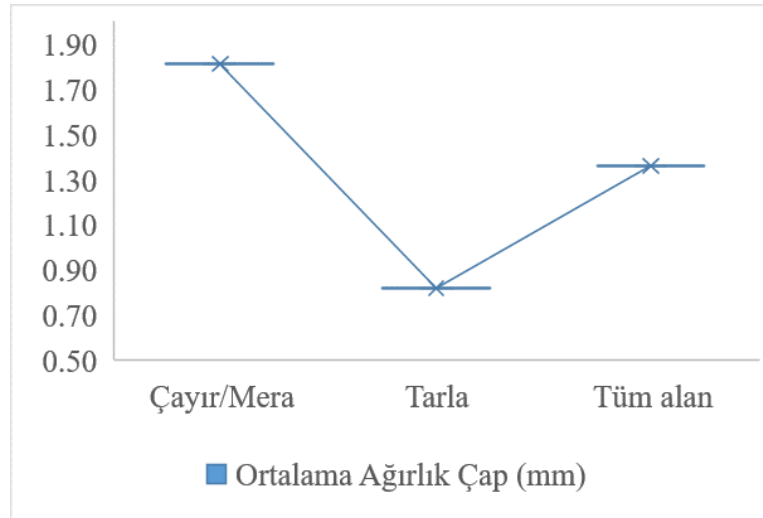
Bulgular ve Tartışma

Tanımlayıcı İstatistik Verileri

Farklı arazi kullanımlarının bulunduğu Yüksekova ovasında toprakların ortalama ağırlık çapı değerlerine ait istatistiksel parametreler Tablo 1’de verilmiştir. Çalışma alanında OAÇ değerleri 0.08 mm ile 3.95 mm arasında değişmekte olup ortalama OAÇ değeri 1.36 mm’dir. Farklı arazi kullanımlarının OAÇ’na olan etkisi ortaya koymak için mera/biçenek ve tarla bitkilerinin olduğu arazilerden alınan örnekler ayrı değerlendirilmiştir. Mera/biçenek alanlarına ait toprakların OAÇ değerleri tarım arazilerine kıyasla çok daha yüksek idi (Tablo 1). İşlemeli tarımın yapıldığı arazilerde toprakların OAÇ değeri 0.82 mm iken çayır/mera alanlarında bu değer 1.81 mm olarak ölçülmüştür (Tablo 1; Şekil 3). Mera/biçenek olarak kullanılan arazilerinin topraklarında, işlemeli tarım yapılan arazilere kıyasla daha yüksek organik madde birikmiş olması, daha yüksek olan OAÇ değerlerinin ana nedenidir. Budak ve ark. (2023). Yüksekova ovasında mera alanlarında ilk 10 cm toprak derinliğinde TOK içeriğinin ortalama 51.65 g kg^{-1} , işlemeli arazilerde ise 23.59 g kg^{-1} olduğunu bildirmiştir. Bu durum çalışma alanında OAÇ değerlerinin artmasında organik maddenin daha yüksek olmasının etkili olduğunu ortaya koymaktadır. Bugüne kadar yapılan birçok çalışmada da toprakta organik madde birikiminin makro-agregat oluşumunu önemli derecede arttırdığı bildirilmiştir (Six ve ark., 2000; De Gryze et al., 2005; Yılmaz ve ark., 2019).

Tablo 1. Çalışma alanı topraklarının ortalama ağırlık çapı değerlerine ait istatistiksel veriler

	N	En Küçük	En Büyük	Ortalama	S.Sapma	Vary. Kats.	Basıklık	Çarpıklık
			mm			%		
Tüm Veri	232	0.08	3.95	1.36	0.89	65.70	-0.52	0.59
Çayır/Mera	129	0.15	3.95	1.81	0.86	47.66	-0.72	0.14
Tarım Arazisi	103	0.08	3.05	0.82	0.59	71.86	1.81	1.24



Şekil 3. Farklı arazi kullanımları altındaki toprakların ortalama OAC değerleri (mm).

Ortalama Ağırlık Çapı Değerlerinin Mekânsal Değişiminin Modellenmesi ve Haritalanması

Yüksekova ovası topraklarının ortalama ağırlık çapı değerlerinin mekânsal değişkenliğinin tanımlanmasında kullanılan semivariogram modeline ait parametreler Tablo 2’de verilmiştir. Çalışma alanı için OAC değişkenliğini en iyi tanımlayan model küresel (spherical) model olmuştur. Arazide toprak özeliğinin mekânsal bağımlılığın boyutunun karakterize edilmesinde uzaysal bağımlılık yaygın olarak kullanılmaktadır. Ova topraklarında OAC değerleri için elde edilen uzaysal bağımlılık değeri %45.57 olup (Tablo 2) Wang and Shao (2013)’e göre uzaysal bağımlılık orta düzeydedir. Örnekler arası uzaysal bağımlılığın çok kuvvetli olmaması kısa mesafelerde örnekler arası benzerliğin azaldığına işaret etmektedir. Bu durum, etraftaki yüksek arazilerden ovaya inen Nehil çayının yanı sıra birçok dere yatağının alana farklı karakterdeki materyalleri depolamış olması ile ilişkilendirilebilir. Ayrıca, arazi kullanımlarında kısa mesafelerdeki değişimler de toprak organik karbon içeriğinin kısa mesafelerde farklılaşmasına neden olduğundan (Budak ve ark., 2023), çalışma alanında OAC değerleri kısa mesafelerde değişmektedir.

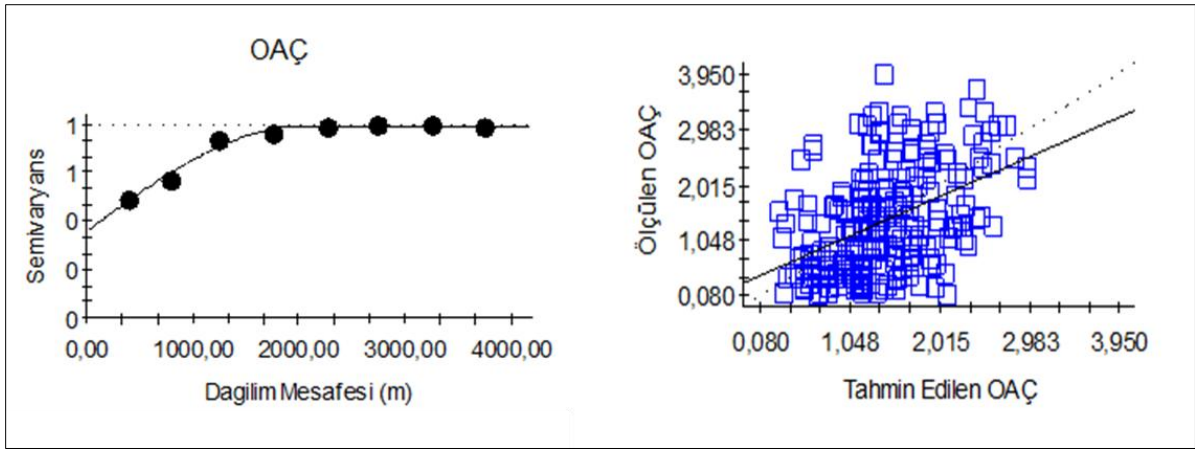
Tablo 2. Çalışma alanı topraklarının OAC değerlerinin mesafeye bağlı değişkenliğinin modellenmesinde kullanılan semivariyograma ait parametreler

OAC	Semivariogram					Çapraz Değerlendirme		
	Model	Nugget	Sill	% UB	Range	RSS	r^2	Komşu sayısı
Küresel	0.36	0.79	45.57	2032	1.89E-03	0.98	4	0.70

*OAC: ortalama ağırlık çapı; UB: Uzaysal bağımlılık; RSS: Artık Kareler Toplamı

Tahmin edilen iki nokta arasındaki benzerliğin anlamlı olduğu mesafesinin belirlenmesinde range değeri kullanılmaktadır (Iqbal ve ark., 2005). Range değerleri ovada benzerliğin 2032

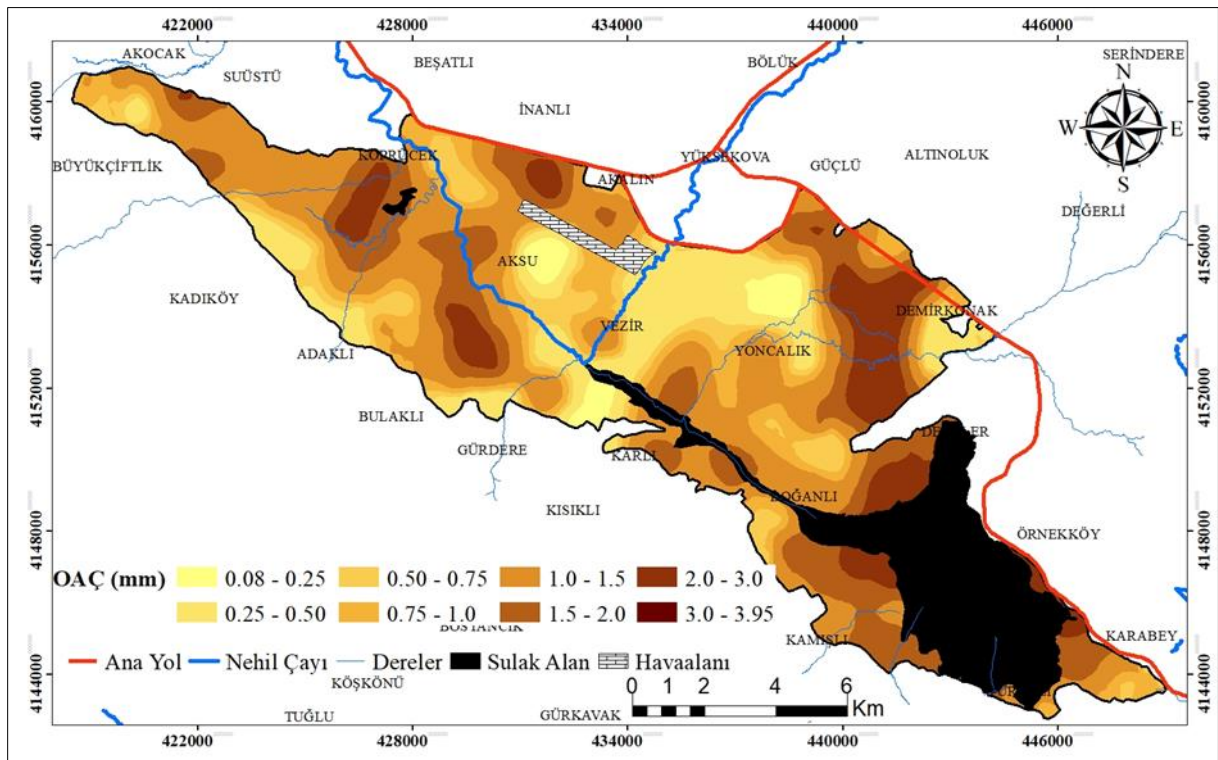
m'ye kadar anlamlı olduğu bu mesafeden sonra ise, anlamlı bir otokorelasyonun olmadığı anlaşılmaktadır (Şekil 4). Arazi yönetim sistemleri yanı sıra toprak organik C, kil ve kireç içeriğindeki değişimler OAÇ değerlerinin mekânsal değişimi üzerinde önemli bir etkiye sahiptir. Zira bu özellikler kısa mesafelerde dahi toprak toprakların birçok fiziksel (agregat stabilitesi, hidrolik iletkenliği, boşluk oranı, su tutma kapasitesi), kimyasal (katyon değişim kapasitesi, besin elementi depolama durumu) ve biyolojik (mikrobiyal çeşitlilik) özelliklerinin değişmesine neden olmaktadır (Kühn ve ar., 2009; Summers ve ark., 2011; Salehi ve ark., 2011; Naimi ve ark., 2021).



Şekil 4. Çalışma alanı topraklarının OAÇ için edilen semivariogram modeli ve çapraz doğrulama grafiği

Semivariogram modelleri oluşturulduktan sonra ordinary kriging yöntemi ile hazırlanan OAÇ ait mekânsal dağılım haritası şekil 5'te verilmiştir. Çalışma alanının güneydoğusunda yer alan sulak alan etrafındaki arazilerde ve sulak alan niteliğini kaybedip mera alanlarına dönüşen arazilerde (Köprücek göyünün Güneyi, Demirkonak köyünün Güney ve Güney Batı'sı) OAÇ değerleri 2 ile 3.95 mm arasında değişim gösterirken tarım arazilerine dönüştürülen (Aksu, Vezirli ve Yoncalık köylerinin yakınları) arazilerde OAÇ değerleri yer yer 0.08 mm'ye kadar düşmüştür (Şekil 5). Bu durum, özellikle pulluk gibi toprağı ters çevirerek işleyen aletlerin kullanılması, organik maddenin hızla ayrışıp azalması ile ilişkilidir. Rakotovao ve ark.. (2017), toprak işleme uygulamalarının organik maddenin daha fazla ayrışmasına neden olduğunu ve zaman içerisinde toprakta organik karbon kayıplarının hızlandığını bildirmiştir. Sürekli olarak işlenen tarım arazilerinde topraktaki makro agregatlar parçalanmakta, toprakta havalanma artmakta ve özellikle mikro agregatlar içerisinde korunan organik karbon mineralize olmaktadır. Mineralizasyonun şiddetine bağlı olarak toprakta organik madde içeriğinde önemli azalmalar meydana gelmektedir. Çalışma alanında farklı ana materyallerin olması yanı sıra

arazi kullanımlarındaki değişimlerden kaynaklanan organik karbondaki değişimler OAC değerlerinin yüksek bir değişkenlik deseni sergilemesine neden olmuştur. Bir arazide, OAC değerlerinin (agregat çaplarının) yüksek olması toprakların havalanma, suyun infiltrasyonu ve hidrolik iletkenlik gibi birçok fiziksel özeliğine olumlu etkide bulunmaktadır. Bu durum suya daha dayanıklı agregatların oluşmasına (Zhang ve ark., 2016; Guo ve ark., 2020) ve aynı zamanda toprakların erozyona karşı direncinin artmasına neden olmaktadır (Marakoğlu ve ark., 2019). Özellikle de yoğun toprak işleme, yöntemleri topraktaki agregatların parçalanmasına neden olduğundan erozyona karşı direncin azalmasına ve nihayetinde de toprak kalitesinin azalmasına neden olmaktadır.



Sonuç

Yüksekova ovası topraklarında ortalama ağırlık çap değerinin yüksek olması, yüksek organik madde içeriği ile ilişkilidir. Ancak, tarımsal üretim için kullanılan arazilerde, organik madde içeriğinin azalması OAC değerlerinin de hemen yakınlarındaki mera veya biçenek olarak kullanılan ve yüksek organik madde içeriğine sahip arazilerdeki OAC değerlerine kıyasla önemli miktarda düşük olmasına yol açmıştır. Dünyanın birçok yerinde olduğu gibi, çalışma alanında da toprak işlemenin neden olduğu en önemli bozulmaların başında organik madde

kaybı ile birlikte, agregatların dayanıklılıklarının azalması ve erozyona karşı hassas hale gelmeleri gelmektedir. Toprak işlemede pulluk kullanımının yer aldığı geleneksel uygulamalardan koruyucu işleme uygulamalarına geçiş, toprak profili içinde toprak organik maddesinin birikmesine, zamanla agregatların dayanıklılığının artmasına ve ekosistem hizmetlerinin iyileştirilmesine önemli katkı sağlayacaktır. Toprağın suyu tutma yeteneği, özellikle suyun sınırlı olduğu kurak ve yarı kurak bölgelerde çok daha önemlidir. Toprak işleme uygulamalarının yarayışlı su içeriği üzerine etkilerinin incelendiği birçok çalışmada, sıfır ve azaltılmış toprak işleme uygulamaları altında toprakta organik madde birikimi geleneksel uygulamalara kıyasla daha yüksek olduğundan, yarayışlı su içeriğinin de yüksek olduğu bildirilmiştir. Bu nedenle, özellikle yarı-kurak bir karakterde olan ve sulama imkânlarının sınırlı olduğu Yüksekova ovasında geleneksel toprak işleme yerine, sıfır veya azaltılmış toprak işleme uygulamalarının adaptasyonu, kararlı agregatların oluşmasına ve nihayetinde de toprak kalitesini iyileştirerek sürdürülebilirliğine katkı sunacaktır.

Teşekkür

Bu çalışmada elde edilen veriler 1190947 nolu TÜBİTAK proje kapsamında elde edilmiştir. TÜBİTAK'a desteklerinden dolayı teşekkür ederiz.

Kaynaklar

- Anonim (2019). Yüksekova İklim Verileri. T.C. Çevre, Şehircilik Ve İklim Değişikliği Bakanlığı. Meteoroloji 45nGenel Müdürlüğü. Ankara. (Erişim Tarihi 15.01.2023).
- Budak, M., Çelik, İ., Acir, N., Fidan, M., Farooq, Ş., Yıldız, H., Günal, E., Sirri, M., Köroğlu F. 2023. Yüksekova Havzasında İklim ve Arazi Kullanımı Değişimlerinin Ekosistem Servisleri Üzerine Etkisinin Değerlendirilmesinde Toprak Fonksiyonlarının Kullanılması. TÜBİTAK 119O947 Sonuç Raporu. S: 189-190. Ankara.
- Das, B., Chakraborty, D., Singh, V. K., Aggarwal, P., Singh, R., & Dwivedi, B. S. (2014). Effect of organic inputs on strength and stability of soil aggregates under rice-wheat rotation. *International Agrophysics*, 28(2).
- De Gryze, S., Six, J., Brits, C., & Merckx, R. (2005). A quantification of short-term macroaggregate 566outh566566s: influences of wheat residue input and texture. *Soil Biology and Biochemistry*, 37(1), 55-66.
- Franzluebbers, A. J. (2022). Soil mean-weight diameter and stability index under contrasting tillage systems for cotton production in North Carolina. *Soil Science Society of America Journal*, 86(5), 1327-1337.
- Guo, Y., Fan, R., Zhang, X., Zhang, Y., Wu, D., McLaughlin, N., ... & Liang, A. (2020). Tillage-induced effects on SOC through changes in aggregate stability and soil pore structure. *Science of the Total Environment*, 703, 134617.
- Iqbal, J., Thomasson, J. A., Jenkins, J. N., Owens, P. R., & Whisler, F. D. (2005). Spatial variability analysis of soil physical properties of alluvial soils. *Soil Science Society of America Journal*, 69(4), 1338-1350.
- Kemper, W. D., ve Rosenau, R. C. (1986). Aggregate stability and size distribution. In: Klute A, 566outh566. *Methods of soil analysis. Part 1. Physical and mineralogical methods.* Madison, WI. P 425-442.
- Kühn, J., Brenning, A., Wehrhan, M., Koszinski, S., & Sommer, M. (2009). Interpretation of electrical conductivity patterns by soil properties and geological maps for precision agriculture. *Precision Agriculture*, 10, 490-507.
- Naimi, S., Ayoubi, S., Demattê, J. A., Zeraatpisheh, M., Amorim, M. T. A., & Mello, F. A. D. O. (2021). Spatial prediction of soil surface properties in an arid region using synthetic soil image and machine learning. *Geocarto International*, 1-24.
- Nichols, K. A., & Toro, M. (2011). A whole soil stability index (WSSI) for evaluating soil aggregation. *Soil and Tillage Research*, 111(2), 99-104.
- Salehi, M. H., Beni, O. H., Harchegani, H. B., Borujeni, I. E., & Motaghian, H. R. (2011). Refining soil organic matter determination by loss-on-ignition. *Pedosphere*, 21(4), 473-482.
- Shukla, M. K., Lal, R., & Ebinger, M. (2006). Determining soil quality indicators by factor analysis. *Soil and Tillage Research*, 87(2), 194-204.
- Six, J., Elliott, E. T., & Paustian, K. (2000). Soil structure and soil organic matter II. A normalized stability index and the effect of mineralogy. *Soil Science Society of America Journal*, 64(3), 1042-1049.

- Souza, E. D., Costa, S. E. V. G. A., Anghinoni, I., Carneiro, M. A. C., Martins, A. P., & Bayer, C. (2014). Soil quality indicators in a Rhodic Paleudult under long term tillage systems. *Soil and Tillage Research*, 139, 28-36.
- Summers, D., Lewis, M., Ostendorf, B., & Chittleborough, D. (2011). Visible near-infrared reflectance spectroscopy as a predictive indicator of soil properties. *Ecological Indicators*, 11(1), 123-131.
- Wander, M. M., Bollero, G. A. (1999). Soil quality assessment of tillage impacts in Illinois. *Soil Science Society of America Journal*, 63(4), 961-971.
- Wang, Y.Q., Shao, M.A., 2013. Spatial variability of soil physical properties in a region of the Loess Plateau of PR China subject to wind and water erosion. *Land Degradation and Development*, 24(3): 296-304.
- Wang, J. G., Yang, W., Yu, B., Li, Z. X., Cai, C. F., & Ma, R. M. (2016). Estimating the influence of related soil properties on macro-and micro-aggregate stability in ultisols of 567outh-central China. *Catena*, 137, 545-553.
- Yang, F., Zhang G., Yin X., Liu Z. 2011. Yang, F., Zhang, G., Yin, X., Liu, Z., 2011. Field-scale spatial variation of saline-sodic soil and its relation with environmental factors in Western Songnen Plain of China. *International Journal Of Environmental Research and Public Health*, 8(2): 374-387.
- Yılmaz, E., Çanakcı, M., Topakcı, M., Sönmez, S., Ağsaran, B., Alagöz, Z., ... & Uras, D. S. (2019). Effect of vineyard pruning residue application on soil aggregate formation, aggregate stability and carbon content in different aggregate sizes. *Catena*, 183, 104219.
- Yudina, A. V., Klyueva, V. V., Romanenko, K. A., & Fomin, D. S. (2022). Micro-within macro: How micro-aggregation shapes the soil pore space and water-stability. *Geoderma*, 415, 115771.
- Zhang, Z., Zhang, X., Mahamood, M., Zhang, S., Huang, S., & Liang, W. (2016). Effect of long-term combined application of organic and inorganic fertilizers on soil nematode communities within aggregates. *Scientific reports*, 6(1), 1-12.
- Zhou, M., Liu, C., Wang, J., Meng, Q., Yuan, Y., Ma, X., ... & Du, W. (2020). Soil aggregates stability and storage of soil organic carbon respond to cropping systems on Black Soils of Northeast China. *Scientific Reports*, 10(1), 265.

**YÜKSEKOVA OVASI TOPRAKLARININ SU DOLU GÖZENEK HACMI VE AZOT
GAZLARI EMİSYONU POTANSİYELİ**

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Özet

Toprağın su içeriği ve toplam gözeneklilik değerleri kullanılarak hesaplanan su ile dolu gözenek hacmi (SDGH), toprak mikrobiyal aktivitesi ve özellikle de azot gazı emisyonları ile yakından ilişkilidir. Bu çalışma, Yüksekova ovası yüzey topraklarının SDGH değerlerinin belirlenmesi, fiziksel, kimyasal ve biyokimyasal özellikleri ile olan ilişkisinin belirlenmesi ve mekânsal dağılımının modellenerek haritalanması amacı ile yapılmıştır. Ayrıca, SDGH ile gerçekleşmesi muhtemel azot emisyonları arasındaki ilişkinin tartışılması da çalışmanın öncelikleri arasındadır. TÜBİTAK tarafından desteklenen, kapsamlı bir projenin amaçlarını gerçekleştirmek için yapılan toprak örneklerine ait veriler çalışmanın materyalini oluşturmaktadır. Çalışma alanından toplam 232 yüzey toprağı alınmış ve çeşitli fiziksel, kimyasal ve biyokimyasal özellikleri belirlenmiştir. Çalışma alanında SDGH değerleri % 38.8 ile %96.0 arasında değişmekte olup, ortalama SDGH değeri %69.6 olarak hesaplanmıştır. Literatürde, çalışılan toprak ve iklim özelliklerine bağlı olarak, mikroorganizma faaliyetleri ve azot emisyonu için kritik eşik olarak kabul edilen değer >%60-70'dir. Buna göre çalışma alanında, bir kısım arazilerde, azot emisyonu önemli bir sorun değil iken, bir kısım araziler için yüksek SDGH değerleri azot emisyonunun da yüksek olabileceğinin göstergesi olarak düşünülmelidir. Toprakların kil, hacim ağırlığı ve üreaz enzim aktivitesi ile önemli düzeyde pozitif ilişkisi olduğu tespit edilen SDGH değerlerinin, makro gözenek miktarı, organik madde içeriği ve mikrobiyal biyokütle karbonu ile önemli düzeyde negatif bir ilişkisi olduğu tespit edilmiştir. Sonuçlar, Yüksekova ovasının genelinde topraklardan azot emisyonu potansiyelinin yüksek olduğunu göstermektedir. Özellikle tarım arazilerinde, drenaj sisteminin kurulması SDGH değerlerinin dolayısı ile de azot emisyonunun azalmasına katkı verecektir. Bununla birlikte, halihazırda biçenek olarak kullanılan veya sulak alan olarak tanımlanan arazilerde ise kesinlikle drenaj faaliyetleri yapılmamalıdır. Zira, bu arazilerde uzun yıllar içinde depolanan topraktaki karbonun atmosfere salınımı, atmosferik karbon miktarının artmasına ve bu toprakların verimliliğinin azalmasına neden olacaktır.

Anahtar Kelimeler: Üreaz enzim aktivitesi, makro gözeneklilik, azot gazları, emisyon, sulak alan

**WATER FILLED PORE VOLUME AND NITROGEN GASES EMISSION
POTENTIAL OF THE SOILS OF YÜKSEKOVA PLAIN**

Abstract

Water filled pore space (WFPS), which is calculated using soil water content and total porosity values, is closely related to soil microbial activity and especially nitrogen gases emissions. This study was carried out to i.) determine the SDGH in surface soils of Yüksekova plain, ii.) assess the relationship of SDGH with physical, chemical and biochemical properties and iii.) model and map the spatial distribution of SDGH. In addition, discussing the relationship between SDGH and possible nitrogen emissions is among the priorities of the study. The material of the study consists of data obtained from soil sampling carried out to achieve the objectives of a large-scale project funded by TÜBİTAK. A total of 232 surface soils were collected from the study area and various physical, chemical and biochemical properties were determined. The SDGH values in the study area varied between 38.8% and 96.0% and the average SDGH value was 69.6%. In the literature, the critical threshold of WFPS value for microorganism activities and nitrogen emission is >60-70%, depending on the soil and climate characteristics studied. Accordingly, while nitrogen emission is not a significant problem in some lands in the study area, high SDGH values for some lands should be regarded as an indicator of high nitrogen emission. The SDGH values of the soils had a significant positive correlation with clay, bulk density and urease enzyme activity, while they had a significant negative correlation with macroporosity, organic matter content and microbial biomass carbon. The findings indicate a high potential of nitrogen emission from the soils in Yüksekova plain. Establishment of drainage systems, especially in agricultural lands, will decrease the SDGH values and therefore nitrogen emission. However, drainage activities should definitely be avoided on lands that are currently used as mowing or defined as wetlands. The emission of the stored carbon in the soils to the atmosphere over a long period of time will cause an increase of atmospheric carbon content and a decline in the fertility of the soils.

Keywords: Urease enzyme activity, macroporosity, nitrogen gases, emission, wetland

Giriş

Küresel ısınmaya katkı potansiyeli ile karbondioksitten 298 kat daha etkili bir sera gazı olan azot oksit (N₂O)'in atmosferdeki konsantrasyonu 1750 yılından bu yana %20 artarak 2011'de küresel olarak ortalama 324 ppb'ye ulaşmıştır. Atmosferdeki artışın en temel nedeni ise tarımsal faaliyetler olarak nitelendirilmektedir (IPCC, 2014). Küresel ölçekte yıllık salınan N₂O'in yaklaşık %60-70'i topraktaki mikrobiyal süreçlerin bir ara ürünü (örn. nitrifikasyon, denitrifikasyon) şeklinde salınır. Bu salınım topraktaki azot varlığı, toprağın su içeriği ve havalanma oranına bağlı olarak önemli miktarda değişkenlik göstermektedir (Butterbach-Bahl ve ark., 2013).

Toprakta N₂O oluşumuna neden olan nitrifikasyon ve denitrifikasyon süreçleri, topraktaki su dolu gözenek hacmi (SDGH), oksijen miktarı, toprak sıcaklığı ve toprak nitrat ve amonyum konsantrasyonları gibi çeşitli değişkenlere bağlı olarak gerçekleşmektedir (Butterbach-Bahl ve ark. 2013). Su dolu gözenek hacmi terimi, toprak hacim ağırlığı farklılıklarını normalleştirmede etkili olduğu, ancak SDGH'nin toprak türleri arasında aerobik mikrobiyal aktiviteyi düzenlemede özellikle yeterli olmadığı ifade edilmiştir (Schjønning ve ark. 2003). Schjønning ve ark. (2003), optimum net nitrifikasyon için SDGH değerlerini tınlı kum (L1 toprağı, %11 kil), tınlı (L3 toprağı; %22 kil) ve siltli kil (L5 toprağı; %35 kil) şeklinde 3 farklı tekstüre sahip topraklar için sırasıyla 0.63, 0.83 ve 0.82 olarak rapor etmiştir. Araştırmacılar, kil içeriği nispeten yüksek olan topraklar için belirledikleri optimum SDGH (0.82-0.83) değerlerinin Franzluebbbers (1999) tarafından bildirilen değerlerden çok daha yüksek olduğunu belirtmişlerdir. Bunu yanında kum içeriği yüksek olan L1 toprağı için çok daha düşük bir optimum değer elde edilmiş olması, toprak türleri arasında SDGH değerlerinin 'evrensel' olmadığını göstermektedir. Stanford ve Epstein (1974) en yüksek nitrifikasyon oranlarının %80 ila 90 SDGH'de olduğunu belirtirken, Franzluebbbers (1999) farklı toprak tipleri için ortalama SDGH'nin %42 olduğunu bildirmiştir.

Dört farklı organik madde uygulamasının yağışlı ve kurak mevsimlerde N₂O emisyonuna üzerine etkisinin toprağın SDGH ile olan ilişkisini inceleyen Ariani ve ark. (2021), toprakta SDGH >%45 olması durumunda, topraktan atmosfere N₂O salınımının gerçekleştiğini bildirmişlerdir. İki farklı SDGH (%20-70)'inde gübrelenmiş (200 kg N ha⁻¹) siltli tınlı tekstüre sahip bir toprakta denitrifikasyon, ototrofik nitrifikasyon ve heterotrofik nitrifikasyon sırasında meydana gelen N₂O üretimini belirlemek için Batemann ve Baggs (2005) kararlı izotop ve asetilen inhibisyon tekniklerinin ilk kez birlikte kullanılmıştır. Artan SDGH ile birlikte

atmosfere yayılan N₂O miktarında önemli düzeyde artış olduğu tespit edilmiştir. Araştırmacılar, gübre uygulanan SDGH'nin %70 olduğu uygulamada gerçekleşen N₂O emisyonunun, deneme boyunca SDGH %20 ve 60 olan uygulamalara kıyasla 6 ve 16 kat daha yüksek olduğunu bildirmişlerdir. Bu durum, SDGH %70 olduğunda topraktaki mikro gözeneklerin ağırlıklı olarak anaerobik olmasının denitrifikasyonun artması ile açıklanmıştır. Ayrıca, SDGH 35% ve %50 olan uygulamalarda 24 gün boyunca yayılan toplam N₂O miktarı arasında önemli bir farklılık olmadığı ve yayılan toplam N₂O'nun %47'sinin ilk 3 günde oluştuğu belirtilmiştir. Topraklarda SDGH düzeyi %35-60 arasında olduğunda, yayılan N₂O'nun ana kaynağının denitrifikasyona kıyasla rolü genellikle yeterince önemsenmemiş olan nitrifikasyon olduğu belirtilirken, bu sürecin küresel ısınma açısından önemine vurgu yapılmıştır. SDHG düzeyi 20%'den 35%'e çıkarıldığında N₂O emisyonlarda önemli düzeyde bir artış olduğu tespit edilmiş ve bu artış SDGH %20 iken ortamda su yetersiz olduğundan N₂O üretimi için gerekli substrat difüzyonu ve mikrobiyal aktivite sınırlı olması ile ilişkilendirilmiştir.

Bu çalışma, ülkemizin en dağlık ve engebeli arazilerinin yer aldığı Hakkari ilinin, en geniş ve düz ovası olan Yüksekova ilçesinde, Yüksekova ovası topraklarının ve ovada yer alan sulak alanların toprak kalitesi ve ekosistem hizmetlerinin değerlendirilmesi amacı ile yürütülmekte olan bir TÜBİTAK projesi kapsamında elde edilen verilerden üretilmiştir. Sözlü sunu olarak hazırlanan bu çalışmada, ovada yüzey topraklarının özellikle mikroorganizma aktivitesinin önemli bir göstergesi olan SDGH'nin belirlenmesi, proje kapsamında belirlenen çeşitli fiziksel, kimyasal ve biyokimyasal özellikler ile ilişkisini ortaya koymak ve SDGH değerlerinin ovadaki alansal değişimini modelleyerek haritalamak amacı ile hazırlanmıştır. Literatürde, SDGH değeri, topraktan atmosfere azot salınımı için önemli bir gösterge olarak kabul edildiğinden, SDGH değerleri ile azot emisyonu arasındaki ilişki de bu sunu kapsamında yorumlanmıştır.

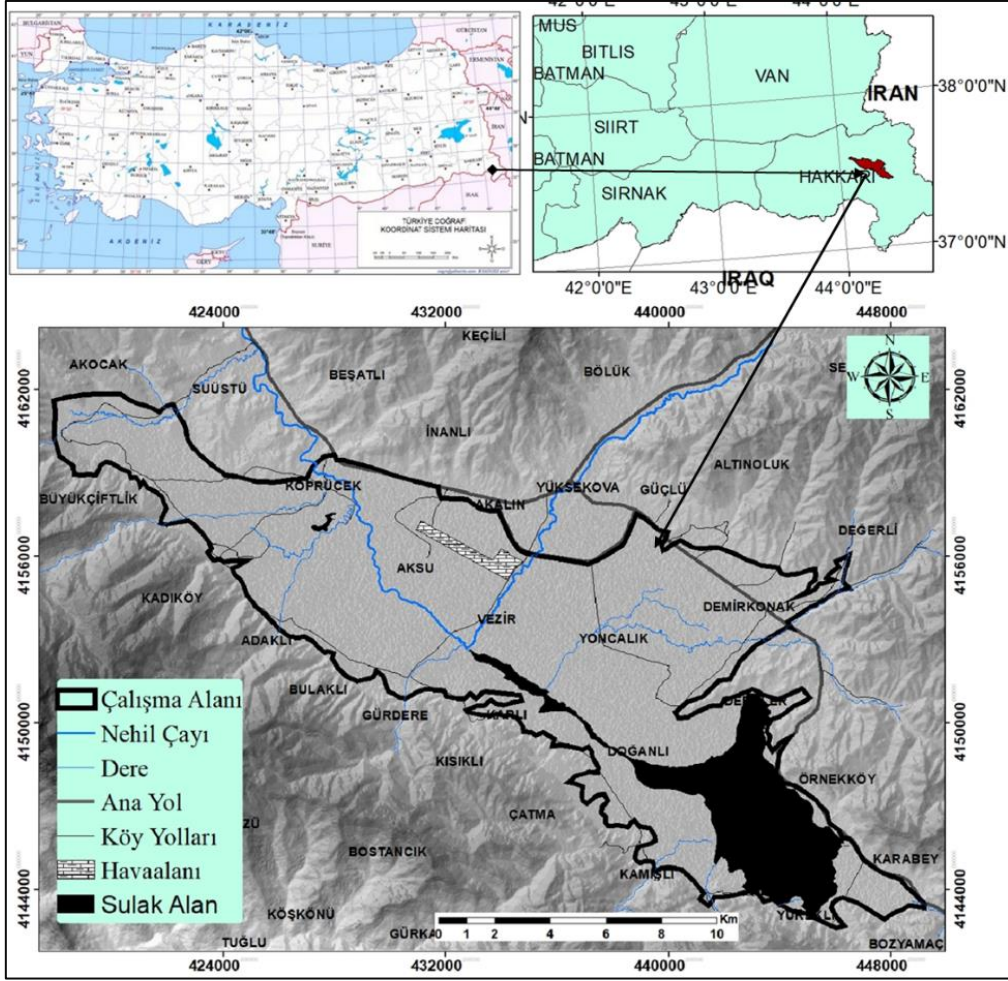
Materyal ve Yöntem

Çalışma alanı

Çalışma alanı, 37°25'49" - 37°36'32" K enlemleri ile 44°04'21" - 44°22'56" D boylamları arasında yer almaktadır. Yaklaşık 17.5 bin ha'dan oluşan çalışma alanı etrafı yüksek dağlarla çevrili bir çöküntü ovasıdır (Şekil 1). Yirminci yüzyılın ortalarına kadar büyük çoğunluğu sulak alanlardan oluşan Yüksekova ovasında yağışların azalması, ovadaki yerleşim ve tarımsal üretim için yeni arazi arayışı gibi insan etkisi nedeniyle sulak alanlar önemli miktarda azalmıştır. Uzun yıllar (1979-2018) ortalama yıllık yağış miktarı 762 mm, ortalama yıllık buharlaşma ise 850 mm'dir. Yıllık ortalama sıcaklık 6.9 °C olup en düşük ortalama sıcaklık Ocak (-9.3°C) ve en

yüksek ortalama sıcaklık Temmuz (21.3 °C) ayında gerçekleşmektedir. Yüksekova'da yaz mevsimi çok kısa ve kış mevsimi ise oldukça uzundur. Son 40 yıllık iklim verilerine göre yıllık ortalama 96 gün yağışlı geçmekte olup bunun 43 gününde kar yağışı görülmektedir. Yaklaşık 1 m'lik kar örtüsünün görüldüğü çalışma alanı ortalama 120 gün kar ile kaplı kalmaktadır (Anonim, 2019).

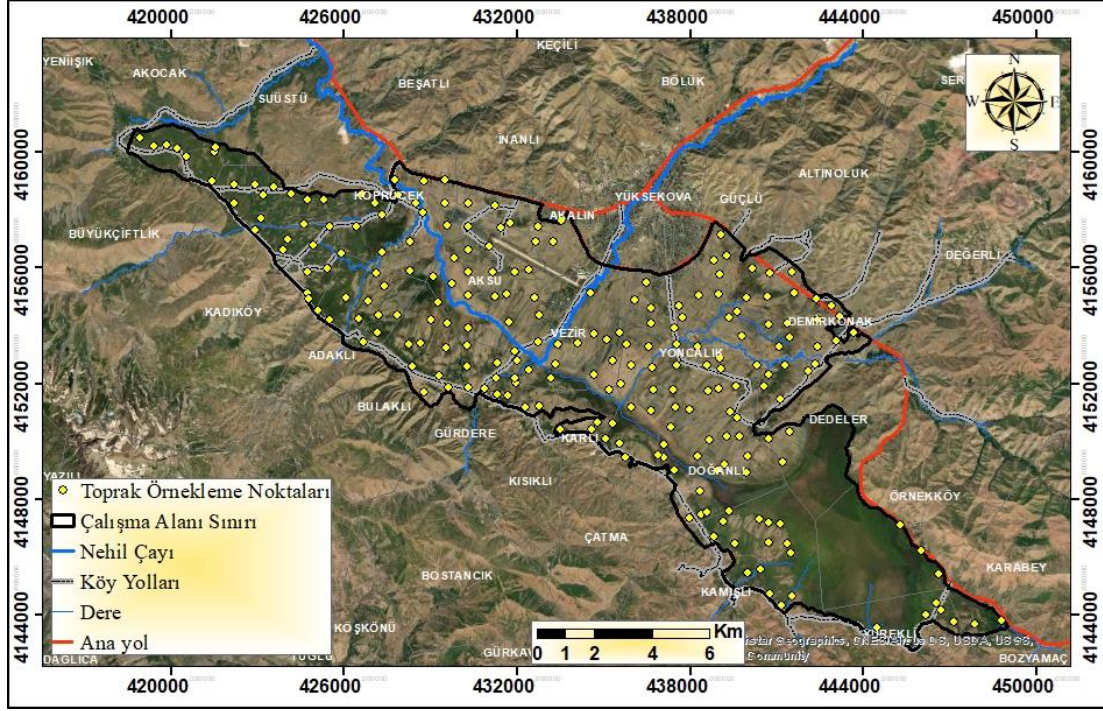
Yüksekova ovasındaki arazilerin önemli bir kısmında tarla tarımı yapılmakla beraber büyük çoğunluğu sulak alanların kurumasından sonra oluşan çayır-mera (büyük çoğunluğu biçenek olarak kullanılmaktadır) alanlarından oluşmaktadır. Zira toprak örnekleme noktalarından 130'u mera/biçenek alanlarına, geriye kalan 102'si ise ekili alanlara denk gelmiştir. Ekili tarım arazilerine dönüştürülen alanlarda yoğunlukla buğday ve yonca olmak üzere nohut ve fiğ yetiştiriciliği yapılmaktadır. Mera/Biçenek olarak kullanılan alanlarda ise çoğunlukla saz çimi (*Calamagrostis pseudophragmites* (Haller) Koeler), çayır it kuyruğu (*Phleum pratense* L.), eres çimi (*Lolium persicum* Boiss. & Hohen.) yumrulu salkım (*Poa bulbosa* L.), sina ayak otu (*Carex* spp), seyrek saz (*Eleocharis* spp.), yonca (*Medicago sativa* L. subsp. sativa), ak üçgül (*Trifolium repens* L. var. repens), at kuyruğu (*Equisetum arvense* L.), çayır üçgülü (*Trifolium pratense* var. pratense L.), dere nanesi (*Mentha longifolia* (L.) subsp. typhoides (Briq.) Harley), kırk damar otu (*Plantago lagopus* L.), ibubuk otu (*Bromus danthoniae* Trin. subsp. *Danthoniae*), cilo düğün çiçeği (*Ranunculus arvensis* L.) ve çınarcık (*Ranunculus sericeus* Banks & Sol.) bitkileri bulunmaktadır.



Şekil 1. Çalışma alanının konumu

Toprak Örnekleme

Farklı arazi kullanımlarının bulunduğu çalışma alanı 800x800 m genişliğindeki gridlere bölünmüş ve gridlerin köşe noktalarına en yakın yerden ve 0-20 cm derinlikten toplam 232 (Şekil 2) noktadan toprak örneği alınmıştır.



Şekil 2. Toprak örnekleme deseni

Yöntem

Toplam Gözeneklilik: Toplam gözeneklilik Eşitlik 4 ile hesaplanmıştır.

$$TG = 1 - \frac{\rho_b}{\rho_k} \quad 4$$

Bu eşitlikte; Bu eşitlikte; ρ_b = Toprağın hacim ağırlığı ($g\ cm^{-3}$), ρ_k = Toprağın özgül ağırlığıdır ($2.65\ g\ cm^{-3}$).

Su İle Dolu Gözenek Hacmi (SDGH): SDGH eşitlik 5 ile belirlenmiştir (Linn ve Doran, 1984).

$$SDGH = \frac{\theta}{TG} \quad 5$$

Burada; θ : Hacimsel nem içeriği ve TG: Toplam gözenekliliktir.

İstatistiksel Analizler, Alansal Değişkenliğin Modellenmesi ve Haritalama

Elde edilen SDGH değerlerine ait tanımlayıcı istatistik parametreleri ile SDGH değerlerinin diğer özellikler ile olan ilişkisini gösteren korelasyon testi SPSS 21.0 paket programı kullanılarak yapılmıştır.

Su dolu gözenek hacmi değerlerinin mekânsal değişiminin modellenmesinde jeostatistiksel yöntemler kullanılmıştır. Mekânsal değişkenliğin tanımlanması için GS+ 7.0 paket programı

kullanılmış, elde edilen en iyi modele ait parametreler ArcGIS 10.0 paket programında kullanılarak alansal değişkenlik haritası üretilmiştir.

Bulgular ve Tartışma

Aerobik veya anaerobik mikrobiyal aktivitenin gerçekleşmesi için gerekli olan, su, hava ve karbona erişimin önemli bir göstergesi olarak kabul edilen su dolu gözenek hacmi (SDGH) (Linn ve Doran, 1984) değeri, çalışma alanında % 38.8 - %96.0 arasında değişim göstermekte ve ortalama SDGH değeri %69.6'dır (Tablo 1). Elde edilen bu veriler çalışma alanında SDGH'nin mikrobiyal aktivitenin en yüksek düzeyde desteklenebilmesi için sınır değer aralığında olduğunu göstermektedir. Zira Bending ve ark., (2004), toprak tekstürü ve organik madde içeriğine bağlı olarak SDGH'nin %30 ile %70 arasında olduğu topraklarda mikrobiyal aktivitenin en üst seviyede olduğunu rapor etmiştir.

Çalışma alanı içerisinde tanımlanan 16 farklı toprak serisi içerisinde ortalama SDGH değeri en yüksek olan toprak serisi Karlı (SDGH, %77) ve en düşük olan ise Aksu serisidir (%61.7). Toprak serilerinin, seri içi SDGH değerleri değişkenliği genel olarak düşüktür.

Tablo 1. Toprak Serilerinin 0-20 cm derinliklerinde su dolu gözenek hacmi (%) değerlerine ait tanımlayıcı istatistik değerleri

Serisi Adı	N	En Küçük	En Büyük	Ort.	Std. Sapma	%VK	Basıklık	Çarpıklık
Adaklı	6	54.4	86.1	71.0	11.2	15.8	-0.46	-0.23
Aksu	3	56.5	67.3	61.7	5.4	8.7	-	0.28
Beşbulak	21	38.8	91.0	67.8	13.1	19.3	-0.28	-0.26
Budak	10	59.7	84.7	72.5	8.1	11.2	-0.52	0.13
Büyükçiftlik	5	60.9	80.2	71.2	8.7	12.3	-2.81	-0.37
Çatma	5	60.2	82.0	72.7	8.5	11.7	-0.12	-0.71
Gever	7	55.6	76.9	67.8	6.8	10.1	1.24	-0.60
Kadıköy	13	61.3	83.4	73.8	6.0	8.1	0.33	-0.44
Kamışlı	11	60.2	85.0	73.2	8.5	11.6	-1.12	-0.14
Karabey	50	44.7	84.2	64.9	9.1	14.1	-0.46	-0.04
Karlı	7	71.4	81.5	77.0	4.0	5.2	-1.46	-0.57
Köprücek	9	55.2	86.5	70.7	9.2	13.0	-0.86	-0.04
Mamaklı	3	67.3	75.7	72.3	4.5	6.2	-	-1.44
Vezirli	7	54.3	81.3	65.7	9.2	14.0	0.01	0.49
Yoncalık	11	51.3	85.2	68.3	11.1	16.2	-1.18	-0.11
Yüksekova	52	47.1	96.0	71.7	9.7	13.5	0.33	0.16
Tüm Çalışma Alanı		38.8	96.03	69.58	9.7	13.9	-0.18	-0.11

Topraktaki aerobik/anaerobik koşulların göstergesi olarak kabul edilen (Sharma ve ark., 2020) su dolu gözenek hacmi (SDGH), hacimsel toprak su içeriğinin gözenekliliğe bölünmesi ile hesaplanmaktadır (Laryea ve ark., 1997). SDGH, çalışma alanında % 39 ile % 96 arasında

değişim göstermiştir (Şekil 69). Daha önce de değinildiği gibi, biyolojik aktivitenin optimum düzeyde gerçekleşebilmesi için SDGH hacminin organik madde ve tekstür içeriğine bağlı olarak % 30 ile %70 arasına olması istenmektedir (Bending ve ark., 2004). Andrews ve ark., (2004) ise toprak kalitesi açısından kil içeriğine bağlı olarak SDGH değerinin % 45 - %60 arasında olması gerektiğini rapor etmiştir. SDGH'ine ait mesafeye bağlı değişim haritaları, Yüksekova ovasında yer alan arazilerin neredeyse tamamında SDGH değerlerinin biyolojik aktivitenin optimum düzeyde gerçekleşmesi için uygun aralıkta olduğunu göstermektedir. Ancak bazı noktalarda (Havaalanının güneyi ve daha önce sulak alan olan diğer arazilerin en düşük kodlu yerleri) ise yüksek nem içeriğinden (drenaj yetersizliği) dolayı biyolojik aktivitenin olumsuz etkileneceği göz ardı edilmemelidir. Bu alanlarda, uygun projelendirmeler ile mevsimsel olarak yükselen taban suyunun ortadan kaldırılması gerekmektedir.

Çalışma alanı yüzey topraklarının çeşitli fiziksel, kimyasal ve biyolojik özellikleri ile SDGH arasındaki ilişki gösteren korelasyon testi sonuçları Tablo 1'de verilmiştir. Tekstür bileşenlerinden kil içeriği SDGH ile önemli düzeyde pozitif ve silt içeriği ise negatif bir ilişkiye sahiptir. Bu ilişki toprakta kil içeriği artışı ile SDGH'nin arttığını aksine silt içeriği artışı ile SDGH'nin azaldığını göstermektedir. Strüktür ile ilgili özelliklerden hacim ağırlığı ile SDGH arasında beklentilerimizin aksine önemli düzeyde pozitif bir ilişki olduğu görülmektedir. Hacimsel su içeriğinin toplam gözenekliliğe oranı ile hesaplanan SDGH'nin (Eşitlik 2), normal koşullarda toplam gözenekliliğin azalması ile artması beklenir. Toplam gözeneklilik ise hacim ağırlığı ve kütle yoğunluğu değerlerinden hesaplanmaktadır. Eşitlik 1'den anlaşılacağı üzere, hacim ağırlığı artışı, birim hacimdeki toprağın hava dolu gözeneklerinin azalmasına yol açacağından, toplam gözeneklilik azalacaktır. Yukarıda da bahsedildiği üzere, hacim ağırlığı artışı toprağın SDGH değerinin azalmasına yol açması beklenirken, çalışma alanımızda tam aksine hacim ağırlığı artışı ile SDGH değerinin önemli düzeyde arttığı anlaşılmaktadır. Toprak nemi, toprak solunumu, toprak agregasyonu ve toprak sıkışması, toprakların havalanmasını ve oksijensiz mikro bölgelerin oluşumunu belirleyen temel faktörlerdir. Toprakta N₂O, öncelikli olarak düşük ve orta seviyedeki toprak nem oranlarında nitrifikasyon yoluyla oluşur ve denitrifikasyon ise azalan O₂ tedariki nedeniyle SDGH'nin %60'dan daha yüksek toprak nemi içeriklerinde daha etkili olur (Ruser ve ark., 2006). Çalışma alanında HA değerlerinin yüksek olduğu yerlerin çoğunluğunda SDGH değerinin de yüksek olduğu ve bu alanlarda potansiyel olarak N₂O emisyonunun yüksek olduğu düşünülmektedir. Bu bulgumuzu destekleyen bir başka açıklama, Flessa ve ark. (2001) tarafından yapılmıştır. Araştırmacılar, traktör trafiği nedeniyle toprağın sıkışması ve dolaylı olarak hacim ağırlığının artışının topraktaki N₂O

emisyollarını önemli düzeyde artırırken, toprak işleme ile toprağın kabartılmasının N₂O emisyonlarını azalttığını bildirmişlerdir. Toprağın gevşetilmesi veya sıkıştırılması ile makro gözenek hacmindeki bir azalma veya artış, toprakta O₂'nin azalması veya artmasına yol açacağından, bu durum topraktaki SDGH düzeyinin ve dolayısı ile N₂O emisyonunun azalması veya artmasına neden olacağı söylenebilir. Örnek sayısı fazla olduğundan dolayı, korelasyon katsayısı düşük olsa dahi, korelasyon testi ilişkinin önemli olduğuna işaret etmektedir. Örneğin, ortalama ağırlıklı çap değerleri (MWD) ile SDGH arasındaki korelasyon katsayısı -0.19 olmasına rağmen, bu ilişki istatistiksel olarak P<0.01 düzeyinde önemli olarak nitelendirilmiştir. Bununla birlikte, bu ilişkinin veri setindeki değişkenliğin sadece %19'unu temsil ediyor olması bizim için yeterli görülmemiş ve bu nedenle bu ilişki yorumlanmamıştır.

Tablo 2. Çalışma alanında belirlenen toprak özellikleri ile su dolu gözenek hacmi arasında ilişkiyi gösteren korelasyon testi

<i>Parçacık Büyüklük Dağılımı</i>							
Su Dolu Gözenek Hacmi	Kil	Silt	Kum				
	0.24**	-0.24**	-0.08				
	Strüktür ile İlgili Özellikler						
	HA	AS	MWD	PD			
	0.48**	-0.14*	-0.19**	-0.05			
	Gözeneklilik ve Su Tutma ile ilgili Özellikleri						
	MaG	MiG	TG	TK	SN	YSİ	
	-0.85**	0.28**	-0.39**	0.28**	0.23**	0.12	
	Kimyasal Özellikleri						
	EC	pH	OM	AP	AK	Kireç	TN
0.04	0.04	-0.32**	-0.04	0.15*	-0.13	-0.26**	-0.31**
Biyokimyasal Özellikler							
Fosfataz	Üreaz	BGEA	MBC				
-0.12	0.23**	0.10	-0.38**				

Ha: hacim ağırlığı, AS: agregat stabilitesi, MWD; ortalama ağırlık çapı, MaG; makro gözeneklilik, MiG; mikro gözeneklilik, TG; toplam gözeneklilik, TK, tarla kapasitesi, SN; solma noktası, YSİ, yarıyışlı su içeriği, SDGH; su ile dolu gözenek hacmi, OM; organik madde, AP; alınabilir P, AK; alınabilir K, TN; toplam azot, TC; toplam karbon, BGEA; beta glikosidaz enzim aktivitesi, MBC; mikrobiyal biyokütle karbonu

Toprak gözeneklilik ve su miktarı parametrelerinden makro gözenek hacmi (MaG) ile SDGH arasında oldukça önemli düzeyde negatif bir ilişki olduğu görülmektedir. Dolaylı olarak bu ilişkiden yola çıkarak MaG değerinin yüksek olmasının, toprakta N₂O emisyonunun azalmasına neden olduğu söylenebilir. Toprakta MaG hacminin yüksek olması, oksijensiz mikro alanların da azalmasına neden olacağından, azot oksit emisyonu da düşük olacaktır. Birçok araştırmacı gibi Ruser ve ark. (2006) da, toprakta gerçekleşen N₂O emisyonlarının çoğunlukla denitrifikasyonun bir neticesi olduğunu belirtirken, araştırmalarında toprak sıkışmasının olduğu

uygulamalarda $SDGH \geq \%70$ olduğunda N_2O emisyonun meydana geldiğini bildirmişlerdir. Buna ilaveten, toprakta N_2 üretiminin yalnızca en yüksek toprak nemi seviyesinde ($\geq \%90$ SDGH) meydana geldiği ve çoğu durumda N_2 salınımının N_2O salınımından belirgin şekilde daha küçük olduğu ifade edilmiştir. Toprakta tarla kapasitesi ve solma noktasında tutulan nem miktarları ile SDGH arasında önemli düzeyde negatif bir ilişki olduğu görülmektedir (Tablo 2). Nem içeriğindeki artışın ise N_2O emisyonunda artışa neden olduğunu ortaya koyan çok sayıda araştırma sonucu bulunmaktadır.

Toprağın kimyasal özellikleri ile SDGH arasında göze çarpan en önemli ilişki, toprağın organik madde ve toplam azot içerikleri ile SDGH arasında negatif bir ilişki olmasıdır. Toprağın SDGH miktarının yüksek olduğu arazilerde, organik madde ve toplam azot içeriğinin düşük olması, bu alanlarda, aslında azot emisyonu için gerekli olan karbon ve azot kaynağının da düşük olduğuna işaret etmektedir.

Üreaz enzimi, topraktaki organik ve inorganik kolloidler tarafından tutulan üreinin karbondioksit ve amonyak hidrolizini katalize eden hücre dışı bir enzimdir (Das ve Verma, 2010). Üreaz aktivitesinin etkisi ile toprakta oluşan inorganik NH_4^+ , daha sonra nitrifikasyonun etkisi ile NO_3^- yükseltgenir. Bitkiler tarafından alınma ve toprakta kalmasının yanı sıra, NO_3^- 'in bir kısmı da denitrifikasyon yoluyla N_2 'ye dönüştürülür, bu arada N_2O 'da yukarıda bahsedilen iki sürecin ara ürünüdür (Tang ve ark., 2022). Bu nedenle de toprakta NH_4^+ ve NO_3^- oluşumunun azaltılması, nitrifikasyon ve denitrifikasyonun oluşumunu azaltacağından N_2O şeklinde azot kaybının da azalmasına neden olacaktır (Wells ve Eyre, 2021). Araştırma alanımızda toplam 232 noktadan alınan yüzey topraklarının üreaz enzim aktivitesi ile SDGH arasında önemli düzeyde pozitif bir ilişki bulunmuştur (Tablo 2). Bu ilişki, SDGH miktarının yüksek olduğu alanlarda, üreaz enzim aktivitesinin de yüksek olduğunu göstermektedir. Yukarıda açıklandığı gibi üreaz enzim aktivitesinin yüksek olması, toprakta daha fazla NH_4^+ ve NO_3^- oluşumuna neden olacağı akılda tutulmalıdır. Bir başka çalışmada, kuraklığın besin elementlerinin döngüsünü araştıran (Sardans ve Penuelas, 2005), toprağın nem içeriğinin %10 ve %21 oranında azalmasının üreaz aktivitesinde sırasıyla %10-67 ve %42-62 oranında azalmaya neden olduğunu beyan etmişlerdir.

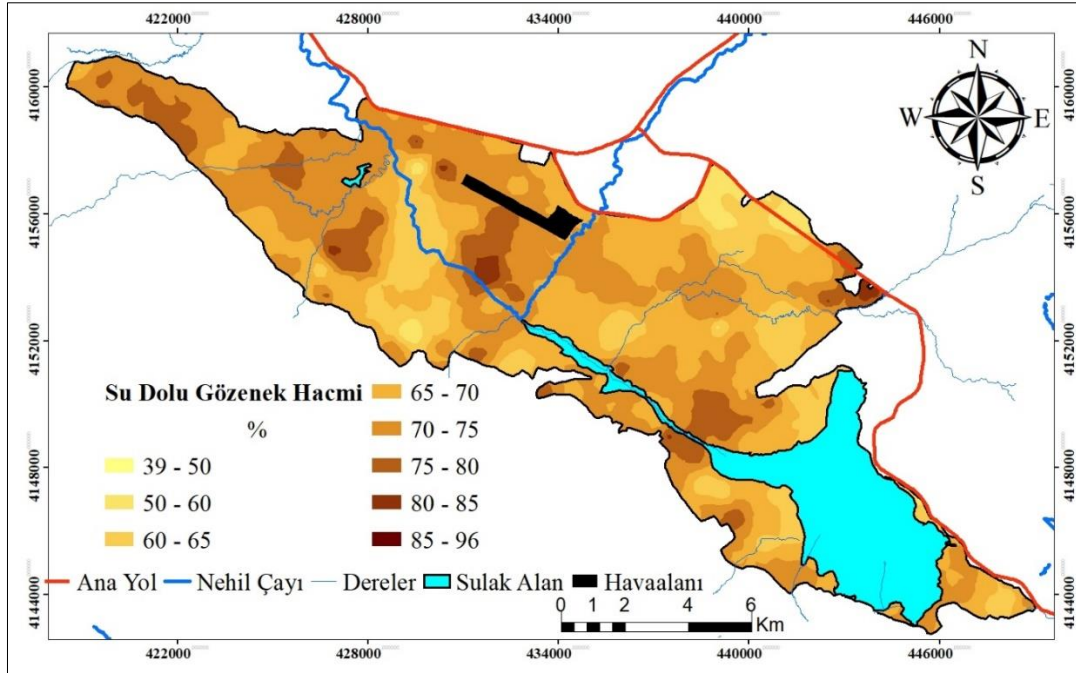
Çalışma alanı yüzey topraklarının SDGH değerlerinin mekânsal dağılımını en iyi tanımlayana model ve oluşturulan semi-variogram a ait parametreler Tablo 3'de verilmiştir. Bir alandaki özelliklerin, oto korelasyonun gücünü ifadesi olan ve nugget değerlerinin sill değerlerine oranının yüzdesi ile hesaplanan uzaysal bağımlılık değeri (%12.3), SDGH'nin çalışma alanında

zaysal bağımlılığının oldukça kuvvetli olduğunu göstermektedir. Çalışma alanı içerisinde, oto korelasyonun kuvvetli olduğu mesafenin göstergesi olan range değeri ise 1110 m olarak hesaplanmıştır. Çalışma alanında 1110 m içerisinde toprakların SDGH değerlerinin birbirlerine önemli düzeyde benzer olduğu ve bu mesafenin ötesinde ise örneklerin anlamlı bir benzerliğinin olmadığı anlaşılmaktadır.

Tablo 3. Toprak özelliklerinin haritalanmasında kullanılan Semivariogram modellerine ait veriler.

Özellik	Model	Nugget	Sill	% UB	Range	RSS	r2	lag (m)	Komşu sayısı
SDGH	Üstel	11.8	96.08	12.3	1110	2.1E+01	0.9	800	8

Çalışma alanında, SDGH değerlerinin mekânsal dağılım modeli kullanılarak oluşturulan dağılım haritası Şekil 3'te verilmiştir. Tüm çalışma alanında %39 ile %96 arasında değişen SDGH değerlerinin çalışma alanında yer yer oldukça yüksek değerlere ulaştığı görülmektedir. Her ne kadar literatürde, azot emisyonları için belirtilen eşik değerler değişiyor olsa da, ovanında genelinde SDGH değerlerinin %60'ın üzerinde olması, ova topraklarından önemli miktarda azot emisyonlarının olabileceğini göstermektedir. Bu durum, hem topraktaki azot kaynaklarının azalmasına yol açarak tarımsal üretimin olumsuz etkilenmesine, hem de atmosfere salınan ve karbondioksit göre çok daha fazla sera etkisi yapma özelliği olan azot gazlarının atmosferdeki konsantrasyonunun artmasına neden olacaktır.



Şekil 3. Su dolu gözenek hacmine ait mesafeye bağlı değişim haritası

Sonuç

Önceleri çok büyük bir kısmı, yılın önemli bir kısmında sulak alan olan Yüksekova ovası topraklarının su dolu gözenek hacmi (SDGH) genel olarak atmosfere azot salınımına neden olacak düzeyde yüksektir. Bu konuda yapılan çalışmalarda, SDGH değerinin yükselmesi ile toprakta oksijen miktarının azaldığı ve nitrifikasyon ile üretilen nitratin, anaerob denitrifikasyon bakterileri faaliyeti ile N₂ ve N₂O gibi azot gazlarına dönüşerek, atmosfere salınım olduğu ifade edilmiştir. Bu kapsamda, ovanın önemli bir kısmında, sıcaklığın uygun olduğu yılın belirli dönemlerinde atmosfere azot gazları salınımının gerçekleşiyor olması muhtemeldir. Atmosfere salınan azot, üreticiler için çok değerli olan topraktaki mineral azotun azalmasına yol açmasının yanında, küresel ısınmada aktif rol alan karbondioksitten dahi çok daha tehlikeli olan azot gazlarının atmosferdeki konsantrasyonunun artmasına neden olabileceği unutulmamalıdır. Bu nedenle, özellikle tarımsal üretim yapılan arazilerde SDGH'nin daha güvenli olabileceği seviyelere çekilebilmesi için, drenaj sistemlerinin kurulması gerekmektedir. Bununla birlikte, günümüzde hala sulak alan veya biçenek olan arazilerin ise, korunması birçok ekosistem hizmetinin üretilmesinin devamlılığı için son derece önemli olduğundan, bu arazilerde kesinlikle drenaj faaliyetleri yapılmamalıdır. Bu arazilerde yapılacak drenaj faaliyetleri, çok uzun yıllar toprakta depolanmış olan karbonun atmosfere salınmasına neden olacaktır.

Teşekkür

Bu çalışmada elde edilen veriler 1190947 nolu TÜBİTAK proje kapsamında elde edilmiştir.

TÜBİTAK'a desteklerinden dolayı teşekkür ederiz.

Kaynaklar

- Andrews, S. S., Karlen, D. L., Cambardella, C. A. (2004). The soil management assessment framework: A quantitative soil quality evaluation method. *Soil Science Society of America Journal*, 68(6), 1945-1962.
- Ariani, M., Setyanto, P., & Wihardjaka, A. (2021, February). Water filled-pore space and soil temperature related to N₂O fluxes from shallot cultivated in rainy and dry season. In *IOP Conference Series: Earth and Environmental Science* (Vol. 648, No. 1, p. 012109). IOP Publishing.
- Bateman, E. J., & Baggs, E. M. (2005). Contributions of nitrification and denitrification to N₂O emissions from soils at different water-filled pore space. *Biology and fertility of soils*, 41, 379-388.
- Bending, G. D., Turner, M. K., Rayns, F., Marx, M. C., ve Wood, M., 2004. Microbial and biochemical soil quality indicators and their potential for differentiating areas under contrasting agricultural management regimes. *Soil Biology and Biochemistry*, 36(11):1785-1792.
- Butterbach-Bahl K, Baggs EM, Dannenmann M, Kiese R, Zechmeister-Boltenstern S (2013) Nitrous oxide emissions from soils: how well do we understand the processes and their controls? *Philos Trans R Soc Lond B Biol Sci* 368:20130122.
- Das, S. K., & Varma, A. (2011). Role of enzymes in maintaining soil health. *Soil enzymology*, 25-42.
- Flessa, H., Ruser, R., Schilling, R., Loftfield, N., Munch, J. C., Kaiser, E. A., & Beese, F. (2002). N₂O and CH₄ fluxes in potato fields: automated measurement, management effects and temporal variation. *Geoderma*, 105(3-4), 307-325.
- Franzluebbers, A. J. (1999). Microbial activity in response to water-filled pore space of variably eroded southern Piedmont soils. *Applied Soil Ecology*, 11(1), 91-101.
- IPCC (2014) Climate change 2014: synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change. In: Core Writing Team, Pachauri RK, Meyer LA (eds) IPCC, Geneva.
- Laryea, K. B., Pathak, P., & Katyal, J. C. (1997). Measuring soil processes in agricultural research. *International Crops Research Institute for the Semi-Arid Tropics*.
- Linn, D. M., Doran, J. W. (1984). Effect of water-filled pore space on carbon dioxide and nitrous oxide production in tilled and non-tilled soils. *Soil Science Society of America Journal*, 48(6), 1267-1272.
- Ruser, R., Flessa, H., Russow, R., Schmidt, G., Buegger, F., & Munch, J. C. (2006). Emission of N₂O, N₂ and CO₂ from soil fertilized with nitrate: effect of compaction, soil moisture and rewetting. *Soil Biology and Biochemistry*, 38(2), 263-274.
- Sardans, J., Penuelas, J. 2005. Drought decreases soil enzyme activity in a mediterranean quercus ilex l. Forest. *Soil Biology and Biochemistry*. 37, 455-461.
- Schjønning, P., Thomsen, I. K., Moldrup, P., & Christensen, B. T. (2003). Linking soil microbial activity to water-and air-phase contents and diffusivities. *Soil Science Society of America Journal*, 67(1), 156-165.
- Sharma, N., & Kumar, S. (2020). Gross rates of nitrogen transformation in soils of a global biodiversity hotspot (Western Ghats, India). *Journal of Plant Nutrition and Soil Science*, 183(5), 579-591.

- Stanford, G., & Epstein, E. (1974). Nitrogen mineralization-water relations in soils. *Soil Science Society of America Journal*, 38(1), 103-107.
- Tang, Z., Liu, X., Li, G., & Liu, X. (2022). Mechanism of biochar on nitrification and denitrification to N₂O emissions based on isotope characteristic values. *Environmental Research*, 212, 113219.
- Wells, N. S., & Eyre, B. (2021). Flow regulates biological NO₃⁻ and N₂O production in a turbid sub-tropical stream. *Geochimica et Cosmochimica Acta*, 306, 124-142.

**EKOSİSTEM HİZMETLERİ SUNUMU KAPSAMINDA YÜKSEKOVA OVASININ
GENEL DEĞERLENDİRİLMESİ; SORUNLAR VE ÇÖZÜM ÖNERİLERİ**

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Özet

Ülkemizin önemli sulak alanlarından biri olan Yüksekova ilçesi sınırları içinde yer alan Nehil Sazlığı ekosistemleri, bölgenin en önemli doğal zenginliğidir. Sahip olduğu nitelikleri ve ürettikleri ekosistem hizmetleri ile her yıl önemli miktarda hizmeti tamamen ücretsiz olarak sunarak insan sağlığı ve refahına hayati bir katkı sağlamaktadır. Yüksekova sulak alanlarının tarım arazisi oluşturmak amacı ile kurutulması ve uluşturulan tarım arazileri etrafında yerleşimin artması, sulak alanların biyolojik çeşitlilik, besin döngüsü, su kalitesinin iyileştirilmesi, sel ve taşkınların önlenmesi, yer altı su kaynaklarının beslenmesi ve küresel iklim değişiminin önlenmesi gibi çeşitli hizmetlerinin aksamasına neden olacaktır. Yüksekova ovası tarım arazileri, önceleri sulak alan olduğundan yüksek miktarda organik madde içeriğine sahiptir. Toprak verimliliği için oldukça önemli bir bileşen olan organik madde içeriğinin yüksek olmasına rağmen, yetiştiriciliği yapılan buğday, yonca ve nohut gibi ürünlerin verimleri türkiye ortalamasının oldukça altındadır. Bu verim düşüklüğünün temel nedenleri, yüksek taban suyu, toprak sıkışması, mineral veya organik gübre kullanımının olmaması, sulama altyapısının ve imkânlarının yetersizliği, hastalık zararlı ve yabancı otlar ile yeterli mücadele edilememesi şeklinde sıralanabilir. Yüksekova ovasında ekosistem hizmetlerinin üretilmesi ve sunumu ile tarımsal üretimin sürdürülebilirliğini tehdit eden diğer bir önemli problem ise, tarım arazilerinin özellikle yerleşim için amaç dışı kullanımudur. Son 80 yıldaki uydu ve hava görüntülerinin incelenmesi, sulak alanların miktarının önemli miktarda küçüldüğünü ve bir kısım alanlarda yeni yerleşim yerlerinin kurulduğunu ve Yüksekova ilçesinin düz düze yakın tarım arazilerine doğru genişlediğini göstermektedir. Sonuç olarak, bölge için son derece önemli olan sulak alanların ve tarım arazilerinin korunup korunması, bölgedeki insanlar için üretilecek çeşitli ekosistem hizmetlerin sunumunun ve tarımsal üretimin devamlılığının sağlanması adına son derece önemlidir.

Anahtar Kelimeler: Ekosistem, Nehil Sazlığı, Arazi Bozulması, Yüksekova ovası

A GENERAL OVERVIEW OF THE YÜKSEKOVA PLAIN WITHIN THE SCOPE OF ECOSYSTEM SERVICE; PROBLEMS, AND SOLUTIONS

ABSTRACT

Nehil Reed ecosystems located within the borders of Yüksekova district, one of the most important wetlands of our country, are the most important natural wealth of the region. The wetland provides a vital contribution to human health and welfare in the region by providing a significant amount of services completely free of charge every year with its characteristics and the ecosystem services produced. The drying of Yüksekova wetlands to create agricultural land and the increase in settlements around the agricultural lands will cause disruption of various services of wetlands such as biodiversity, nutrient cycling, improvement of water quality, prevention of floods and floods, replenishment of underground water resources and mitigation of global climate change. The agricultural fields of Yüksekova plain have a high organic matter content since they were formerly wetlands. Although the organic matter content, which is a very important component for soil fertility, is high, the yields of crops such as wheat, alfalfa and chickpea are well below the national average. The main causes of the low yields can be summarised as high ground water table, soil compaction, lack of mineral or organic fertilizer application, insufficiency of irrigation infrastructure and facilities, insufficient control of diseases, pests and weeds. Another important problem threatening the production and provision of ecosystem services and the sustainability of agricultural production in the Yüksekova plain is the improper use of agricultural lands, especially for settlement. The satellite and aerial images of the last 80 years show that the extent of wetlands has significantly decreased and new settlements have been established in some of the areas and Yüksekova district is spreading towards agricultural lands. In conclusion, the conservation and protection of wetlands and agricultural lands, which are crucial for the region, is of utmost importance for the provision of various ecosystem services to be produced for the people in the region and for the sustainability of agricultural production.

Keywords: Ecosystem, Nehil reed, Land degradation, Yüksekova plain

Giriş

Toprak, gıda üretiminin istikrarını, gıda/besin kalitesini ve verimi belirleyen temel üretim ortamıdır. Karasal ekosistemde yer alan toprak, toplumun çoğunluğu tarafından yenilenemez bir kaynak olarak düşünülmemektedir. Sahip olduğu özellikleri ile insanların gereksinim duyduğu birçok hizmetin sunumunda alternatifsiz bir doğal kaynak olan toprak, sınırsız bir varlık değildir. Hızla artan dünya nüfusunun gıda ihtiyacının karşılanabilmesi için daha fazla girdi kullanımını tarımsal üretimin yoğunlaşması ve tarım ve mera alanlarının tarım arazilerine dönüştürülmesi, tarım arazilerinin yerleşim ve sanayi gibi amaç dışı kullanımı, bu sınırlı kaynak üzerinde her geçen gün daha da artan bir baskının oluşmasına neden olmaktadır. İnsanoğlunun yeryüzündeki varlığı devam ettikçe, nüfus artmaya şüphesiz devam edecektir. Bu kapsamda, günümüzde 7 milyara yaklaşan dünya nüfusunun 2050 yılında 9.8 milyara ulaşması (Koppitke ve ark., 2019), gelecekte topraklar üzerine oluşacak baskının daha da artacağını göstermektedir (Budak ve Kılıç, 2022).

Bir taraftan tarım arazilerinin tarım dışı kullanımlar ve arazi bozulması nedeni ile elden çıkması, diğer taraftan artan nüfus nedeniyle oluşan gıda açığı, önümüzdeki 30 yıl içerisinde dünya nüfusunun önemli bir kesiminin ciddi bir açlık tehlikesi ile karşı karşıya kalacağını sinyallerini vermektedir. Bu nedenle, mevcut tarım arazilerinde en yüksek verimi ve üretkenliğin sürdürülebilirliğini sağlayacak yöntemlere ihtiyaç duyulmaktadır. Toprak verimliliğini artırmaya yönelik herhangi bir eylem, temel toprak işlevlerini iyileştirmek ve sürdürülebilir toprak üretkenliğini sağlamak için uzun vadeli bir toprak yönetim stratejisinin geliştirilmesi gerekmektedir (Rojas ve ark., 2016).

İnsanların gıda güvenliğine sahip olması küresel bir arzudur, ancak bununla etkileşime giren ve böyle bir hedefi mümkün kılan sistemleri anlamak için daha fazlasına ihtiyaç bulunmaktadır. Toprak sınırlı bir kaynaktır ve dünyanın gıda üretiminde önemli olan birçok bölgesinde, bilgi eksikliğinden veya bakım eksikliğinden kaynaklanan yanlış yönetim nedeniyle topraklar üretkenliklerini kaybetme riskiyle karşı karşıyadır. Toprağı güvence altına almak için bilgi ve uygun yönetim stratejisi oluşturmak esastır (Pozza ve Field, 2020).

Toprak yönetim stratejilerinde meydana gelen değişimler (arazi kullanım değişikliği veya arazi kullanımına bağlı olarak bitki örtüsündeki değişimler), karasal ekosistem üzerinde önemli etkiler oluşturmakta ve çoğunlukla toprakların fonksiyon görme kapasitesini olumsuz etkilemektedir (Foley ve ark., 2005; Hernandez ve ark., 2016). Bu değişimler, insan gelişiminin farklı mekansal ve zamansal ölçeklerde meydana gelen doğal peyzajlar üzerindeki baskısının temsili bir sonucudur. Arazi kullanımındaki değişim süreçlerinin türüne ve yoğunluğuna bağlı

olarak, ekosistemler farklı yapıları, işlevleri ve dinamikleri yansıtarak, bitki örtüsü, toprak ve besin öğeleri arasında yeni ve karmaşık etkileşimler yaratır (Hernandez ve ark., 2016). Ayrıca, arazi kullanımındaki değişim süreçleri, toprağın fiziksel, kimyasal ve biyolojik özellikleri ile toprak canlılarının popülasyonu ve çeşitliliğinde de önemli değişime neden olabilmektedir. Bu da zamanla arazinin verimliliğinde bir azalmaya yol açabilmektedir.

Dünyanın birçok yerinde olduğu gibi ülkemizde de doğal sulak alanlar ve çevresinde bulunan arazilerin önemli bir kısmı drene edilmiş, otlak, mera veya tarım arazisi olarak kullanılmaya başlanmıştır. Hakkâri ilinin Yüksekova ilçesinde denizden yaklaşık 2000 m yükseklikteki Yüksekova ovasında bulunan ve bölgenin en önemli alt ekosistemlerinden biri olan Yüksekova sazlıkları da tarım arazisi oluşturmak için açılan kurutma kanalı nedeniyle fonksiyonlarını yitirme ve sağladığı ekosistem servislerini kaybetme noktasına gelmiştir. Sulak alanların kurutulması ve tahribatı, biyolojik çeşitlilik, suyun depolanması ve arıtılması, tarımsal kirleticilerin filtrelenmesi, taşkın koruma, karbon depolama, avlanma ve avlanma yoluyla besin temini gibi faydaların kaybolmasına neden olacağından lokal, bölgesel ve ulusal ölçekte olumsuzluklara yol açacaktır. Sulak alanlar, bitki ve hayvan toplulukları için kritik yaşam alanları olduklarından, genellikle çok çeşitli ekosistemleri temsil etmektedir. Ovadaki sulak alanlar, biyoçeşitliliğin ve kültürel zenginliğin kaynağı olmanın yanında Sibiryaya ve Afrika arasında göç yapan milyonlarca kuşun da göç yolunda konakladıkları önemli habitatlardır. Bu nedenle, sulak alanların bozulması ve yok edilme süreçleri, insanoğluna sunulan faydaların ve hizmetlerin azalmasına ve çoğu zaman tamamen yok olmasına neden olabilmektedir. Dolayısıyla ile bu alanlar, hem bölgesel hem de küresel ölçekte korunması gereken oldukça önemli ekosistemlerdir.

Bu çalışmada, önemli miktarda sulak alanları içinde bulunduran Yüksekova ovasında uygulamaların ekosistem hizmetlerinin üretilmesi ve sunumu çerçevesinde değerlendirilmesi, tarımsal üretimin önündeki sorunların tespiti ve ekosistem hizmetlerinin sürdürülebilirliğinin sağlanması adına çözüm önerilerinin geliştirilmesi amacı ile yürütülmüştür.

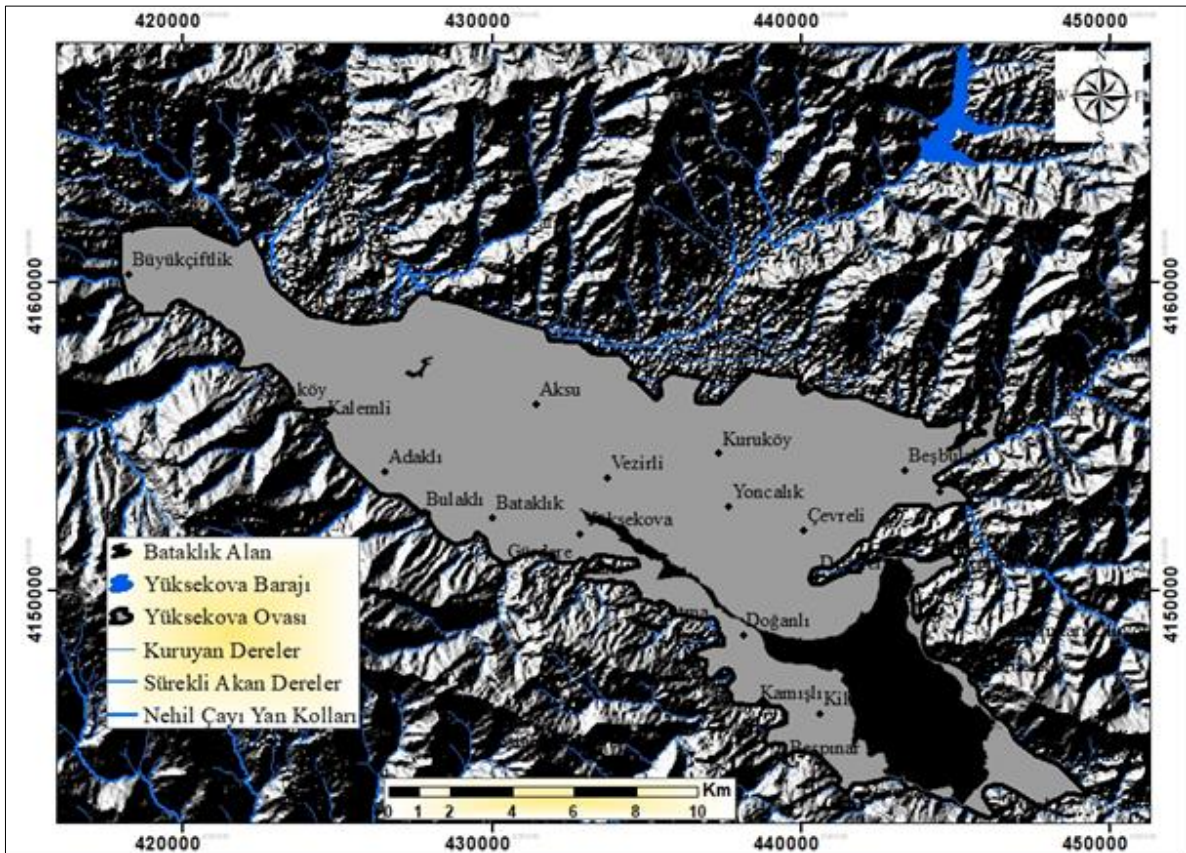
Materyal Metolar

Çalışma alanı

Çalışma alanı 37.427253° K - 37.598928° K enlemleri ile 44.071683° D - 44.423028° D boylamları arasında yer almakta olup, yaklaşık 17.500 ha genişliğinde farklı kullanımlar altındaki arazilerden oluşmaktadır. Alanın denizden ortalama yüksekliği 1950 m'dir. Çalışma alanında uzun yıllar (1979-2018) ortalama yıllık yağış miktarı 762 mm, ortalama aylık sıcaklık

-9.3°C (Ocak) ve 21.3°C (Temmuz) arasında olup yıllık ortalama buharlaşma ise 850 mm'dir (Anonim, 2019a). Bölgedeki doğal bitki örtüsü, bozkır olup daha çok geven, yavşan otu, keçi kulağı, çoban yastığı, deve diken, yabani yonca, yabani korunga gibi türler yetişmektedir. Ayrıca ova bazında buğday, yonca, fiğ, nohut, silajlık mısır ve aspir gibi tarla bitkileri, ceviz, kayısı, elma ve armut gibi meyve bitkileri ile karpuz, biber, hıyar, domates ve soğan gibi sebze bitkileri yetiştirilmektedir. Orman bitkisi yok denecek kadar az olan bölgede otlak ve meralarda çoğunlukla deve diken, papatya, yabani yonca, yabani korunga ve süpürge çalısı gibi bitkiler bulunmaktadır.

Çalışma alanı, dağlarla çevrili bir çöküntü ovası niteliğindedir. Alanın batısında Cilo dağı, kuzeyde Mor dağı, doğusunda İran sınır dağları ve güneyinde ise Cilo dağlarının uzantısı olan Sipiriz sıra dağları bulunmaktadır (Şekil 1). Alanda Kuzeybatı-Kuzeydoğu hattı boyunca Bitlis Metamorfileri (Ultra bazik kayaç, serpantin), Sekse Formasyonu (konglomera, kumtaşı, kil taşı ve kireçtaşı) ve Kırkgeçit Formasyonu (kumtaşı, marn ve şeyl türü kayaçlar) özellikli jeolojik materyaller yer almaktadır. Çalışma alanının Güneybatı-Güneydoğu hattı boyunca ise Urşe Formasyonu (kireç taşı, kumtaşı ve şeyl), Kandilli Kireçtaşı ve Yüksekova Karmaşığı (volkano-sedimenter kayaçlar ve kireçtaşı) özellikli materyaller bulunmaktadır (Sançar, 2018).



Şekil 1. Çalışma alanı sınırları ve yerleşim yerleri

Metot

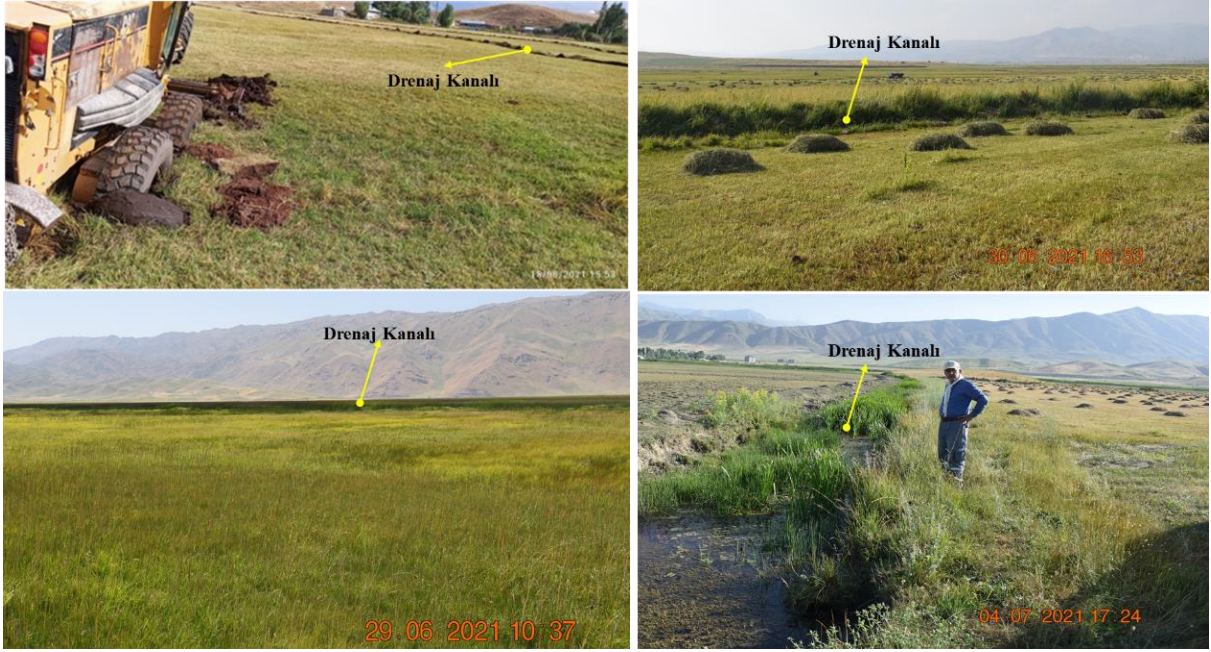
Bu çalışma, devam etmekte olan TUBITAK destekli “Yüksekova Havzasında İklim ve Arazi Kullanımı Değişimlerinin Ekosistem Servisleri Üzerine Etkisinin Değerlendirilmesinde Toprak Fonksiyonlarının Kullanılması” başlıklı geniş kapsamlı bir proje kapsamında elde edilen veriler ve gözlemlerin derlenmesi ile oluşturulmuştur. Çalışmanın ana verisi, toprak, bitki ve su örneklemeleri esnasında arazide yapılan gözlemler ve üreticiler ile yapılan toplantılarda edinilen bilgilerdir.

Bulgular ve Tartışma

Yüksekova ovası topraklarının ve ovada yer alan sulak alanların toprak kalitesi ve ekosistem hizmetlerinin değerlendirilmesi amacı ile yürütülmekte olan TUBITAK projesi kapsamında arazi çalışmalarındaki gözlemler ve yapılan detaylı araştırmalarda Yüksekova ovasında tespit edilen sorunlar ve bu sorunların Ekosistem servisleri açısından önemi ayrı ayrı başlıklar altında sunulmuştur.

Sulak Alanların Tarım Arazilerine Dönüştürülmesi

Ova genelinde yürütülen arazi çalışmalarında hem iklim değişimleri hem de arazi yönetim sistemlerinden dolayı sulak alanların (Nehil Sazlığı) önemli bir kısmının bozulduğu tespit edilmiştir. Özellikle de daha önceleri sulak alan niteliğinde olan arazilerin önemli bir kısmında drenaj kanalları açılarak hali hazırda mera/biçenek olarak kullanılan alanlara dönüştürüldüğü tespit edilmiştir (Şekil 2). Bazı arazilerde ise daha sık aralıklarla açılan drenaj kanalları ile taban suyu daha da düşürülüp yonca, fiğ, buğday ve nohut tarımının yapıldığı ekili arazilere dönüştürülmüştür.



Şekil 1. Eski sulak alanların mevcut kullanımları ve açılan drenaj kanallarından görüntüler

Yirminci yüzyılın ortalarına kadar büyük çoğunluğu sulak alan olan Yüksekova ovasında yağışların azalması, ovadaki yerleşim ve tarımsal üretim için yeni arazi arayışı gibi insan etkisi sulak alanlar önemli miktarda azalmasına neden olmuştur. Tarım ve Orman Bakanlığı tarafından 2015 yılında tamamı (21.533 ha) ulusal öneme sahip sulak alan olarak kabul edilen çalışma alanında (Anonim, 2019b), 2021 yılı itibari ile 3.203 ha'lık sulak alan kalmıştır. Ancak, yıllık yağış miktarına ve mevsime göre bu alan yaklaşık 2.700 ha ile 3.500 arasında değişmektedir. Zira, Landsat uydu görüntüleri ve arazi çalışmaları esnasında yöre halkından alınan bilgiler doğrultusunda 2010-2018 yılları arasında açılan drenaj kanalları nedeni ile 11 noktada (yaklaşık 500 ha) sulak alan karakterde olan arazilerin mera/biçenek alanlarına, 2010-1989 yılları arasında ise 61 noktada (yaklaşık 3 bin ha) sulak alan olan arazilerin vafını kaybedip 51 noktanın mera/biçenek alanlarına geriye kalan 10 noktanın tarla tarımına ve 1989 yılından önce uydu görüntüsüne ulaşılmadığından arazi sahiplerinden alınan bilgiler doğrultusunda 34 noktanın (tahminen 2 bin ha) noktadan 20'sinin mera/biçenek alanlarına geriye kalan 14 noktanın ise tarım arazilerine dönüştürüldüğü tespit edilmiştir. Şahinoğlu ve Özdemir (2019) tarafından çalışma alanında bulunan sulak alan etrafında yapılan çalışmalarda, sulak alanın kenar ve taban kesimlerinde çok sayıda yataklanmış gidya (yüksek oranda karbon ve hümik asitler içeren, kömür düzeyine ulaşmamış doğal bir organik materyal) olduğu ve havza içinde turbaların tabanını oluşturduğu bildirilmiştir. Aynı araştırmacıların 60 farklı noktada yaptığı sondaj çalışmalarında sulak alanda turba kalınlıklarının 0.5 m ile 12 m arasında

değişim gösterdiği tespit edilmiştir. Bu durum, çalışma alanının önemli bir kısmının daha önceleri sulak alan karakterde olduğunu açıkça ortaya koymaktadır.

Sulak alanlar, tüm dünyada kapladıkları 12.1 milyon km²'lik alan ile toplam küresel ekosistem hizmetleri (ES) değerinin %40.6'sını oluşturduğundan insan yaşamı için hayati öneme sahiptir (Xu ve ark., 2020). Sulak alanlar fauna ve flora için kritik habitatları oluşturduğundan, genellikle çok çeşitli ekosistemlerini üretilmesi için temel ortamlar olarak kabul edilmektedir. Ülkemizdeki sulak alanlar biyoçeşitliliğin ve kültürel zenginliğin kaynağı olmanın yanında, Sibiryaya ve Afrika arasında göç yapan milyonlarca kuşun da göç yolunda konakladıkları önemli habitatlardır (Richardson ve Hussain, 2006). Sulak alan çevresinde yerleşim alanlarının ve ovada tarımsal faaliyetlerin artması ile daralan sulak alanlara kapasitelerinin üzerinde kirletilmiş suyun gelmesi, etkinliklerinin azalmasına yol açmaktadır. Toprak özelliklerine ve bunların etkileşimlerine dayanan ve çoğunlukla kullanım ve amenajmandan etkilenen toprak ekosistem servisleri bu koşullar altında olması gerektiği gibi sağlanamamaktadır. Ovada yer alan sulak alanlarının kurutulmasına devam edilmesi aşağıda belirtilen problemlerin ortaya çıkmasına neden olmaktadır.

Biyçeşitlilik kaybı: Sulak alanlar, dünyadaki biyolojik olarak en çeşitli ekosistemler arasında yer almaktadır. Göçmen kuşlar, amfibiler, sürüngenler, balıklar ve omurgasızlar dahil olmak üzere çeşitli bitki ve hayvan türleri için yaşam alanı sağlarlar. Sulak alanlar kurduğunda, bu türlerin çoğu yaşam alanlarını kaybeder ve bu da biyolojik çeşitliliğin azalmasına neden olur (Richardson ve Hussain, 2006; ; Borges ve ark., 2020; Xu ve ark., 2020).

Besin zincirlerinin bozulması: Sulak alanlar, besin için birbirine bağlı çeşitli organizmaların varlığı ile karmaşık besin zincirlerini desteklerler. Sulak alanlar kurduğunda, gıda bulunabilirliği azalır ve tüm gıda zinciri etkilenir. Besin kaynağı olarak sulak alanlarda yaşayan canlı türleri, alternatif besin kaynakları bulmakta zorlanabilir, bu da popülasyon tür ve sayılarının düşüşlerine ve hatta yok olmalarına neden olabilmektedir (Wang ve ark., 2021).

Su kalitesinin bozulması: Sulak alanlar, doğal filtre görevi görerek tortuları, besinleri ve kirleticileri filtre ederek suyu arındırırlar. Su sistemlerinde ötrofikasyona neden olabilen azot ve fosfor gibi besin maddelerinin seviyelerini azaltarak su kalitesinin iyileştirilmesine yardımcı olurlar (Daneil ve ark., 2019; Lefebvre ve ark., 2019).

Artan sel riski: Sulak alanlar, şiddetli yağış veya fırtınalar sırasında fazla suyu emerek ve depolayarak sellere karşı doğal tampon işlevi görür. Sulak alanlar kurutulduğunda, selleri azaltma yetenekleri kaybolur. Bu, insan yerleşimleri ve tarım arazileri dâhil çevredeki alanlarda sel riskinin artmasına neden olabilir (Rashid, ve Aneaus, 2019)

Yer altı su kaynaklarının beslenememesi: Sulak alanlar, yeraltı suyu rezervlerinin yeniden beslenmesinde çok önemli bir rol oynarlar. Doğal rezervuarlar gibi davranırlar, suyu depolayıp yavaş yavaş aküferlere ulaştırırlar. Sulak alanların kurutulması, hem insan hem de doğal sistemler için su mevcudiyetini etkileyerek yer altı su tablasına giren su miktarını azalmasına neden olmaktadır (Meng ve ark., 2020; Yang ve ark., 2021).

Sıcaklıkların artması: Sulak alanlar, büyük miktarda karbon depolayarak sera gazı emisyonlarını azaltmaya yardımcı olurlar. Sulak alanların kuruması, depolanan bu karbonu tekrar atmosfere salarak iklim değişikliğine neden olur. Ayrıca, sulak alanlar, evapotranspirasyon yoluyla çevredeki alanı soğutarak yerel iklimi düzenlemek için önemli alanları oluşturmaktadır. Bu nedenle sulak alanların kaybı, çok azda olsa yerel sıcaklıkların artmasına neden olabilir (Li ve ark., 2019; Liu ve ark., 2019; Jin ve ark., 2022).

Tarımsal Üretim Verim

Ovada tarımla uğraşan üreticiler, çoğunlukla buğday, yonca, fiğ ve nohut yetiştiriciliği yapmaktadır. Ancak, arazi çalışmalarında yapılan gözlemler ve çiftçilerden alınan bilgiler, birim alandan alınan ürün miktarlarının ülke ortalamasının çok çok altında olduğunu göstermektedir. Buğday üretiminde ülkemiz ortalaması yaklaşık 350 kg/da iken Yüksekova Ovası gibi oldukça verimli arazilerin olduğu bir alanda en iyi koşullarda dahi 200 kg/da verim alınmaktadır. Çoğu zaman buğday miktarı 200 kg/da'dan dahi çok daha düşük olmaktadır. Bu durum diğer bitkisel ürünler içinde geçerlidir ve düşük ürün almanın temel nedenleri aşağıda belirtilmiştir.

Toprak sıkışması (pulluk katmanı oluşumu): Tarımsal üretim yapılan arazilerde kulaklı pulluk ile uygun olmayan nem içeriğinde toprak işleme yapılması kil içeriği yüksek olan arazilerde toprak işleme derinliğinin altında oldukça sert ve geçirimsiz bir pulluk katmanı oluşumuna neden olmuştur (Şekil 3). Sert ve geçirimsiz bir katman olan pulluk katmanı bitkilerin kök gelişimini, suyun ve havanın hareketini olumsuz etkilemektedir. Bahar döneminde ovayı çevreleyen yüksek arazilerden gelen taşkın sularının veya arazi yüzeyindeki karların erimesi ile ortaya çıkan suyun toprak profilinin derinliklerine inmesini engelleyen bu pulluk katmanı, arazilerin çok daha uzun süre su altında kalmasına da neden olmaktadır. Bu bağlamda, uzun zamandır toprak işleme yapılan alanlarda bir dip kazan veya çizel ile yaklaşık 60 cm derinlikte işleme ile oluşmuş pulluk katmanının ortadan kaldırılması sağlanmalıdır. Ayrıca, bitkisel üretim yapılan arazilerde pulluğun yer aldığı yoğun toprak işleme yöntemleri yerine toprağı devirmeden işleyen ve bitki atıklarının bir kısmını arazi yüzeyinde bırakan diskaro, goble,

kültivatör veya çizel gibi azaltılmış toprak işleme aletlerinin tercih edilmesi de sağlanmalıdır. Bu bağlamda, bölgede uygulanan kırsal kalkınma desteklerinde azaltılmış toprak işlemeyi sağlayan makine ve ekipmanlara yer verilmesi toprakların üretkenlik kapasitesinin artmasına ve sürdürülebilirliğine katkı sağlayacaktır.



Şekil 3. Çalışma alanında toprak işlemede uygun olmayan nem içeriğinde birincil işleme aleti olarak kulaklı pulluk kullanımı sonucu oluşan pulluk katmanı

Bir arazide aşırı toprak işlemenin neden olduğu diğer bir önemli arazi bozulması organik madde kaybı ile birlikte, agregatların dayanıklılıklarının azalması ve erozyona karşı hassas hale gelmeleridir. Geleneksel toprak işleme yöntemleri toprak yapısını bozarak nem ve sıcaklık koşullarını değiştirmektedir (de Oliveira Silva ve ark., 2019). Özellikle de nem içeriğinin azalıp oksijenli ortamın oluşması organik maddenin mikroorganizmalarca hızlı bir şekilde parçalanmasına ve organik karbonun CO₂ şeklinde atmosfere salınmasına neden olmaktadır. Rakotovao ve ark. (2017), toprak işleme uygulamalarının CO₂ emisyonlarını ve sonuç olarak toprak karbon kayıplarını hızlandığını bildirmiştir. Toprak işlemede pulluk kullanımının yer aldığı geleneksel uygulamalardan koruyucu işleme uygulamalarına geçiş, toprak profili içinde toprak organik maddesinin birikmesine, zamanla agregatların dayanıklılığının artmasına ve ekosistem hizmetlerinin iyileştirilmesine önemli katkı sağlayacaktır.

Sulama olanakları: Su kaynakları bakımından oldukça zengin olan Yüksekova ovasında tarım arazilerinin büyük çoğunluğunda alt yapı yetersizliği nedeniyle sulama olanakları bulunmamaktadır. Bunun temel nedeni ovaya akan su kaynakları (nehir, dere) üzerine herhangi bir sulama göleti veya barajının yapılmaması ve arazilerin büyük çoğunluğuna sulama kanallarının ulaştırılmamasıdır. Sulama imkânlarının olmadığı arazilerde buğday veya nohut

yetiştiriciliği yapılmaktadır. Üreticilerden edinilen bilgiler buğday veriminin en fazla 200 kg da⁻¹ olduğunu göstermektedir. Ovada verimin bu kadar düşük olmasının temel nedenleri sulama imkânlarının olmamasının yanında mineral veya organik gübre kullanımının olmaması ve yıllardır aynı buğday tohumunun kullanılmasıdır. Bölgede sulama imkânları genellikle ovanın kenar köylerinde dere kaynaklarından veya ovanın iç kısımlarında artezyen kuyulardan (Şekil 4) sağlanmaktadır. Tarlaya ulaştırılan su yetersiz olmasına rağmen, sulama yöntemi olarak genellikle salma sulama yöntemi tercih edilmektedir. Bu durum, arazilerde drenaj sorununun şiddetlenmesine ve yer yer bitki kökleri için uzun zaman boyunca havasız koşulların oluşmasına da neden olmakta ve sulanan arazilerde de verim düşüklüğüne yol açmaktadır. Hernandez ve ark. (2019), dünyadaki ekin alanlarının yalnızca %20'sinde sulama olanaklarının olduğunu ve küresel anlamda sulanan arazilerde sulanamayan alanlara göre % 200 daha fazla ürün alındığını ifade etmiştir. Ayrıca, araştırmacılar kurak ve yarı kurak bölgelerde, sulama olanaklarının ekonomik getirileri artırdığını ve üretimde karlılığı %400'e kadar artırabildiğini rapor etmiştir. Bu nedenle, bölgede kritik bitki gelişme dönemlerinin kurak geçtiği yıllarda sulamanın yapılabilmesi verim artışlarının ve üretimde istikrarın sağlanması adına önemli katkı sağlayacaktır. Özellikle de kurak ve yarı kurak bölgelerde çimlenme, sapa kalkma ve başaklanma dönemlerinde toprak nem düzeyi tahıllarda verimin oluşumunda belirleyici olduğundan (Bulut, 2017) yağışın olmadığı kurak dönemlerde toprak neminin yetersiz olması durumunda buğday ve arpada sulama, verimi önemli derecede arttıracaktır. Bu nedenle ova genelinde sulama imkânlarının geliştirilmesi oldukça önem arz etmektedir.



Şekil 4. Yüksekova ovasında sulamada kullanılan bazı artezyen su kuyularına ait görüntüler

Gübreleme: Tarımsal üretimde gübreleme, verimi artırmakla beraber daha kaliteli ürün elde etmenin en önemli yollardan biridir (Savcı, 2012). Farias ve ark. (2020), tarım arazilerinde toprakta erozyon, bitki hasadı, yıkanma ve diğer yollar ile kaybolan besin elementlerinin tekrar toprağa ilavesi, birim alandan alınacak verimin artmasını sağladığını bildirmiştir. Bunun bilincinde olan çiftçilerin uygun dozlarda gübre kullanımına olan talep tüm dünyada giderek artmaktadır. Zira FAO (2015), tarım topraklarında en çok kullanılan azot, fosfor ve potasyum gübrelere olan taleplerin her yıl sırası ile %1.4, %2.2 ve %2.6 oranında arttığını bildirmiştir. Bitkisel üretimde birim alandan daha fazla ürün almak için en az sulama kadar önemli bir girdi olan gübrelemenin Yüksekova ovasında yer alan arazi sahipleri (çiftçiler) tarafından neredeyse hiç yapılmaması birim alandan alınan ürünün düşük olmasının en önemli nedenidir. Bölgede küçükbaş ve büyükbaş yayvan yetiştiriciliği önemli bir yer tutsa da özellikle kırsal kesimde yakacak temini sorunundan dolayı çok değerli bir gübre olan hayvan gübresinin yakacak olarak kullanılmasına neden olmaktadır (Şekil 5). Zira ülkemizde birincil enerji tüketiminin halen %10-20'sini tezek oluşturmaktadır. Bu durum, toprakların sürdürülebilir toprak kalitesi için hem toprak düzenleyici hem de besin elementi kaynağı olan organik gübrelere elden çıkmasına neden olmaktadır (Boyacı ve ark., 2011).



Şekil 5. Yüksekova ovası genelinde bulunan bazı köylerde yakacak olarak kullanılmak üzere koyun gübresinden üretilen tezek yığınları

Hastalık, zararlı ve yabancı otlar ile mücadele: Yüksekova ovasında, tarım arazilerinde birim alandan alınan ürünün Türkiye ortalamasının altında olmasının bir diğer önemli sebebi hastalık, zararlı ve yabancı otlar ile mücadelenin yeterince veya hiç yapılmamasıdır. Bölgede bitki koruma etmenleri ile uygun ve yeterli düzeyde mücadele yapılmadığında kültür bitkisi türüne bağlı olarak önemli verim kayıpları meydana gelmektedir. Nitekim küresel düzeyde bitki koruma etmenlerinin yol açtığı ürün kayıplarının kültür bitkisine göre değişmekle birlikte her yıl ortalama %35-42 arasında değiştiği tahmin edilmektedir (Oerke, 2006). Ülkemizde ise yetiştirilen farklı kültür bitkilerinde ekonomik düzeyde zarar yapan 552’den fazla hastalık, zararlı ve yabancı ot türü bulunmaktadır (Kadioğlu, 2012). Bu etmenlerin neden olduğu verim kayıplarının %30-40 arasında değiştiği, mücadele yapılmadığı alanlarda bu oranın %100’e ulaşabildiği belirtilmiştir (Canhilal ve Tiryaki, 2010).

Bölgede kar sularının geç çekilmesi nedeniyle toprak neminin yüksek olduğu buğday alanlarında fungal hastalıkların (*Fusarium* spp. ve *Puccinia* spp vb) yoğun bulaşıklı olduğu görülmektedir (Şekil 6). Bölgedeki buğday verimini etkileyen ana faktörlerden birini hastalık etmenleri oluşturmaktadır. Dolayısıyla bölgede başta buğday yetiştiriciliği olmak üzere tarımsal üretimin geliştirilmesi ve sürdürülebilirliği açısından bölge iklimine adaptasyonu yüksek ve hastalıklara dayanıklı çeşitlerin geliştirilmesi ve kullanılması verim ve kalite açısından önemli olacaktır.



Şekil 6. Yüksekova Havzasında buğday üzerinde tespit edilen *Puccinia graminis* Pers. hastalık etmeni ve belirtisi

Bölgede tarımsal üretimde önemli verim kayıplarına neden olan bitki koruma faktörlerden bir diğeri de zararlılardır. Özellikle ovada buğday ve yem bitkileri ekili tarım arazilerinde çekirge istilası nedeniyle verim kayıplarının her yıl değişmekle birlikte %100’e ulaştığı sezonlar olduğu çiftçiler tarafından belirtilmiştir. Ayrıca süne, nohut yeşil kurdu vb zararlı türlerinin de bitkisel üretimde önemli verim kayıplarına neden olduğu tespit edilmiştir. Bu durum bölge çiftçisinin

zararlıların üreme biyolojisi, mücadele dönemleri ve mücadelede stratejileri hakkında yeterli düzeyde bilgi sahibi olmadığından ileri gelmektedir. Bu nedenle bölgede zararlılara karşı kimyasal mücadele yapılsa dahi uygun dönem, uygun madde ve uygun dozlarda yapılmadığında etkili olmadığı gözlemlenmiştir (Şekil 7). Bu nedenle bölge çiftçisinin zararlılar ve mücadelesi hakkında bilgilendirme çalışmalarının yapılması üretimde sorun oluşturan zararlılarla etkili bir şekilde mücadele etmek için oldukça önemlidir. Ayrıca bölgede çekirge istilası ile etkili bir mücadelenin yapılması için yumurta çıkış dönemlerinin takip edilerek bölgesel olarak ilaçlama faaliyetlerinin gerçekleştirilmesi çekirge yoğunluğunun azaltılmasında etkili olabilecektir.



Şekil 7. Yüksekova Havzasında buğday tarlasında çekirge istilası ve mücadelesi (Anonim, 2022)

Bölgede kültür bitkilerinde verim ve kaliteyi etkileyen diğer bir önemli faktör ise yabancı ot mücadelesinin yetersiz olmasıdır. Bölgedeki çiftçilerin sertifikalı veya selektörden geçirilmiş temiz tohumluk kullanmadığı gibi vejetasyon dönemi içerisinde yabancı otlarla herhangi bir mücadelesi söz konusu değildir. Bu nedenle, bölgede yapılan sürvey çalışmalarında farklı kültür bitkilerinin içerisinde yabancı ot yoğunluğunun çok yüksek olduğu ve önemli verim ve kalite kayıplarına neden olduğu gözlemlenmiştir (Şekil 8). Bölgede tarımsal üretimi artırmak ve sürdürülebilirliği sağlamak için verim ve kaliteyi etkileyen ve diğer hastalık ve zararlılara konukçuluk yapan yabancı otların kontrol altına alınması oldukça önemlidir. Ülkemizde yabancı otlardan kaynaklanan verim kayıplarının bölgelere ve kültür bitkilerine göre değişmekle birlikte %20-35 arasında olduğu belirtilmiştir (Özer, 1993; Oerke, 2006; Önen, 2021).



Şekil 8. Yüksekova Havzasında buğday tarlasında yabancı ot tür ve yoğunluğu

Arazilerin amaç dışı kullanımı: Çalışma alanında ait uydu görüntüleri incelendiğinde son 30 yılda tarım arazilerinin önemli bir kısmı yerleşim alanlarına dönüştürülmüştür. Özellikle Yüksekova ilçe merkezinin ovaya doğru gelişim göstermesi tarım arazilerinin önemli bir kısmının işgal edilmesine neden olmuştur (Şekil 9). Daha önceleri yaklaşık 23 bin hektar olan ovanın (Mera/Biçenek ve sulak alan ve tarım arazileri dahil) yaklaşık 17.5 bin hektara kadar düştüğü tespit edilmiştir. Zira işgal edilen arazilerin büyük bölümünü tarım arazileri oluşturmaktadır. 1950’li yıllarda ilçe merkezinin de dâhil olduğu ovanın önemli bir kısmı sulak alan özellikte iken hem iklimsel değişimler hem de insan etkisi sonucu bu alanlar kurumuş ve imara açılmıştır. Bu durum bir taraftan bölgenin en verimli tarım arazilerinin elden çıkmasına neden olurken diğer taraftan da deprem olasılığı göz önünde bulundurulduğunda bu alanların en riskli alanlar olmasına neden olmuştur. Bölgede hem tarım arazilerinin sınırlı olması hem de 1. Derecede deprem bölgesinde yer alması nedeni ile ova genelinde arazilerin imara açılmaması ve imara açılan arazilerin tekrar gözden geçirilmesi gerekmektedir.



Şekil 8. Ovada son 30 yılda İlçe merkezinin ovaya doğru gelişimi

Sonuç

Tüm ovada oldukça detaylı yapılan arazi gözlemleri ve yapılan toprak analizleri, tarımsal ekosistemde verim ve kalitenin artırılması; sürdürülebilir kültürel önlemlerin (temiz tohum, münavebe ekim, gübreleme, sulama vb), korumaya yönelik geliştirilmiş olan modern tarım uygulamalarının (hastalık ve zararlılara dayanıklı çeşitler, adaptasyonu yüksek çeşitler vb), toprağı çok fazla parçalamadan tohum yatağı hazırlamaya yardımcı olacak uygun toprak işleme

tekniklerinin adaptasyonu ve uygun harman makineleri kullanılmasının yanı sıra önemli verim ve kalite sorunlarına neden olan bitki koruma etmenleriyle farklı mücadele tekniklerinin entegre bir şekilde kullanılarak (mekanik, fiziksel, biyolojik ve kimyasal) kontrol altına alınmasıyla sağlanabilir.

Teşekkür

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Kaynaklar

- Anonim 2019a. Yüksekova İklim Verileri. T.C. Çevre, Şehircilik Ve İklim Değişikliği Bakanlığı. Meteoroloji 45nGenel Müdürlüğü. Ankara. (Erişim Tarihi 15.01.2023).
- Anonim 2019b. Tarım ve Orman Bakanlığı, Su Yönetimi Genel Müdürlüğü, Su kalitesi yönetimi hizmet içi eğitim kitabı. 03-05. Nisan 2019 S: 10 <https://www.tarimorman.gov.tr/SYGM/Belgeler/Su%20Kalitesi%20HC4%B0E%20Haber%202019/Sulak%20Alanlar%20ve%20Onemi.pdf> (Erişim Tarihi: 18.01.2023).
- Anonim, 2022. <https://www.hurriyet.com.tr/gundem/yuksekovada-cekirge-istilasi-bolge-halki-dertli-ilk-kez-boylesiyle-karsilastik-42101825> Erişim Tarihi. 20.04.2023
- Budak, M., Kılıç, M., 2022. Arazi Bozulması ve Toprak Kalitesi İlişkisi. Toprak Kalitesi ve Değerlendirilmesi Kitabı P: 5-44. ISBN: 978-625-6380-93-6. Ankara
- Bulut, S. (2017). Kayseri’de tahıl tarımı, verimlilik sorunları ve çözüm önerileri. *Journal of Natural and Applied Sciences*, 33(3), 83-94.
- Borges, P. A., Gabriel, R., & Fattorini, S. (2020). Biodiversity erosion: causes and consequences. In *Life on land* (pp. 81-90). Cham: Springer International Publishing.
- Boyacı, S., Akyüz, A., Kükürtçü, M. (2011). Büyükbaş hayvan barınaklarında gübrenin yarattığı çevre kirliliği ve çözüm olanakları. *Tarım Bilimleri Araştırma Dergisi*, (1), 49-55.
- Canhilal, R., & Tiryaki, O. (2010). Kayseri ve civarında bitki koruma uygulamaları: problemler ve çözüm önerileri. *Erciyes Üniversitesi Fen Bilimleri Enstitüsü Fen Bilimleri Dergisi*, 26(2), 88-101.
- Çelebi, M. (2010). Topluşturmanın Karaman ilinde sulama ve diğer tarımsal faaliyetlerin verimliliği üzerinde etkileri. *Tarım Bilimleri Araştırma Dergisi*, (2), 1-6.
- Daniel, J., Gleason, J. E., Cottenie, K., & Rooney, R. C. (2019). Stochastic and deterministic processes drive wetland community assembly across a gradient of environmental filtering. *Oikos*, 128(8), 1158-1169.
- de Oliveira Silva. B., Moitinho. M. R., de Araujo Santos. G. A., Teixeira. D. D. B., Fernandes. C., & La Scala Jr. N. (2019). Soil CO₂ emission and short-term soil pore class distribution after tillage operations. *Soil and Tillage Research*. 186. 224-232.
- FAO, Food and Agriculture Organization of the United Nations. (2015). World fertilizer trends and outlook to 2018.
- Farias, G. D., Dubeux, J. C. B., Savian, J. V., Duarte, L. P., Martins, A. P., Tiecher, T., ... & Bremm, C. (2020). Integrated crop-livestock system with system fertilization approach improves food production and resource-use efficiency in agricultural lands. *Agronomy for Sustainable Development*, 40, 1-9.
- Fernández-Cirelli, A., Arumí, J. L., Rivera, D., & Boochs, P. W. (2009). Environmental effects of irrigation in arid and semi-arid regions. *Chilean Journal of Agricultural Research* 69 (2009), Nr. SUPPL. 1, 69(SUPPL. 1), 27-40.
- Foley, J.A., R. DeFries, G.P. Asner, C. Barford, G. Bonan, S.R. Carpenter, et al. 2005. Global consequences of land use. *Science* 309:570–574. doi:10.1126/science.1111772Fu, B., L. Zhang, Z. Xu, Y. Zhao, Y. Wei, and D. Skinner. 2015. Ecosystem services in changing land use. *J. Soils Sediments* 15:833–843. doi:10.1007/s11368-015-1082-x
- Hernández, Á., Arellano, E. C., Morales-Moraga, D., & Miranda, M. D. 201). Understanding the effect of three decades of land use change on soil quality and biomass productivity in a Mediterranean landscape in Chile. *Catena*, 140, 195-204.
- Kadioğlu, İ. Türkiye Tarımında Bitki Koruma ve Bazı Güncel Yaklaşımların Değerlendirilmesi. *Ziraat Mühendisliği*, (359), 18-25.
- Kopittke, P. M., Menzies, N. W., Wang, P., McKenna, B. A., & Lombi, E. (2019). Soil and the intensification of agriculture for global food security. *Environment international*, 132, 105078.
- Lefebvre, G., Redmond, L., Germain, C., Palazzi, E., Terzago, S., Willm, L., & Poulin, B. (2019). Predicting the vulnerability of seasonally-flooded wetlands to climate change across the Mediterranean Basin. *Science of the Total Environment*, 692, 546-555.
- Li, Z., Gao, J., Wen, L., Zou, C., Feng, C., Li, D., & Xu, D. (2019). Dynamics of soil respiration in alpine wetland meadows exposed to different levels of degradation in the Qinghai-Tibet Plateau, China. *Scientific Reports*, 9(1), 1-14.
- Liu, Z. W., Li, S. N., Wei, W., Song, X. J. (2019). Research progress on alpine wetland changes and driving forces in Qinghai-Tibet Plateau during the last three decades. *Chinese Journal of Ecology*, 38(3), 856.

- Jin, X., Jin, H., Luo, D., Sheng, Y., Wu, Q., Wu, J., ... & Li, Y. (2022). Impacts of permafrost degradation on hydrology and vegetation in the source area of the Yellow River on Northeastern Qinghai-Tibet Plateau, Southwest China. *Frontiers in Earth Science*, 10, 845824.
- Meng, B., Liu, J. L., Bao, K., & Sun, B. (2020). Methodologies and management framework for restoration of wetland hydrologic connectivity: A synthesis. *Integrated environmental assessment and management*, 16(4), 438-451.
- Oerke, E.-C., H-W. Dehne, F. Schonbeck, and A. Weber. 1994. Crop Production and Crop Protection: Estimated Losses in Major Food and Cash Crops, 808 pp.
- Oerke, E. C. (2006). Crop losses to pests. *The Journal of Agricultural Science*, 144(1), 31-43.
- Önen, H. 2021a. Giriş, 1. Bölüm. "Herboloji (Yabancı Ot Bilimi): İlkeler, Kavramlar ve Uygulamalar / Weed Science: Theory and Practice" içinde (s. 1-7). Adana, DOI: 10.13140/RG.2.2.15848.39684
- Özer, Z. (1993). Niçin yabancı ot bilimi (Herboloji) ? Türkiye I. Herboloji Kong.. 3-5 Subat. 1993, 1-7, Adana.
- Özer, Z., Kadioğlu, İ., Önen, H., Tursun, N. (2001). Herboloji (Yabancı Ot Bilimi). Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Yayınları, No: 20 Kitap Seri No: 10, Tokat.
- Pozza, L. E., Field, D. J. (2020). The science of soil security and food security. *Soil Security*, 1, 100002.
- Rakotovo. N. H., Razafimbelo. T. M., Rakotosamimanana. S., Randrianasolo. Z., Randriamalala. J. R., & Albrecht. A. 2017. Carbon footprint of smallholder farms in Central Madagascar: The integration of agroecological practices. *Journal of Cleaner Production*. 140. 1165-1175.
- Rashid, I., & Aneaus, S. (2019). High-resolution earth observation data for assessing the impact of land system changes on wetland health in Kashmir Himalaya, India. *Arabian Journal of Geosciences*, 12(15), 453.
- Richardson, C.J., Hussain, N.A. (2006). Restoring the Garden of Eden: an ecological assessment of the marshes of Iraq. *BioScience*, 56(6), 477-489.
- Rojas, R. V., Achouri, M., Maroulis, J., & Caon, L. (2016). Healthy soils: a prerequisite for sustainable food security. *Environmental Earth Sciences*, 75, 1-10.
- Sançar, T. (2018). Investigation of Uplift Rate History of the Yüksekova Basin (Southeast Turkey). *Türkiye Jeoloji Bülteni/Geological Bulletin of Turkey*, 61(2), 207-240.
- Savci, S. (2012). An agricultural pollutant: chemical fertilizer. *International Journal of Environmental Science and Development*, 3(1), 73.
- Şahinoglu, A., & Ozdemir, A. (2019). Investigation of Yüksekova (Hakkari) peat bed by geological and geophysical methods. III. In *International Scientific And Vocational Studies Congress*.
- Wang, Y., Tan, W., Li, B., Wen, L., & Lei, G. (2021). Habitat alteration facilitates the dominance of invasive species through disrupting niche partitioning in floodplain wetlands. *Diversity and Distributions*, 27(9), 1861-1871.
- Xu, X., Chen, M., Yang, G., Jiang, B., & Zhang, J. (2020). Wetland ecosystem services research: A critical review. *Global Ecology and Conservation*, 22, e01027.
- Yang, X., Liu, S., Jia, C., Liu, Y., & Yu, C. (2021). Vulnerability assessment and management planning for the ecological environment in urban wetlands. *Journal of Environmental Management*, 298, 113540.

**MEASUREMENT OF NESFATIN-1 HORMONE IN BREAST MILK of
LACTATIONAL SHEEP**

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Abstract

Nesfatin-1 is a protein produced by the hypothalamus and identified satiety molecule in Zucker rats (Oh-I et al. 2006). In addition to its appetite-regulating effects, nesfatin has also been shown to be present in human milk (Aydın S., 2010). It was not determined that the hormone nesfatin 1 in milk was found in sheep. So in this study we wanted to measure the value of nesfatin 1 in sheep milk.

Materials-Methods

During the study, water and oat hay were given ad-libitum to the sheep and 500 g of concentrated feed (sheep milk feed) per animal daily.

We measured nesfatin-1 in the milk of sheep in early lactation period. Milk of 15 Kıvırcık sheep was taken for analysis 3 weeks after birth Nesfatin 1 levels in milk were analyzed with a plate reader using specific commercial ELISA kit (Mybisource, cat. no: MBS735285, Sheep Nesfatin-1 Elisa Kit)

Results

In order to determine the concentration of nesfatin 1, it was found that nesfatin-1 was found in the milk of 15 sheep in our analysis.

Sheep milk (n:15)	Nesfatin-1 concentrations ng(ml)
1	2,15
2	2,21
3	3,96
4	3,75
5	3,56
6	3,43
7	2,6
8	3,27
9	3,36
10	2,79
11	2,58
12	3,61
13	3,29
14	2,54
15	3,98

Discussion

RT-PCR study demonstrated that nesfatin/NUCB2 mRNA was expressed in various tissues including the brain and the adipose tissue. The origin of circulating nesfatin 1 in the serum has not been determined. However Aydın (2010) reported that nesfatin-1 was present in human breast milk.

It was assumed that nesfatin-1 in breast milk was transferred from the maternal circulation to breast milk and then passed to the neonatal blood. In conclusion, breast milk contain nesfatin-1 in sheep. Therefore, nesfatin -1 could be some functions about the development of the gastrointestinal system, regulation of appetite and contribution to metabolism in both sheep and lambs.

References

- Shinsuke Oh-I, Hiroyuki Shimizu, Tetsuro Satoh, Shuichi Okada, Sachika Adachi, Kinji Inoue, Hiroshi. Identification of nesfatin-1 as a satiety molecule in the hypothalamus. *Nature*, 443 (2006), pp. 709-712.
- Aydın S., The presence of the peptides apelin, ghrelin and nesfatin-1 in the human breast milk, and the lowering of their levels in patients with gestational diabetes mellitus. *Peptides*, 31 (2010), pp. 2236-2240.

**SÜRDÜRÜLEBİLİR BAĞCILIK VIZYONUNA UYGUN ETKİLİ VE EKONOMİK
BİR BİYOSTİMÜLAN: DENİZ YOSUNU EKSTRAKTI**

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ÖZET

Biyostimülanlar, sentetik gübrelere ve bitki büyüme düzenleyicilerine çevre dostu ve uygun maliyetli alternatifler olarak kabul edilir. Bu bağlamda deniz yosunları, küresel olarak bulunabilmesi nedeniyle özel ilgi görmektedir. Deniz yosunu ekstraktları, abiyotik ve biyotik streslere karşı bitki toleransını artırarak ve besin kullanımını iyileştirerek farklı toprak türlerine sahip ürünler ve tarım sistemlerinde verimi ve kaliteyi sürdürülebilir bir şekilde artırma kapasitesine sahip geniş tarımsal biyo-uyarıcılardır. Deniz yosunu ekstraktlarının ürün verimini ve bitkinin çevresel strese karşı toleransını iyileştirdiği mekanizmalar hakkında daha fazla bilgi geliştirmek, deniz yosunu ekstraktlarının yetiştiriciler tarafından benimsenmesi için önemli bir bilimsel itici güç oluşturmaktadır. Deniz yosunu ekstraktının kullanımı yenilikçi bir şekilde bağcılık için mevcut sistemlere dahil edilmesi kolay, gelecek vadeden sürdürülebilir bir yaklaşım sunmaktadır. Biyostimülanlar, endüstride etkili, sürdürülebilir bir alternatif olarak destek kazanmaya devam ettikçe, artık çoğu araştırma, bunların etki tarzlarını ve genel ürün verimliliği üzerindeki olumlu özelliklerini nasıl ortaya çıkardıklarını anlamayı amaçlamaktadır. Bu çalışmada, deniz yosunu ekstraktlarının üzüm üretiminde kullanımı ve bunların asma fizyolojisi ve strese uyum mekanizmaları üzerindeki etkileri güncel çalışmalar ışığında derlenmiştir.

Anahtar kelimeler: Asma, ekonomik sürdürülebilirlik, stress toleransı, verimlilik

**EFFECTIVE AND ECONOMICAL BIOSTIMULANT IN PROPER WITH THE
VISION OF SUSTAINABLE VITICULTURE: SEAWEED EXTRACT**

ABSTRACT

Biostimulants are considered environmentally friendly and cost-effective alternatives to synthetic fertilizers and plant growth regulators. In this context, seaweeds are of particular interest due to their global availability. Seaweed extracts are broad agricultural biostimulators with the capacity to sustainably increase yield and quality in crops and agricultural systems with different soil types by increasing plant tolerance to abiotic and biotic stresses and improving nutrient utilization. Developing more knowledge of the mechanisms by which seaweed extracts improve crop yield and plant tolerance to environmental stress is an important scientific impetus for industry adoption of seaweed extracts. The use of seaweed extract innovatively offers a promising sustainable approach to viticulture that is easy to incorporate into existing systems. As biostimulants continue to gain support in industry as an effective, sustainable alternative, most research now seeks to understand their mode of action and how they reveal their positive properties on overall product efficiency. In this study, the use of seaweed extracts in grape production and their effects on vine physiology and stress adaptation mechanisms were compiled in the light of current studies.

Keywords: Grapevine; economic sustainability, stress tolerance, productivity

Giriş

Biyostimülanlar; bitkinin gelişimini, beslenmesini, ürün kalitesini ve verimini olumlu yönde etkileyen; bitkilerin strese dayanıklılığını artıran; bitkilere topraktan, yapraktan ya da tohuma uygulanan, içeriğinde inorganik veya organik bileşikler, mikroorganizmalar bulundurabilen, aynı zamanda toprak yapısını düzenleyici etkileri de bulunabilen materyallerdir (Külahtaş ve Çokuysal 2013).

Su bitkileri olarak adlandırılan deniz yosunları (makro algler) enerji, tıp, kimya, gıda ve tarım alanlarında hammadde veya katkı maddesi olarak kullanılmaktadır. Dünyada yaklaşık 6 milyon ton deniz yosunu hasat edilmekte olup bunun 1 milyon tonu fikoit (su yosunlarından elde edilen ekstraktlar), 1 milyon tonu tarım alanında toprak düzenleyici/zenginleştirici ve tarım kimyasalları üretiminde, geriye kalan büyük kısım ise gıda maddesi olarak tüketilmektedir (Engin ve ark., 2019). Vitamin, mineral ve iz elementler en çok okyanuslar ve denizlerde bulunmaktadır. Deniz yosunları bu elementleri yüksek konsantrasyonlarda bünyesine alma ve bünyesinde barındırma yeteneğindedir (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021).

Deniz yosunları birçok ülkede; sıvı ekstrakt veya doğrudan toprağa karıştırılarak kullanılmaktadır. Deniz yosunu ekstraktları, bitki tarafından kullanılabilir veya bitki tarafından parçalanabilir bir takviye sağlamak yerine bitkiye uygulandığında iç tepkileri (bitki savunması ve büyümesi) "uyardıkları" için biyo-gübrelerin aksine biyo-uyarıcılar olarak sınıflandırılır (Ali et al. 2021). Deniz yosunlarının doğrudan toprağa karıştırılmasının ana hedefi toprak yapısını düzelterek, toprak verimliliğini artırmaktır. Her ne kadar deniz yosunlarının doğrudan toprağa karıştırılıp gübre olarak kullanıldığı, eski zamanlardan beri biliniyorsa da, son 45-50 yıldır bu ekstraktların yapraklardan çeşitli aletlerle püskürtülerek uygulanmasının da verim ve ürün kalitesini artırdığı tespit edilmiştir (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021).

Avrupa ülkeleri genellikle kahverengi yosunlardan *Ascophyllum*, *Fucus* ve *Laminaria* cinslerini; Amerika ise *Macrocystis*, *Nereocystis* gibi büyük talluslu kahverengi yosunları yaygın olarak kullanmaktadır (Güner ve Aysel, 1996). Ülkemizde de kelpak ve maxicrop gibi ithal deniz yosunu ekstraktlarının domates, marul, üzüm ve zeytin gibi çeşitli tarımsal ürünlere olan etkilerinin araştırıldığı çalışmalar bulunmaktadır (Akman, 1995; Özlü, 1997; Demir ve ark., 2003; Güllüoğlu ve Arıoğlu, 2005; Kök ve Bal, 2016).

Bu çalışmada, deniz yosunu ekstraktlarının üzüm üretiminde kullanımı ve bunların asma fizyolojisi ve strese uyum mekanizmaları üzerindeki etkileri güncel çalışmalar ışığında derlenmiştir.

Deniz Yosunu Türleri, Bileşimleri ve Etkileri

Deniz yosunları, yaklaşık 10.000 adet kırmızı, kahverengi ve yeşil türü kapsayan çeşitli bir fotosentetik ökaryotik organizma grubudur (Khan ve ark., 2009). Sayıları ve dağılımları göz önüne alındığında, kahverengi türler (*Phaeophyceae*) bahçe bitkileri üretiminde çeşitli uygulamalarla ticari ekstrakt hazırlamak için yaygın kullanılanlardır (Battacharyya ve ark., 2015).

Deniz yosunlarından hazırlanan biyostimülan ürünlerin çoğu, Avrupa'nın kuzeybatı ve kuzey Amerika'nın kuzeydoğu kıyıları boyunca bol miktarda dağılmış olan tek bir kahverengi yosun türü olan *Ascophyllum nodosum* (L.) Le Jolis'den üretilmektedir (Craigie, 2011). Bununla birlikte, şu anda piyasalarda bulunan çeşitli ticari ekstraktlar, *Ecklonia maxima*, *Durvillaea potatorum*, *D. antarctica*, *Himantalia elongata*, *Laminaria digitata*, *L. hyperborea*, *Macrocystis pyrifera* ve *Sargassum* spp. gibi diğer kahverengi yosun türlerinden yapılmaktadır. *Fucus serratus*, *Ulva intestinalis*, *U. lactuca* ve *Kappaphycus alvarezii* gibi diğer daha az yaygın türler de kullanılmaktadır (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021).

Kahverengi yosunlardan (*Ascophyllum nodosum*) yapılan ticari ekstraktlar, azot, fosfor, potasyum, kalsiyum, demir, magnezyum, çinko, sodyum, sülfür ve değişen miktarlarda amino asit içermektedir (Fleurence, 2004; Rayirath ve ark., 2009; Gutiérrez-Gamboa ve ark., 2020c).

Deniz yosunları, geçmişte gübre olarak değerlendirilmiştir. *A. nodosum* türü, deniz suyundan besinleri ve mineralleri biriktirmede çok etkili olup bu türün hasat edilen biyokütlesi, bitkilerdeki fizyolojik tepkileri iyileştirmek için bahçe bitkileri yetiştiriciliğinde gübre olarak kullanılmaktadır (Pereira ve ark., 2020). Ayrıca toprağı havalandırma ve nem tutma özellikleri yanında azot yönünden çiftlik gübresi kadar zengin olması, çok küçük konsantrasyonlarda bile bitkilerde farklılaşma, büyüme gibi birçok fizyolojik olayı kontrol eden oksinler, sitokininler, gibberellinler, absisik asit ve brassinosteroidler (Stirk ve ark., 2014) dahil olmak üzere birkaç fitohormon ile mikro ve makro besin maddelerini ihtiva etmelerinden dolayı günümüzde farklı ülkelerde; örtüaltı yetiştiriciliği başta olmak üzere; armut, asma, elma, ve turuncgiller ile süs bitkileri yetiştiriciliğinde yaygın olarak kullanılmaktadır (Güner ve Aysel, 1996).

Alaria esculenta, *A. nodosum*, *Ectocarpus siliculosus*, *Fucus serratus*, *F. spiralis*, *F. vesiculosus*, *Halidrys siliquosa*, *Laminaria digitata*, *L. hyperborea*, *L. saccharina* ve *Pilayella littoralis* gibi kahverengi yosun türleri, abiyotik faktörlere yanıt olarak aktive olan mannitol

gibi önemli koruyucu bileşikler de içerir (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021). Mannitol aynı zamanda bir şelatlama maddesi olarak da bilinir ve bu, alglerin bitki kullanımı için toprakta uygun olmayan elementleri neden bitkinin yararlanabileceği hale getirdiğini açıklar (Reed ve ark., 1985). Kahverengi yosun *Pterygophora californica*'nın önemli miktarlarda melatonin içerdiği belirlenmiştir (Fries ve Thorén-Tolling, 1978).

Deniz yosunu ekstratı uygulamalarının biyotik ve abiyotik stres faktörlerine karşı direnç sağladığı, bitkilerde verimi etkilediği ve tohum çimlenmesini iyileştirdiği bildirilmiştir (Mahima ve ark., 2018).

Polisakkaritler, çoğu yosun türünün ticari ekstratlarının ana bileşenlerinden biridir (Sharma ve ark., 2014). Bu bileşenler, deniz yosunu ekstratının kuru ağırlığının % 30 veya % 40'ını oluşturabilir (Rayirath ve ark., 2009). Kahverengi yosun ekstratları söz konusu olduğunda, en yaygın polisakkaritler aljinatlar, fukoidanlar, laminatlar ve glukanlardır (Khan ve ark., 2009). Bitki büyümesini teşvik ettiği gösterilen (Yabur ve ark., 2007) β -D-mannuronik ve α -L-guluronik asitlerin polimerleri olan aljinatlar, kullanılan yosun türlerine göre viskozite bakımından farklılık göstermektedir (Battacharyya ve ark., 2015). Deniz yosunu ekstratlarının diğer önemli bileşenleri, bağcılıkta kullanılan ve bitkilerin mantar ve bakteriyel patojenlere karşı savunma tepkilerini modüle etmede etkisi olduğu iyi bilinen laminarinlerdir (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021).

Kahverengi yosunlar, özellikle *E. stolonifera*, *F. vesiculosus*, *F. serratus* ve *A. nodosum*, 30 g/100 g ekstrakta bile yüksek fenolik bileşik konsantrasyonlarına ulaşabilmektedir (Balboa ve ark., 2013). Florotanninler, kahverengi yosunlarda bulunan floroglukinolün oligomerleridir ve kateşin, askorbik asit, epigallokateşin gallat, *trans*-resveratrol ve tokoferol ile karşılaştırıldığında daha etkili antioksidanlar olduğu bildirilmektedir (Shibata ve ark., 2003).

A. nodosum'un benzersiz özelliklerinden biri, kendisini kurumadan koruyan mantar endofit *Mycosphaerella ascophylli* ile mutual ilişkisidir (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021). *A. nodosum*'dan elde edilen ekstratlarda bulunan *M. ascophylli*'den türetilen mantar sterollerinin bitkilerdeki tuzluluk stresini azaltabildiği tespit edilmiştir (Shukla ve ark., 2019).

Bağcılıkta Deniz Yosunu Kullanımı

Bağcılıkta deniz yosunu kullanımı günümüzde yoğun araştırma konusu olup literatürde asma hastalıklarından korunma, üzüm ve şarap kalitesinin iyileştirilmesi üzerindeki etkisini değerlendiren az sayıda literatür bulunmaktadır (Aziz ve ark., 2003; Sharma ve ark.,

2014; Zhang ve ark., 2016; Frioni ve ark., 2018, 2019; Mondello ve ark., 2018; Guti rrez-Gamboa ve ark., 2019b; Salvi ve ark., 2019; Taskos ve ark., 2019; Guti rrez-Gamboa ve ark., 2020a, b, c; Thankaraj ve ark., 2020).

Geçtiğimiz yirmi yıl boyunca, dünyanın başlıca bağcılık bölgeleri tahmin edilemeyen iklim koşulları ve çoğunlukla yaz döneminde, üzümün olgunlaşma dinamiklerini ve kalitesini güçlü bir şekilde etkileyen sıcaklık artışıyla karşı karşıyadır (Jones ve Davis, 2000; Tomasi ve ark., 2011; Keller, 2020). Deniz yosunu bazlı biyostimulanlar, abiyotik ve biyotik faktörlere karşı koruma sağlayabilir ve verimliliği artırabilir (Salvi ve ark., 2019). Ayrıca çevre dostu bağcılık stratejilerinin de geliştirilmesinde önemli bir rol oynayarak iklim değişikliğinin olumsuz etkilerini hafifletebilir (Sabir ve ark., 2014; Frioni ve ark., 2018).

Bağcılıkta yapraktan deniz yosunu uygulanmalarının etkileri ile ilgili literatürün çoğu verimlilik, tane-şarap bileşimi ve fizyoloji üzerine odaklanmıştır.

Deniz Yosunu Ekstrakt Uygulamalarının Verim Üzerine Etkileri

Sultani Çekirdeksiz üzüm çeşidinde *A. nodosum* ekstraktının 2.35 l/ha'lık bir dozda uygulanması, verim, salkım ve tane ağırlığı, salkım boyu ve sertliğinde bir artış sağlamış, ancak tanelerde SÇKM üzerinde olumsuz etki oluşturmuştur (Norrie ve ark., 2002).

Üç ticari deniz yosunu ekstraktının (Maxicrop®, Proton® ve Algipower®) 1.0 g/l ile 2.0 g/l dozunda kullanımı Karaerik çeşidinin bir yaşlı fidanlarında bakır ve diğer mikro besinlerin emilimini artırmıştır (Turan ve Köse, 2004).

Başka bir çalışmada, 170 ml/hl'lik bir dozda *A. nodosum* ticari ekstraktının (Alga Special®) omcalara yapraktan uygulanması, Fetească albă üzüm çeşidinde vejetatif büyümeyi, sürgün uzunluğunu, çapını ve yaprak alanını artırmıştır (Popescu ve Popescu, 2014).

Çözünür bir *A. nodosum* ekstraktı, Narince omcalarına %0.5 (h/h) konsantrasyonunda uygulandığında yaprak kuru ağırlığı, tane ağırlığı, tane hacmi, Ca, Zn, S, B ve klorofil içeriklerinde artışa neden olmuştur (Sabir ve ark., 2014).

Perlette üzüm çeşidinde, Primo adındaki bitkinin deniz yosunu temelli yaprak gübresinin 0.1 ml/l'lik uygulaması, bitkinin yaprak boyutu ve klorofil içeriği, tane tutumu, sürgün başına salkım sayısı, sap uzunluğu, tane ağırlığı ve büyüğü, SÇKM miktarı ve pH'yı artırmış ve tane su kaybını azaltmıştır (Khan ve ark., 2012).

Serin iklimde yetiştirilen Carmenère üzüm çeşidinde 3 l/ha dozunda ticari bir *A. nodosum* ekstraktının (BM86®) yapraklara uygulandıktan sonra tane tutumu ve verimliliği artırdığı bildirilmiştir (Guti rrez-Gamboa ve ark., 2019a).

Trakya İlkeren üzüm çeşidinin sofralık kalite özelliklerini iyileştirmek amacıyla uygulanan deniz yosununun farklı dozları farklı etkiler göstermekle birlikte, özellikle 1000 ve 3000 ppm dozlarının çeşidin sofralık kalite özellikleri üzerinde en iyi sonuçları verdiği bildirilmiştir (Kök ve ark., 2010).

Deniz Yosunu Ekstrakt Uygulamalarının Tane ve Şarap Bileşimi Üzerine Etkileri

Riesling üzüm çeşidinde ben düşme döneminden (ben düşme dönemi, ben düşmeden 15 ve 30 gün sonra) hasat dönemine kadar geçen sürede yapraktan uygulanan deniz yosunu ve hümitik asit uygulamalarına ait farklı dozların (0, 1000 ve 3000 ppm) çeşidin tane biyokimyasal özellikleri üzerine etkileri incelenmiştir. Araştırma sonucunda deniz yosunu uygulama dönemleri arasında en iyi kalite özelliklerinin sırasıyla ben düşme döneminden 30 gün sonra, ben düşme döneminden 15 gün sonra ve ben düşme dönemlerinden elde edildiği ve yapraktan uygulanan deniz yosunu ve hümitik asit uygulamalarının (özellikle 1000 ppm uygulama dozunun) Riesling üzüm çeşidinin tane biyokimyasal özelliklerini değiştirdiği tespit edilmiştir (Kök ve Bal, 2016).

Cabernet Sauvignon üzüm çeşidinde ben düşme döneminde 2 kg N/ha uygulanan *Durvillaea antarctica* yosunu bazlı ticari bir azotlu gübre (Basfoliar® Algae SL), çeşidin tane ve şaraplarındaki birkaç amino asit içeriğini artırmış ve aroma içeriğini iyileştirmiştir (Gutiérrez-Gamboa ve ark., 2017b, c, 2018). Birçok çalışma, ben düşme döneminde yaprak uygulamasının toprak uygulamasına oranla asmalarda besin emilimini iyileştirdiğini doğrulamıştır (Lacroux ve ark., 2008; Lasa ve ark., 2012; Verdenal ve ark., 2015; Dienes-Nagy ve ark., 2020). Bu nedenle, hem azot hem de deniz yosunu ekstratlarının birlikte yaprak uygulamaları, omca azot metabolizmasını ve dolayısıyla amino asitlerin sentezini uyararak, kaynak organlarda azotun depolanmasına yol açabilmektedir (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021). Frioni ve ark. (2018) ile Salvi ve ark. (2019), *A. nodosum* ekstraktını sırasıyla hektara 3 g/l ve 1.5 kg olarak omcalara yapraktan uygulamışlar ve tanelerde kabuk antosiyanin birikimi ile toplam fenolik bileşik içeriğini artırdığını belirlemişlerdir. Frioni ve ark. (2019), bu artışın flavonoid sentezinin metabolik yollarının aktivasyonunda yer alan genlerin spesifik modülasyonu ile ilişkili olduğunu göstermiştir. Araştırmacılar ayrıca *A. nodosum* ekstraktı uygulanan omcaların, uygulanmayan omcalara oranla *Botrytis cinerea*'dan daha az etkilendiğini gözlemlemişlerdir.

Taskos ve ark. (2019), *A. nodosum* ekstraktını %1 (h/h) konsantrasyonda Merlot üzüm çeşidine ait omcalara yapraktan uyguladıklarında, tane kabuğunda ve çekirdekte antosiyanin

ekstraksiyon kapasitesininin, verim ve salkım sayısının arttığını, tane toplam polifenol indeksini ise azalttığını gözlemlemiştirlerdir.

Tempranillo Blanco üzüm çeşidine ait omcalarda %0.25 (h/h) oranında deniz yosunu yaprak uygulamalarının iklim koşullarına bakılmaksızın kateşin ve flavonol içeriklerini artırdığı, yosun dozunun %0.50 (h/h) oranında uygulamasının ise tanelerde kurak koşullarda birkaç amino asit konsantrasyonunu nemli koşullara oranla artırdığı saptanmıştır (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021). Farklı zamanlarda (tane tutumu ve ben düşme) ve dozlarda (0, 1000, 2000 ve 3000 ppm) yapraktan uygulanan deniz yosunun etkilerinin incelendiği bir çalışmada, ben düşme dönemi+ 3000 ppm dozunun Cabernet Sauvignon üzüm çeşidinin SÇKM, toplam fenolik bileşik içerik, toplam antosiyanin miktarı ve antioksidan kapasitesi üzerinde etkili olduğu bildirilmiştir (Koç, 2020).

Deniz Yosunun Asma Fizyolojisi Üzerine Etkileri

Aziz ve ark. (2003), asma yapraklarına uygulanan *L. digitata*'dan elde edilen laminarin ekstraktının sera denemelerinde *Botrytis cinerea* ve *Plasmopara viticola* enfeksiyonunu azalttığını bildirmişlerdir. Araştırmacılar, bu etkiyi, kalsiyum akışı, hücre dışı ortamın alkalileşmesi, ROS (reaktif oksijen türleri) üretimi, savunma genlerinin ifadesi ve *trans-resveratrol* ile *viniferin* gibi stilben fitoaleksinlerin birikimi üzerindeki ekstraksiyonlara dayanarak açıklamışlardır. Stilbenlerin birikimi, Tempranillo Blanco çeşidine *A. nodosum* ekstraktının uygulanmasından sonra gerçekleştirilen bir bağ denemesinde yakın zamanda doğrulanmıştır (Gutiérrez-Gamboa ve Moreno-Simunovic, 2021). Ek olarak, Garde-Cerdán ve ark. (2017), asmalara uygulanan laminarin ve *Saccharomyces* ekstraktlarına dayalı bir uygulamanın üzüm tanelerindeki birkaç amino asit içeriğini azalttığını saptamışlardır. Bitkilerde savunma mekanizmalarının eksojen olarak ortaya çıkarılması yoluyla indüksiyonu, bazı amino asitlerin enzimatik substratlar olarak tüketilmesini veya bu bileşiklerin bir hayatta kalma mekanizması olarak rezerv organlarda bölümlere ayrılmasını içeren fizyolojik bir maliyetle sonuçlanabilir (Gutiérrez-Gamboa ve ark., 2017a). Patojenik mikroorganizmalar ve deniz yosunları, bitki savunma mekanizmalarını indüklemeye izin veren β - (1 → 3) - glukan bileşimleriyle ilgili yakın bir yapısal benzerlik gösterir (Paris ve ark., 2019). Yakın zamanda yapılan bir araştırma, Marselan üzüm çeşidinde bir laminarin ekstraktının, *P. viticola*'ya karşı savunma mekanizması için bu ekstraktın biyoaktif bileşikleri tarafından gerçekleştirilen savunma mekanizmasında açığa çıkmasından ziyade doğrudan çözeltinin asilasyon derecesi ile ilgili antimikrobiyal aktiviteyle daha çok ilişkili olduğunu göstermiştir (Paris ve ark., 2019).

Sonuç

Deniz yosunu ekstraktı ile ilgili çalışmalar her geçen gün artmaktadır. Derlemede ele alınan çalışmalara dikkat edildiğinde ise, deniz yosunu ekstraktlarının bağıcılıkta ürün verimine, bitki gelişimine ve stres etmenlerine dayanıklılık üzerine olumlu etkilerinin bulunduğu görülmektedir. Günümüzde, deniz yosunu ekstraktı kullanımı ile tarımsal ilaç ve gübrelerin aşırı ve bilinçsiz kullanımını azaltmak dolayısıyla da tarımda bilinçsizce kullanılan kimyasallar nedeniyle ortaya çıkan çevre kirliliğinin önüne geçilebilmesi mümkün görünmektedir.

Kaynaklar

- Akman, İ., 1995. Yuvarlak Çekirdeksiz Üzüm Bağlarında ve Amerikan Asma Çeliklerinde Bazı Gelişmeyi Düzenleyici Maddelerin Etkilerinin Belirlenmesi Üzerine Araştırmalar, (Doktora tezi, basılmamış). EÜ, Fen Bilimleri Enstitüsü, İzmir.
- Ali, O.; Ramsubhag, A.; Jayaraman, J. Biostimulant properties of seaweed extracts in plants: Implications towards sustainable crop production. *Plants* 2021, 10, 531.
- Aziz, A., Poinssot, B., Daire, X., Adrian, M., Bézier, A., Lambert, B., Joubert, J. M., Pugin, A., 2003. Laminarin elicits defense responses in grapevine and induces protection against *Botrytis cinerea* and *Plasmopara viticola*. *Molecular Plant-Microbe Interaction*, 16: 1118-1128.
- Balboa, E. M., Conde, E., Moure, A., Falqué, E., Domínguez, H., 2013. In vitro antioxidant properties of crude extracts and compounds from brown algae. *Food and Chemistry*, 138: 1764-1785.
- Battacharyya, D., Babgohari, M. Z., Rathor, P., Prithiviraj, B., 2015. Seaweed extracts as biostimulants in horticulture. *Scientific Horticultura*, 196: 39-48.
- Craigie, J. S., 2011. Seaweed extract stimuli in plant science and agriculture. *Journal of Applied Phycology*, 23: 371-393.
- Demir, H., Topuz, A., Gölükçü, M., Polat, E., Özdemir, F., Şahin, H., 2003. Ekolojik üretimde farklı organik gübre uygulamalarının domatesin mineral madde içeriği üzerine etkisi. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi*, 16 (1): 19-25.
- Dienes-Nagy, Á., Marti, G., Breant, L., Lorenzini, F., Fuchsmann P., Baumgartner D., Zufferey V., Spring J. L., Gindro K., Viret O., Wolfender J. L., Rösti J., 2020. Identification of putative chemical markers in white wine (Chasselas) related to nitrogen deficiencies in vineyards. *OENO One*, 54: 583-599.
- Fleurence J., 2004. Seaweed Proteins, Chap. 9. *Food Science, Technology and Nutrition*. (Editor: R. Y. Yada), Woodhead Publishing Series in Food Science, Technology and Nutrition, Elsevier, Amsterdam.
- Fries, N., Thorén-Tolling, K., 1978. Identity of the fungal endophyte of *Ascophyllum* with *Mycosphaerella ascophylli* established by means of fluorescent antibody technique. *Botanica Marina*, 21: 409-412.
- Frioni, T.; Sabbatini, P.; Tombesi, S.; Norrie, J.; Poni, S.; Gatti, M.; Palliotti, A., 2018. Effects of a biostimulant derived from the brown seaweed *Ascophyllum nodosum* on ripening dynamics and fruit quality of grapevines. *Scientia Horticulturae*, 232: 97-106.
- Frioni, T., Tombesi, S., Quaglia, M., Calderini, O., Moretti, C., Poni, S., Gatti, M., Moncalvo, A., Sabbatini, P., Berríos, J. G., Palliotti, A., 2019. Metabolic and transcriptional changes associated with the use of *Ascophyllum nodosum* extracts as tools to improve the quality of wine grapes (*Vitis vinifera* cv. Sangiovese) and their tolerance to biotic stress. *Journal of the Science of Food and Agriculture*, 99: 6350-6363.
- Garde-Cerdán, T., Mancini, V., Carrasco-Quiroz, M., Servili, A., Gutiérrez-Gamboa, G., Foglia R., Pérez-Álvarez, E. P., Romanazzi, G., 2017. Chitosan and laminarin as alternatives to copper for *Plasmopara viticola* control: Effect on grape amino acid. *Journal of Agricultural and Food Chemistry*, 65: 7379-7386.
- Godlewska, K., Michalak, I., Tuhy, Ł., Chojnacka, K., 2016. Plant growth biostimulants based on different methods of seaweed extraction with water. *BioMed Research International*, 5973760.
- Gutiérrez-Gamboa, G., Garde-Cerdán, T., Gonzalo-Diago, A., Moreno-Simunovic, Y., Martínez-Gil, A. M., 2017a. Effect of different foliar nitrogen applications on the must amino acids and glutathione composition in Cabernet Sauvignon vineyard. *LWT*, 75: 147-154.

- Gutiérrez-Gamboa, G., Garde-Cerdán, T., Portu, J., Moreno-Simunovic, Y., Martínez-Gil, A. M., 2017b. Foliar nitrogen application in Cabernet Sauvignon vines: Effects on wine flavonoid and amino acid content. *Food Research International*, 96: 46-53.
- Gutiérrez-Gamboa, G., Portu J., Santamaría, P., López, R., GardeCerdán, T., 2017c. Effects on grape amino acid concentration through foliar application of three different elicitors. *Food Research International*, 99: 688-692.
- Gutiérrez-Gamboa, G., Garde-Cerdán, T., Carrasco-Quiroz, M., Martínez-Gil, A. M., Moreno-Simunovic, Y., 2018. Improvement of wine volatile composition through foliar nitrogen applications to “Cabernet Sauvignon” grapevines in a warm climate. *Chilean Journal of Agricultural Research*, 78: 216-227.
- Gutiérrez-Gamboa, G., Garde-Cerdán, T., Souza-Da Costa, B., Moreno-Simunovic, Y., 2019a. Strategies for the improvement of fruit set in *Vitis vinifera* L. cv. ‘Carménère’ through different foliar biostimulants in two different locations. *Ciência e Técnica Vitivinícola*, 33: 177-183.
- Gutiérrez-Gamboa, G., Verdugo-Vásquez, N., Díaz-Gálvez, I., 2019b. Influence of type of management and climatic conditions on productive behavior, oenological potential, and soil characteristics of a ‘Cabernet Sauvignon’ vineyard. *Agronomy*, 9: 64.
- Gutiérrez-Gamboa, G., Garde-Cerdán, T., Rubio-Bretón, P., PérezÁlvarez, E. P., 2020a. Study of must and wine amino acids composition after seaweed applications to Tempranillo Blanco grapevines. *Food Chemistry*, 308: 125605.
- Gutiérrez-Gamboa, G., Garde-Cerdán, T., Rubio-Bretón, P., PérezÁlvarez, E. P., 2020b. Seaweed foliar applications at two dosages to Tempranillo blanco (*Vitis vinifera* L.) grapevines in two seasons: Effects on grape and wine volatile composition. *Food Research International*, 130: 108918.
- Gutiérrez-Gamboa, G., Garde-Cerdán, T., Rubio-Bretón, P., PérezÁlvarez, E. P., 2020c. Biostimulation to Tempranillo grapevines (*Vitis vinifera* L.) through a brown seaweed during two seasons: Effects on grape juice and wine nitrogen compounds. *Scientific Horticulturae*, 264: 109177.
- Gutiérrez-Gamboa, G., Moreno-Simunovic, Y., 2021. Seaweeds in viticulture: a review focused on grape quality. *Ciência e Técnica Vitivinícola*, 36 (1): 9-21.
- Güllüoğlu, L., Arıoğlu, H. H., 2005. Farklı yetiştirme koşullarında uygulanan bazı bitki büyüme düzenleyicilerinin soyada (*Glycine max* merr.) bakla çatlama oranı ve verim kaybı üzerine etkileri. *Harran Üniversitesi Ziraat Fakültesi Dergisi*, 9 (1): 37-42.
- Güner, H., Aysel, V., 1996. *Tohumuz Bitkiler Sistematigi*. 1. cilt (Algler). Bornova, İzmir.
- Jones, G. V., Davis, R. E., 2000. Climate Influences on grapevine phenology, grape composition, and wine production and quality for Bordeaux, France. *American Journal of Enology and Viticulture*, 51: 249-261.
- Keller, M., 2020. *The science of Grapevines. Anatomy and Physiology*. Academic Press, Cambridge.
- Khan, A. S., Ahmad, B., Jaskani, M. J., Ahmad, R., Malik, A. U., 2012. Foliar application of mixture of amino acids and seaweed (*Ascophylum nodosum*) extract improve growth and physico-chemical properties of grapes. *International Journal of Agriculture and Biology*, 14: 383-388.
- Khan, W., Rayirath, U.P., Subramanian, S., Jithesh, M.N., Rayorath, P., Hodges, D. M., Critchley, A. T., Craigie, J. S., Norrie, J., Prithviraj, B., 2009. Seaweed extracts as biostimulants of plant growth and development. *Journal of Plant Growth Regulators*, 28: 386399.

- Koç, M., 2020. Farklı Zamanlarda Ve Dozlarda Yapraftan Uygulanan Deniz Yosununun Cabernet Sauvignon Üzüm Çeşidinin Fitokimyasal Özellikleri Üzerine Etkileri (yüksek lisans tezi, basılmamış). TNKÜ, Fen Bilimleri Enstitüsü, Tekirdağ.
- Kök, D., Bal, E., 2016. Effects of foliar seaweed and humic acid treatments on monoterpene profile and biochemical properties of cv. Riesling berry V. vinifera l. throughout the maturation period. Tekirdağ Ziraat Fakültesi Dergisi, 13 (2): 67-74.
- Kök, D., Bal, E., Celik, S., Özer, C., 2010. The influences of different seaweed doses on table quality characteristics of cv. Trakya Ilkeren (V. vinifera L.). Bulgarian Journal of Agricultural Science, 16 (4): 429-435.
- Külahtaş, B., Çokuysal, B. 2016. Biyostimulantların sınıflandırılması ve Türkiye’deki durumu. Çukurova Tarım ve Gıda Bilimleri Dergisi, 31(3), 185-200.
- Değerlendirmeler. 9-18.
- Lacroux, F., Tregouat, O., Van Leeuwen, C., Pons, A., Tominaga, T., Lavigne-Cruège, V., Dubourdieu, D., 2008. Effect of foliar nitrogen and sulphur application on aromatic expression of Vitis vinifera L. cv. Sauvignon blanc. Journal International des Sciences de la Vigne et du Vin, 42: 125-132.
- Lasa, B., Menendez, S., Sagastizabal, K., Cervantes, M. E. C., Irigoyen, I., Muro, J., Aparicio-Tejo, P. M., Ariz, I., 2012. Foliar application of urea to “Sauvignon Blanc” and “Merlot” vines: Doses and time of application. Plant Growth Regulators, 67: 73-81.
- Mahima, B., Bijnan, C. B., Dhiman, D. S., Nayan, J. O., 2018. Role of seaweed extract on growth, yield and quality of some agricultural crops: A review. Agricultural Reviews, 39: 321-326.
- Mondello, V., Larignon, P., Armengol, J., Kortekamp, A., Vaczy, K., Prezman, F., Serrano, E., Rego, C., Mugnai, L., Fontaine, F., 2018. Management of grapevine trunk diseases: Knowledge transfer, current strategies and innovative strategies adopted in Europe. Phytopathologia Mediterranea, 57: 369-383.
- Norrie, J., Branson, T., Keathley, P. E., 2002. Marine plant extracts impact on grape yield and quality. Acta Horticulturae, 594: 315-319.
- Özilbey, N., 1997. Zeytinde Bazı Bitki Büyüme Düzenleyicileri Ve Yaprak Gübrelerinin Mahsul Miktarı Ve Kalitesine Etkileri Üzerine Bir Araştırma (doktora tezi, basılmamış). EÜ, Fen Bilimleri Enstitüsü, İzmir.
- Paris, F., Trouvelot, S., Jubien, M., Lecollinet, G., Joubert, J. M., Chiltz, A., Héloir, M. C., Negrel, J., Adrian, M., Legentil, L., Daire, X., Ferrières, V., 2019. Hydrophobized laminarans as new biocompatible anti-oomycete compounds for grapevine protection. Carbohydrate Polymers, 225: 115224.
- Pereira, L., Morrison, L., Shukla, P. S., Critchley, A. T., 2020. A concise review of the brown macroalga Ascophyllum nodosum (Linnaeus) Le Jolis. Journal of Applied Phycology, 32: 3561-3584.
- Popescu, G. C., Popescu, M., 2014. Effect of the brown algae Ascophyllum nodosum as biofertilizer on vegetative growth in grapevine (Vitis vinifera L.). Current Trends in Natural Sciences, 3: 61-67.
- Rayirath, P., Benkel, B., Mark Hodges, D., Allan-Wojtas, P., MacKinnon, S., Critchley, A. T., Prithiviraj, B., 2009. Lipophilic components of the brown seaweed, Ascophyllum nodosum, enhance freezing tolerance in Arabidopsis thaliana. Planta, 230: 135-147.
- Reed, R. H., Davison, I. R., Chudek, J.A., Foster, R., 1985. The osmotic role of mannitol in the Phaeophyta: An appraisal. Phycologia, 24: 35-47.
- Sabir, A., Yazar, K., Sabir, F., Kara, Z., Yazici, M. A., Göksu, N., 2014. Vine growth, yield, berry quality attributes and leaf nutrient content of grapevines as influenced by seaweed

- extract (*Ascophyllum nodosum*) and nanosize fertilizer pulverizations. *Scientia Horticulturae*, 175: 1-8.
- Salvi, L., Brunetti, C., Cataldo, E., Niccolai, A., Centritto, M., Ferrini, F., Mattii, G. B., 2019. Effects of *Ascophyllum nodosum* extract on *Vitis vinifera*: Consequences on plant physiology, grape quality and secondary metabolism. *Plant Physiology and Biochemistry*, 139: 21-32.
- Sharma, H. S. S., Fleming, C., Selby, C., Rao, J. R., Martin, T., 2014. Plant biostimulants: A review on the processing of macroalgae and use of extracts for crop management to reduce abiotic and biotic stresses. *Journal of Applied Phycology*, 26: 465-490.
- Shibata, T., Nagayama, K., Tanaka, R., Yamaguchi, K., Nakamura, T., 2003. Inhibitory effects of brown algal phlorotannins on secretory phospholipase A2s, lipoxygenases and cyclooxygenases. *Journal of Applied Phycology* volume, 15: 61-66.
- Shukla, P. S., Mantin, E. G., Adil, M., Bajpai, S., Critchley, A. T., Prithiviraj, B., 2019. *Ascophyllum nodosum*-based biostimulants: Sustainable applications in agriculture for the stimulation of plant growth, stress tolerance, and disease management. *Frontiers in Plant Science*, 10: 655.
- Stirk, W. A., Tarkowská, D., Turečová, V., Strnad, M., van Staden, J., 2014. Abscisic acid, gibberellins and brassinosteroids in Kelpak®, a commercial seaweed extract made from *Ecklonia maxima*. *Journal of Applied Phycology*, 26: 561-567.
- Taskos, D., Stamatiadis, S., Yvin, J. C., Jamois, F., 2019. Effects of an *Ascophyllum nodosum* (L.) Le Jol. extract on grapevine yield and berry composition of a Merlot vineyard. *Scientia Horticulturae*, 250: 27-32.
- Thankaraj, S. R., Sekar, V., Kumaradhas, H. G., Perumal, N., Hudson, A. S., 2020. Exploring the antimicrobial properties of seaweeds against *Plasmopara viticola* (Berk. and M.A. Curtis) Berl. and De Toni and *Uncinula necator* (Schwein) Burrill causing downy mildew and powdery mildew of grapes. *Indian Phytopathology*, 73: 185-201.
- Tomasi, D., Jones, G. V., Giust, M., Lovat, L., Gaiotti, F., 2011. Grapevine phenology and climate change: Relationships and trends in the Veneto region of Italy for 1964-2009. *American Journal of Enology and Viticulture*, 62: 329-339.
- Turan, M., Köse, C., 2004. Seaweed extracts improve copper uptake of grapevine. *Acta Agriculturae Scandinavica, Section B-Soil & Plant Science*, 54: 213-220.
- Verdenal, T., Spangenberg, J. E., Zufferey, V., Lorenzini, F., Spring, J. L., Viret, O., 2015. Effect of fertilisation timing on the partitioning of foliar-applied nitrogen in *Vitis vinifera* cv. Chasselas: 15N labelling approach. *Australian Journal of Grape and Wine Research*, 21: 110-117.
- Winkler, A. J., Cook, J. A., Kliewer, W. M., Lider, L. A., 1974. *General Viticulture: Second Revised Edition*. University Of California Press, Berkeley, California.
- Yabur, R., Bashan, Y., Hernández-Carmona, G., 2007. Alginate from the macroalgae *Sargassum sinicola* as a novel source for microbial immobilization material in wastewater treatment and plant growth promotion. *Journal of Applied Phycology*, 19: 43-53.
- Zhang, S., Mersha, Z., Vallad, G. E., Huang, C. H., 2016. Management of powdery mildew in squash by plant and alga extract biopesticides. *The Plant Pathology Journal*, 32: 528-536.

**ANKARA-KALECİK EKOLOJİSİNDE NARİNCE ÜZÜM ÇEŞİDİ İÇİN SICAKLIK
İLE VERİM ARASINDAKİ İLİŞKİNİN MODELLENMESİ**

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ÖZET

Artan nüfusla birlikte, beslenme ihtiyacının da artması, birim alandan alınan verimin de artırılmasını zorunlu kılmaktadır. Üzüm ve üzüm ürünlerinin beslenmedeki önemi büyüktür. Asmada verim, iklim faktörleri ile yakından ilişkilidir. Bu nedenle, iklim faktörleri ile verim arasındaki ilişkinin doğru belirlenmesi önemlidir. Bu çalışmada, Ankara-Kalecik koşullarında yetiştirilen ve Türkiye'nin en kaliteli beyaz şaraplık çeşitleri arasında yer alan Narince üzüm çeşidinde, sürme, çiçeklenme ve ben düşme dönemleri için iklim faktörlerinden sıcaklık ile verim arasındaki ilişki belirlenmeye çalışılmıştır. Bu ilişkiyi belirlemek üzere; basit, karesel ve kübik regresyon modelleri denenmiştir. Bu modellerin performansını belirlemek üzere, Belirleme katsayısı (R^2) ve Hatta kareler ortalamasının karekökü (RMSE) kullanılmıştır. Çalışma sonucunda, modellere ait belirleme katsayısı %56.8 ile %67.3 arasında değişim göstermiştir. Karesel ve Kübik modele göre Basit model tatminkar sonuçlar vermiş olmakla birlikte, verim ile sıcaklık arasındaki ilişkiyi belirlemek üzere, farklı modellerin de denenmesinin uygun olacağı vurgulanmıştır.

Anahtar kelimeler: Asma, verim, modelleme, belirleme katsayısı, RMSE

**MODELING THE RELATIONSHIP BETWEEN TEMPERATURE AND YIELD FOR
NARINCE GRAPE CULTIVAR IN ANKARA-KALECIK ECOLOGY**

ABSTRACT

By increasing with population, nutrition requirement is also getting increase and this lead to necessary to increase the yield from the unit area. Grape and grape products have great importance in nutrition. Yield in grapevine is closely related to climatic factors. For this reason, it is important to determine the relationship between climatic factors and yield correctly. In this study, the relationship between temperature and yield, which is one of the climatic factors, was tried to be determined in “Narince” grape cultivar, which is grown in Ankara-Kalecik conditions and which is among the the best wine grape cultivars of Türkiye. To determine this relationship; simple, quadratic and cubic regression models were considered. Root mean square error (RMSE) and coefficient of determination (R^2) were used to evaluate the performance of these models. As a result of the study, the coefficient of determination of the models varied between 56.8% and 67.3%. Although the simple model gave satisfactory result according to the quadratic and cubic models, it was emphasized that it would be appropriate to try different models to determine the relationship between yield and temperature.

Keywords: Grapevine, yield, modeling, determination coefficient, RMSE

Giriş

Nüfusun hızla artması, besin ihtiyacını da artırmakta ve bu durum, birim alandan daha fazla ürün üretilmesini zorunlu kılmaktadır. İnsan beslenmesinde, üzümün ve üzüm ürünlerinin önemi büyüktür. Bu nedenle, bağcılıkta üzüm verimin artırılması için verim ile ilişkili olan faktörlerin doğru belirlenmesi gerekir.

Asma, yaklaşık 4-5 yıllık sürede ekonomik olarak kullanıma uygun üzüm verimine ulaşmakta ve 40-50 yıl kadar ekonomik ömrünü sürdürebilen çok yıllık bir bitkidir (Zhu et al., 2021). Asmaların vejetasyon sürecinin başlamasını ifade eden sürme, kuzey yarıkürede ılıman iklim kuşağının hakim olduğu alanlarda ekolojik özelliklere bağlı olarak Mart-Nisan aylarında başlarken, çiçeklenme Haziran-Temmuz aylarında ve ürünün olgunlaşması ise Ağustos ve Eylül aylarında gerçekleşmektedir. Asmada büyüme ve gelişme olayları ile birlikte üzüm verimi, başta sıcaklık, güneşlenme, yağış ve nem gibi iklim faktörleri olmak üzere, kültürel uygulamaları da içeren çevre faktörleri ile şekillenmektedir. Bağcılık faaliyetlerinin yürütülebilmesinde iklimin belirleyici olduğu dikkate alındığında, iklimsel değişikliklerin, verimle ilişkisinin belirlenmesi önemlidir. Bu ilişkiler doğrusal olabileceği gibi doğrusal olmayan yapıda da olabilir. Doğrusal ilişkileri belirlemede veya modellemede; doğrusal regresyon modelleri yaygın olarak kullanılırken, doğrusal olmayan ilişkileri belirlemek üzere, doğrusal olmayan regresyon modelleri de yeterince kullanım alanı bulmaktadır.

Üzümde, iklim özellikleri ile verim arasındaki ilişkiyi modellemek üzere yabancı literatürde yeterince çalışmanın yapılmış olduğu düşünülse de, ülkemizde yok denecek kadar azdır. Özellikle, Ankara-Kalecik koşullarında yetiştirilen ve Türkiye'nin şaraplık çeşitleri arasında yer alan Narince üzüm çeşidinde verim ile iklim özellikleri arasındaki ilişki sürdürülebilir bağcılık ölçeğinde inceleyen çalışmaya rastlanmamıştır. Bu nedenle, çalışmada Ankara-Kalecik koşullarında yetiştirilen Narince üzüm çeşidinde yıllık ortalama verim (kg/da) ile iklim faktörlerinden sıcaklık arasındaki ilişkinin modellenmesi amaçlanmıştır.

Materyal ve Yöntem

Materyal

Çalışmada Ankara Üniversitesi Ziraat Fakültesi Kalecik Bağcılık Araştırma ve Uygulama İstasyonu'nda 1997 yılında tesis edilmiş olan, Narince/5BB üzüm çeşidinde ait bağ alanından elde edilen 2003-2022 yılları arasındaki 20 yıllık verim değerleri (kg/da) kullanılmıştır. Bağ alanında 90 cm yüksekliğindeki gövde üzerinde çift kollu Kordon ve baş terbiye şekli çift T destek sistemi uygulanmıştır. Dikim aralıkları 1.5 x 3.0 m olarak düzenlenmiştir. Bağ alanı damla sulama sistemi ile sulanmaktadır (Çelik ve ark., 2007). Bağa

ait 2003 ile 2022 yılları arasındaki 20 yıllık sıcaklık değerleri (°C) Meteoroloji Genel Müdürlüğü'nden alınmıştır.

Çalışmada kullanılan verilere ait tanımlayıcı istatistikler Çizelge 1' de özetlenmiştir.

Çizelge 1. Tanımlayıcı istatistikler

	Ortalama	St. Sapma	Min	Mak.
Verim (kg/da)	519.65	221.928	156	961
Nisan ayı sıcaklık ortalaması (°C)	10.1570	1.13385	8.73	12.40
Haziran ayı sıcaklık ortalaması (°C)	19.9008	1.02303	17.77	21.23
Temmuz ayı sıcaklık ortalaması (°C)	22.9153	0.52883	22.00	23.93

Yöntem

Verim ile iklim özellikleri arasındaki ilişkileri belirlemek üzere, doğrusal ve doğrusal olmayan modeller kullanılmaktadır. Doğrusal olmayan modellerdeki gerek parametre tahminleri, gerekse tahminlenen parametrelerin yorumlanmasındaki güçlükler, doğrusal modellerin daha çok tercih edilmesine neden olmaktadır. Bu nedenle çalışmada, iklim özelliklerinden sıcaklık ile dekara ortalama verim arasındaki ilişkiyi belirlemek üzere doğrusal regresyon modelleri kullanılmıştır. Bu modellerden standart doğrusal model, Karesel model ve Kübik model kullanılmıştır.

“Y” değişkeni (bağımlı değişken, çıktı değişkeni veya cevap değişken), ortalama verim (kg /da),

“X” değişkeni (bağımsız değişken, açıklayıcı değişken) sıcaklık (°C),

“b” regresyon sayısı ve

“e” de hata terimi olmak üzere;

modeller aşağıdaki gibi oluşturulmuştur.

Basit model: $Y = b_0 + b_1X + e$

Karesel model: $Y = b_0 + b_1X^2 + e$

Kübik model: $Y = b_0 + b_1X^3 + e$

Kalecik koşullarında sürme Nisan ayında, çiçeklenme (başlangıç ve tam çiçeklenme) Haziran ayında ve ben düşme Temmuz ayında olduğundan; bu 3 aydaki sıcaklık değerleri ile verim arasındaki ilişkili modellenmiştir. Modellerin performansını değerlendirmede, Belirleme katsayısı (R^2) ve Hata kareler ortalamasının karekökü (RMSE) ölçütleri kullanılmıştır. Hesaplamalar için SPSS (ver: 21) istatistik paket programından yararlanılmıştır.

Bulgular ve Tartışma

Çalışmada; sürme, çiçeklenme ve ben düşme dönemine ait sıcaklık değerleri ile verim arasındaki ilişkiyi belirlemede kullanılan; Basit, Karesel ve Kübik modellere ilişkin sonuçlar Çizelge 2'de özetlenmiştir. Çizelge 2'de görüldüğü üzere, sürme döneminde, Karesel ve Kübik modele ait regresyon sabitinin haricinde, diğer tüm modellerde, regresyon sabiti istatistik olarak önemli bulunmuştur ($p<0.01$). Regresyon katsayıları ve R^2 değerleri ise tüm modellerde istatistik olarak önemli bulunmuştur ($p<0.01$). Basit doğrusal modellerde en yüksek regresyon katsayısı; 317.71 ile ben düşme döneminde elde edilirken, bunu 174.04 ile çiçeklenme dönemi ve 154.55 ile sürme dönemi izlemiştir. Buna göre sürme dönemindeki ortalama 1 °C'lik sıcaklık artışına karşılık, dekara ortalama verimde 154.55 kg'lık artışın olması beklenmektedir.

Çizelge 2. Modellere ilişkin özet sonuçlar

Dönem	Model	$b_0 \pm S_{b_0}$	$b_1 \pm S_{b_1}$	R^2 (%)	RMSE
Sürme [Nisan]	Basit	-1050.12 ± 289.22 **	154.55 ± 28.31**	62.3 **	4424.27
	Karesel	-252.177 ± 142.33	7.39 ± 1.33**	63.2 **	4375.99
	Kübik	14.24 ± 95.20	0.47 ± 0.08**	63.6 **	4467.85
Çiçeklenme [Haziran]	Basit	-2943.853 ± 608.20**	174.04 ± 30.52**	64.4 **	4304.26
	Karesel	-1265.99 ± 304.19	4.50 ± 0.76**	65.9 **	4210.20
	Kübik	706.82 ± 203.45 **	0.15 ± 0.03**	67.3 **	3412.16
Ben Düşme [Temmuz]	Basit	-6760.78 ± 1481.29**	317.71 ± 64.63**	57.3 **	4710.79
	Karesel	-3120.05 ± 744.72**	6.93 ± 1.42**	57.1 **	4775.13
	Kübik	-1904.82 ± 499.68**	0.21 ± 0.04**	56.8 **	4762.54

** : $p<0.01$; RMSE: Hata Kareler Ortalamasının Karekökü

Karesel modellere ait katsayılardan ise en yüksek katsayı 7.39 ile sürme döneminde elde edilirken, bunu 6.93 ile ben düşme dönemi ve 4.50 ile çiçeklenme dönemi izlemiştir. Kübik modelde ise en yüksek katsayı 0.47 ile sürme döneminde, en düşük katsayı ise 0.15 ile çiçeklenme döneminde elde edilmiştir.

Modellere ait belirleme katsayıları (R^2) incelendiğinde; bu katsayılarının yüzde %56.8 ile %67.3 arasında değişim gösterdiği görülür. Benzer şekilde, Santos ve ark. (2011)'nin yapmış olduğu çalışmada; Mayıs döneminde Basit doğrusal modele ait R^2 %59 olarak bulunurken, Haziran döneminde %62 olarak bulunmuştur.

Sürme dönemindeki basit doğrusal modele ilişkin belirleme katsayısı %62.3 olarak bulunmuştur. Buna göre dekara ortalama verimdeki varyasyonun veya farklılığın %62.3'ünün sürme dönemindeki sıcaklık değişiminden kaynaklandığı söylenebilir.

R^2 ve hata kareler ortalamasının karekökü (RMSE) ölçütleri dikkate alınarak; (Yüksek R^2 ve daha düşük RMSE değeri) karesel ve kübik modeller, basit doğrusal modellere göre değerlendirildiğinde; adı geçen iki modelin, basit doğrusal modele göre belirgin bir üstün performans gösteremedikleri gözlenmiştir. Buna göre sıcaklığa bağlı olarak, dekara ortalama verimi tahmin etmek üzere kurulacak modellerde; karesel ve kübik modellere gerek duymadan, basit doğrusal modellerin tercih edilebileceği söylenebilir. Ancak, Lobell ve Burke, (2010) tarafından da belirtildiği üzere, istatistik modellerin performansı, iklimsel değişkenlerin yapısına göre değişiklik gösterebilmektedir. Bu nedenle optimum model bakımından, farklı modellerin de denenmesi gerektiği açıktır.

Sonuç

İnsan kaynaklı faaliyetler ve küresel düzeydeki iklim değişiklikleri, tarımsal ürün üretimine ve sürdürülebilirliğe etki etmektedir (Zarei ve ark., 2019). Bununla birlikte, bağcılıkta sürdürülebilirlik; budama, sulama ve hastalıklarla mücadele gibi kültürel uygulamaların yanı sıra, toprak ve iklim faktörleri ile de yakından ilişkilidir. Yıllık üzüm veriminin; çiçeklenme ve ben düşme gibi erken dönemlerde tahmin edilmesi, ekonomik değeri ile ilişkilendirilebileceği gibi ileriki dönemlerde yapılacak uygulamalara yön verilebilmesi açısından da katkı sağlayabilir.

Sonuç olarak; iklim faktörlerinin veya iklimsel değişikliklerin, ürün verimi üzerine potansiyel etkisinin modellenmesi ve buna bağlı olarak istenen tahminlerin yapılabilmesi, geleceğe ilişkin yapılacak planlamalarda önemli rol oynamaktadır. Narince üzüm çeşidinde, verimin sıcaklıkla tahmini için her ne kadar basit doğrusal modellerle, tatminkâr R^2 değerleri elde edilmiş olsa da, diğer iklim özelliklerinin de ele alınarak, farklı modellerin denenmesi gerektiği düşünülmektedir.

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Kaynaklar

- Çelik, H., Kunter, B., Söylemezoğlu, G., Keskin, N., Çetiner, H., Karataş, H. (2007). Kalecik (Ankara) koşullarında yetiştirilen Kalecik Karası, Narince, Atasarısı ve Italia üzüm çeşitlerinde anaç ve terbiye şeklinin gelişme, verim ve ürün kalitesi üzerine etkileri. Türkiye V. Ulusal Bahçe Bitkileri Kongresi Bildiri Kitabı Cilt 2:353-357, 04-07 Eylül 2007, Erzurum.
- Lobell, DB., Burke, MB. (2010). On the use of statistical models to predict crop yield responses to climate change. *Agricultural and Forest Meteorology*, 150: 1443-1452.
- Santos, JA., Malheiro, AC., Karremann, MK., Pinto, JG. (2010). Statistical modelling of grapevine yield in the Port Wine region under present and future climate conditions. *Int J Biometeorol* (2011) 55:119-131. DOI 10.1007/s00484-010-0318-0
- Zarei, AR., Ali Shabani, A., Mahmoudi, MR (2019). Comparison of the climate indices based on the relationship between yield loss of rain-fed winter wheat and changes of climate indices using GEE model. *Science of the Total Environment*. 661: 711-722.
- Zhu, J., Parker, A., Gou, F., Agnew, R., Yang, L., Greven, M., Raw, V., Neal, S., Martin, D., Trought, MCT., Huth, N., Brown, HE., (2021). Developing perennial fruit crop models in APSIM Next Generation using grapevine as an example. In *Silico Plants 2021: diab021*; doi: 10.1093/insilicoplants/diab021.

HER ÇAĞIN MALZEMESİ AKILLI POLİMERLER VE KULLANIM ALANLARI

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ÖZET

İleri malzemeler sınıfından olan akıllı malzemeler, ileri teknolojik uygulamalarda kullanılacak olan mikro boyutlu sistemler ve cihazlar ve tıbbi uygulamalar gibi farklı alanlarda kullanım alanı bulması ve günümüzde özellikle son dönemde gelişmekte olan malzemeler içinde dikkatleri üzerine çekmeyi başarmış önemli bir mühendislik malzemesidir. Klasik malzeme gruplarından biri olan polimerler kolay işlenebilirlik, proses kolaylığı, esneklik, düşük ısı ve elektrik iletkenliği, metallere oranla yüksek kimyasal ve korozyon direnci ve çok iyi mukavemet/ağırlık oranı vb özelliklere sahip olması nedeni ile diğer malzemelere göre daha üstün özelliklere sahiptir. Akıllı malzemelerden biri olan akıllı polimerler ise sıcaklık, nem, pH, ışık yoğunluğu, elektriksel veya manyetik alan vb. çevresel uyaranlara karşı tepki vermesi, renk veya transparanlığını değiştirmesi, iletken veya su geçirgen hale gelmesi şekil değiştirerek bu tepkiye yanıt vermesi gibi özellikler nedeni ile akıllı malzemeler içinde en çok tercih edilen malzeme sınıfıdır. Bu nedenle, akıllı polimerlerle yapılan çalışmalarda son kırk ila elli yılda hızlı bir artış olmuştur. Uyaranlara duyarlı polimerler veya çevreye duyarlı polimerler olarak da bilinen akıllı polimerler, biyoteknoloji, tıp ve mühendislik alanında yaygın olarak kullanılmaktadır. Bu çalışmanın amacı akıllı malzemelerden biri olan akıllı polimerler, çeşitleri ve mevcut kullanım alanları hakkında bilgi vermektir. Bu nedenle çalışmada; polimerlerin akıllı malzeme olarak kullanımının avantajları, dezavantajları, akıllı polimer teknolojilerindeki son gelişmelerin ışığı altında incelenmiş ve akıllı polimerler, (i) akıllı polimerik jeller, (ii) şekil hafızalı polimerler, (iii) kendi kendini onaran/iyileştiren polimerler ve (iv) iletken polimerler şeklinde dört başlıkta sınıflandırılarak incelenmiştir.

Anahtar Kelimeler: Akıllı malzemeler, Akıllı polimerler, Hidrojeller, Şekil hafızalı polimerler, Kendi kendini onaran/İyileştiren polimerler, İletken polimerler

Giriş

İnsanoğlunun var oluşundan bu yana değişen ve gelişen hayat şartları nedeni ile farklı amaç ve farklı özellikte malzemeler kullanılmış ve çağlar kullanılan malzemelerin gelişmişlik düzeyine kaba taş devri, yontma taş devri ve cilalı taş devri ve bakır devri vb gruplara ayrılmıştır.

İçinde bulunduğumuz yüzyılda özellikle son otuz yılda gelişmiş özellikte malzemelerin elde edilmesinde büyük ilerleme kaydedilmiştir. Malzemeler esas olarak polimerler, seramikler, metaller ve akıllı malzemeler olmak üzere dört kategoriye ayrılırlar. Bunlardan akıllı malzemeler, standart malzemelere kıyasla sahip oldukları özellikler ve çeşitli uygulamalama alanları nedeni ile günümüzde diğerlerine göre daha popüler hale gelmiştir [1]. Nedir bu akıllı malzemeler? Akıllı malzeme terimi ilk kez 1980'lerde kullanılmış ve yeni bir teknoloji olarak kabul edilmiştir. Fakat, fotokromik gözlükler gibi akıllı davranış sergileyen birçok ürün onlarca yıldır mevcuttu. Literatürde geniş çapta tartışılmasına rağmen, akıllı malzemelerin tam olarak ne olduğuna dair evrensel olarak kabul edilmiş bir tanım yoktu [2,3]. Bununla birlikte günümüzde, bir malzemenin akıllı malzeme olarak kabul edilebilmesi için malzemenin ısı, sıcaklık, mekanik ve manyetik gibi çevresel uyaranlara karşı tepki verme yeteneğini kazanması ve buna bağlı olarak performans veya özelliklerini değiştirebilmesi, malzemenin uyarıcılara karşı tepkilerinin açıklanabilir, anlaşılır ve öngörülebilir olması, enerji alış-verişinde bulunabilmesi (ışık yayan, elektrik üreten ve enerji değişimi yapabilen) ve tersine çevrilebilirlik (malzemenin niteliğinde ve fazında değişimin gerçekleşmesi ve bu değişimin geri alınabilir olması) gibi özelliklere sahip olması gerekmektedir [4].

Günümüzde akıllı malzemeler, sahip oldukları özellikler nedeniyle ileri düzey uygulamalar için ilgi çekici bir malzeme sınıfı olarak karşımıza çıkmaktadır. Çevreye göre özelliklerini değiştirebilen ve duyuşal yeteneklere sahip, otomatik olarak kendi kendini tamir edebilen, ısı ile şekil değiştirebilen veya manyetik alan uygulandığında anında faz değiştirebilen malzemelerden olan piezoelektrik malzemeler (sensörler ve aktüatörler), şekil hafızalı alaşımlar , manyeto-reolojik malzemeler ve elektro-reostat malzemeler termoelektrikler multiferroikler, magnetokalorik malzemeler, mağnetoreolojik ve elektoreolojik akışkanlar, şekil hafızalı malzemeler, termo ve ışığa duyarlı polimerler ve polimerik jeller akıllı malzemeler sınıfına girmektedir.

Akıllı malzemeler, ileri malzemeler grubunda yer alan, bir malzeme grubudur. Çok fazla uygulama alanına sahip olmalarına rağmen, akıllı malzemelerin sınıflandırılmasıyla ilgili henüz akademik ve ticari olarak kullanılan ve yaygın kabul görmüş bir sınıflandırma sistemi mevcut

değildir. Yeni kullanım alanları ortaya çıktıkça bu malzemelerde akıllı malzeme sınıfına dahil edilmektedir [4,5]. Bu çok fonksiyonlu malzemelerin özelliklerini analiz etmek için çeşitli karakterizasyon teknikleri kullanılmaktadır. Kompozitlerden akıllı hafızalı alaşımlara kadar malzeme alanında çok büyük gelişmeler olmuş, akıllı malzemeler geleneksel malzemeleri geride bırakmış ve sentezleri geleneksel teknikler yerine modern teknikler yardımıyla yapılmıştır. Bu malzemeler sağlık sektörü, havacılık, sivil altyapı ve çevre imalatında geniş bir uygulamaya sahiptir [6].

Polimerler, kolay işlenebilirliği, proses kolaylığı, esnekliği, düşük ısı ve elektrik iletkenliği, metallere oranla yüksek kimyasal ve korozyon direnci çok iyi mukavemet/ağırlık oranı vb özellikleri nedeni ile klasik malzemeler içinde seramik ve metallere göre sahip olduğu bazı özellikler nedeniyle daha yaygın olarak kullanılmaktadır.

Akıllı malzemelerden biri olan akıllı polimerler ise sıcaklık, nem, pH, ışık yoğunluğu, elektriksel veya manyetik alan vb. çevresel uyarılara karşı tepki vermesi, renk veya transparanlığını değiştirmesi, iletken veya su geçirgen hale gelmesi şekil değiştirerek bu tepkiye yanıt vermesi gibi özellikler nedeni ile akıllı malzemeler içinde en çok tercih edilen akıllı malzemelerdir [4].

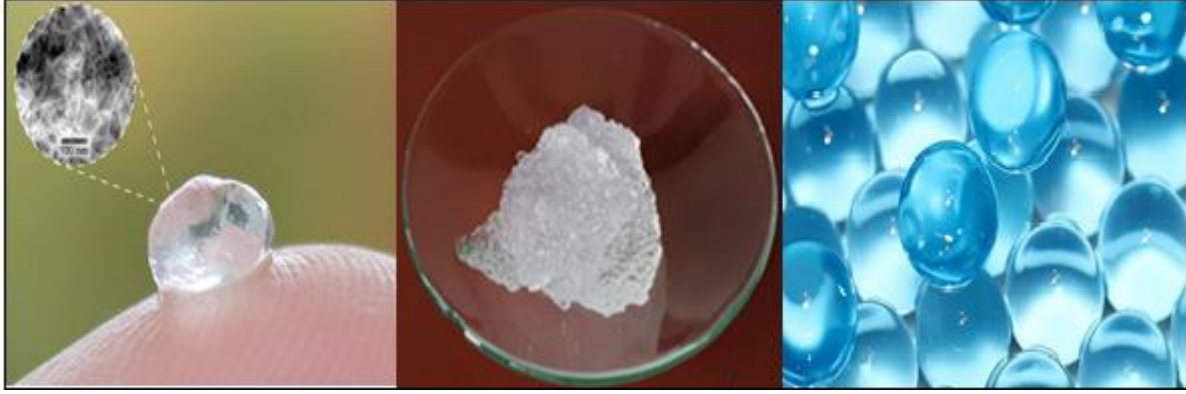
Farklı kullanım ve uygulama alanları, polimer türleri dikkate alındığında, akıllı polimerleri sınıflandırmak oldukça zordur. Ancak bugüne kadar yapılan bilimsel çalışmalar ve kullanım alanları göz önünde bulundurulduğunda, dört temel başlık altında ele alarak incelemek mümkündür. Buna göre akıllı polimerler, (i) akıllı polimerik jeller, (ii) şekil hafızalı polimerler, (iii) kendi kendini onaran/iyileştiren polimerler ve (iv) uyarılara duyarlı polimerler şeklinde sınıflandırılabilir [4].

1. Polimerik Jeller (Hidrojel)

Hidrojel, fiziksel veya kimyasal olarak çapraz bağlanabilen üç boyutlu ağ yapı özelliğine sahip polimerlerdir. Ayrıca, hidrofilik fakat çapraz bağlı yapıları nedeniyle polimeri çözmeden, sudaki kuru ağırlıklarının binlerce katına kadar büyük miktarda suyu emen üç boyutlu (3B) doğal veya sentetik polimerik ağlar şeklinde olan polimerlerdir [4,7].

Genel olarak hidrojel, su ile etkileştiklerinde çözünmez ve çözücüyü içine alarak şişerler (Şekil 1). Sahip olduğu su tutma kapasitesi, yumuşak ve esnek yapıları ile hidrojel canlı dokulara benzerlik göstermektedir. Suda çözünen maddeler için geçirgen olmaları, insan vücudu ile uyumlu olmaları, su ile etkileşip şiştiğinde yumuşak ve düşük sürtünmeye sahip

olmaları, ilaç salınım sistemlerinde kullanılabilmeleri, yüksek su tutma kapasiteleri hidrojellerin en önemli avantajları arasında yer almaktadır. Hidrojellerin zayıf mekanik dayanıma sahip olması, kemik dokusu gibi mukavemet gerektiren alanlarda kullanımını kısıtlamaktadır [4].



Şekil 1. Hidrojel [8]

Akıllı polimerik jeller kendi içinde; uyarıcıya duyarlı hidrojeller, ışığa duyarlı hidrojeller, sıcaklığa duyarlı hidrojeller, pH duyarlı hidrojeller, sıvı kristalli hidrojeller olmak üzere beş gruba ayrılırlar.

Hidrojeller kontakt lensler, yapay tendon materyalleri, biyosensörler, yüzey örtü malzemeleri, yapay kas, yapay deri, ilaç salım sistemleri, estetik cerrahi, tarımda akıllı sulama sistemleri, ağır metal giderimleri vb. alanlarda kullanılmaktadır [4,9].

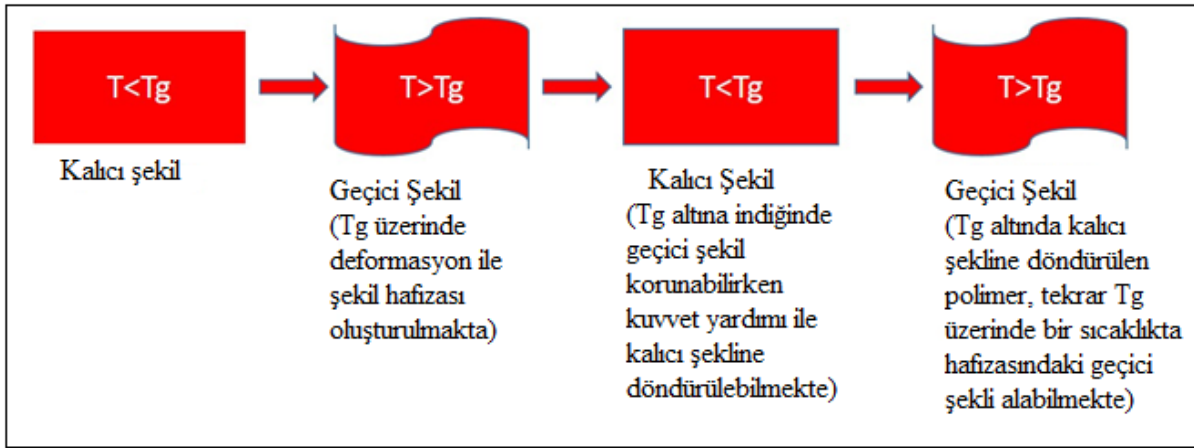
2. Şekil Hafızalı Polimerler

Şekil hafızalı polimerler, deforme edildikleri şekillerinden orijinal şekillerine kendi kendilerine dönebilen akıllı malzemelerdir. İlk olarak, 1984 yılında Japon, Nippon Zeon şirketi tarafından ortaya çıkarılmıştır. Bu polimerler, geçici olarak verilen şekli alsa da, daha sonra sıcaklık gibi duyarlı olduğu bir uyarana sayesinde orijinal şekillerine tamamen kendi kendilerine dönebilirler [10]. Şekil değişikliklerini ise mikroskopik veya makroskopik olarak gerçekleştirebilirler [4]. Şekil değişikliği üretim esnasında aldıkları şekil ile uyarılma sonrası aldıkları şekil arasında değişmektedir. Bu da ilk şekillerini hafızalarında tutabildiklerini göstermektedir [10].

Şekil hafızalı polimerlerin, hafızasında tuttuğu genellikle iki bazen de üç şekil mevcuttur. Bu şekillerden birisi orijinal şekli iken diğeri ise deformasyon sonucu aldığı şekildir.

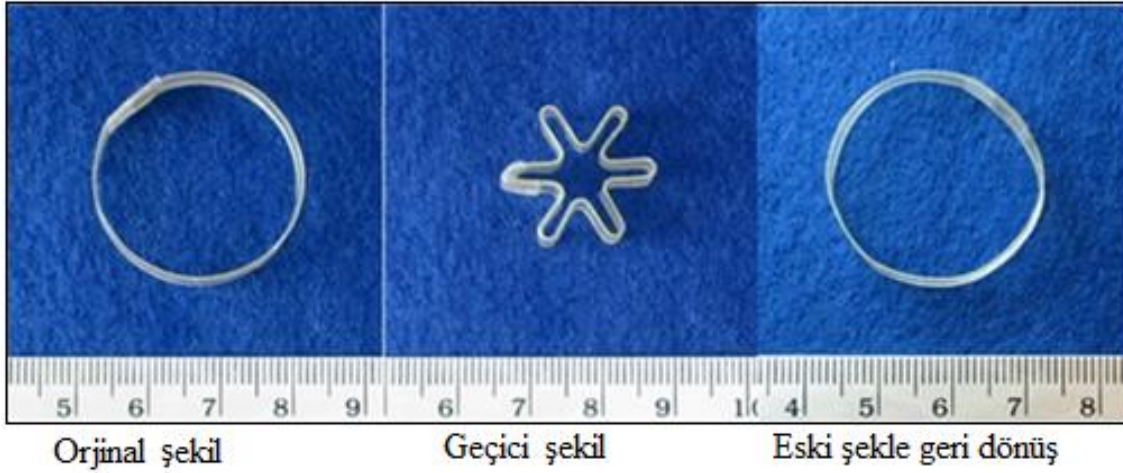
Şekil hafızalı polimerlerin etkilendiği ortam değişkeni genellikle sıcaklık olmakla birlikte, bu değişken manyetik alan, ışık ya da bir solüsyon da olabilir. Bu sayede kullanım alanındaki çeşitliliği de artmaktadır [10].

Polimer malzemelerin belirli bir erime sıcaklıkları ve camsı geçiş sıcaklıkları vardır. Camsı geçiş sıcaklığı (T_g), maddenin camsı özelliklerini kaybedip ağıdalı (hareketlilik kazanarak daha esnek bir yapıya bürünmeleri) özellikler kazanmaya başladığı sıcaklık sınırıdır ve bu sıcaklık sınırı erime sıcaklığından daha düşüktür. İşte bu camsı geçiş sıcaklığı şekil hafızalı polimerler için oldukça önemlidir. Çünkü biraz önce de bahsettiğimiz gibi, bu polimerlerin kalıcı ve geçici olmak üzere iki farklı şekli vardır. Deforme halindeki geçici şekil, camsı geçiş sıcaklığının üzerindeyken verilir. Akıllı polimerler daha sonra soğutulduklarında bu geçici şekillerini korurlar ancak istenilirse dış etmenler ile (kuvvet gibi) kalıcı şekillerine döndürülebilirler. Dış etmenler ile kalıcı şekline döndürülen şekil hafızalı polimerler, tekrardan herhangi bir ortamda camsı geçiş sıcaklığının üzerine çıkarıldığında ise hafızalarındaki geçici şekillerine geri dönerler (Şekil 2).



Şekil 2. Hafızalı polimerler [10]

İlk olarak deforme edilen polimerin kalıcı deformasyona uğramadığını açıklayalım. Bir metal levhayı alıp yeterince büküğümüzde, elimizdeki metal deforme edildiği şekli ile kalır, yani kalıcı bir deformasyona uğrar. Ancak şekil hafızalı polimerler diğer herhangi bir malzeme gibi eğilip büküldüğünde bunu kalıcı bir şekilde bünyesinde tutmadan, eski haline döndürülebilir. Çünkü bu deformasyonlar camsı geçiş sıcaklığının üzerinde gerçekleşmekte ve bu sıcaklığın üzerinde polimerler süper esnek bir özellik göstermektedirler. Bu nedenle bu polimerler istenildiği gibi deforme edilse de, verilen bu şekilden kalıcı şekle dönüşü ve kalıcı şeklinden tekrardan geçici şekline dönüşü mümkün olabilmektedir (Şekil 3) [10].

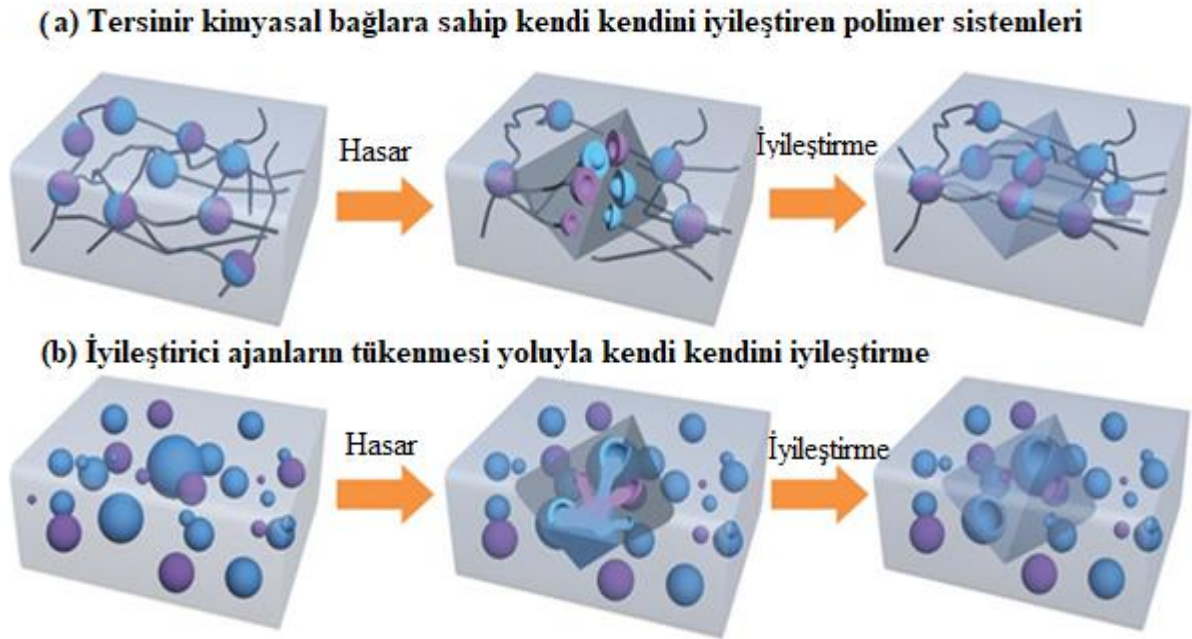


Şekil 3. Hafızalı polimer örneği [10]

Akıllı polimerler sadece inşaat, havacılık, otomobil, ya da ileri mühendislik uygulamalarında değil, sağlık sektörü gibi çeşitli uygulamalarda da karşımıza çıkmaktalar. pH 1-2 civarında iken midede, pH >7 olduğunda bağırsakta, ya da vücut sıcaklığı 37 °C'yi geçtiğinde ilaç salınımını yapan akıllı polimerler, kalp damarlarının içine takılan stentler başlıca kullanım alanlarıdır. Şekil hafızalı polimerler, sağlık, tekstil veya gündelik malzemelerdeki uygulamalarının yanında, ileri mühendislik uygulamalarında da yer almaktadır. Şekil değiştiren uçak (morphing aircraft) olarak bildiğimiz uygulamalarda, uçak kanatları, uçuş sırasında verilen komutlar neticesinde istenilen şekli alabilmektedirler. Bu sayede bu tip uçaklar farklı uçuş koşulları altında en uygun uçuş performansı verebilmektedirler [4,10].

3. Kendi Kendini Onaran/İyileştiren Polimerler

Biyolojik sistemlerdeki kendi kendini onarma özelliğinden yola çıkan ve doğadan ilham alan araştırmacılar tarafından geliştirilmiştir. Kendi kendini onaran/iyileştiren polimerler, kullanım alanı bulduğu uygulamalarda, temel olarak dış yardım olmadan kendi kendini iyileştirme veya kaybolan işlevlerin restorasyonu şeklinde faaliyet göstermektedir (Şekil 4) [4,7].



Şekil 4. Kendi kendini iyileştiren polimer malzeme: (a) Dahili kendi kendini iyileştirme modu, (b) Harici kendi kendini iyileştirme modu aracılığıyla kendi kendini iyileştiren polimer sistemlerinin şematik gösterimi [11]

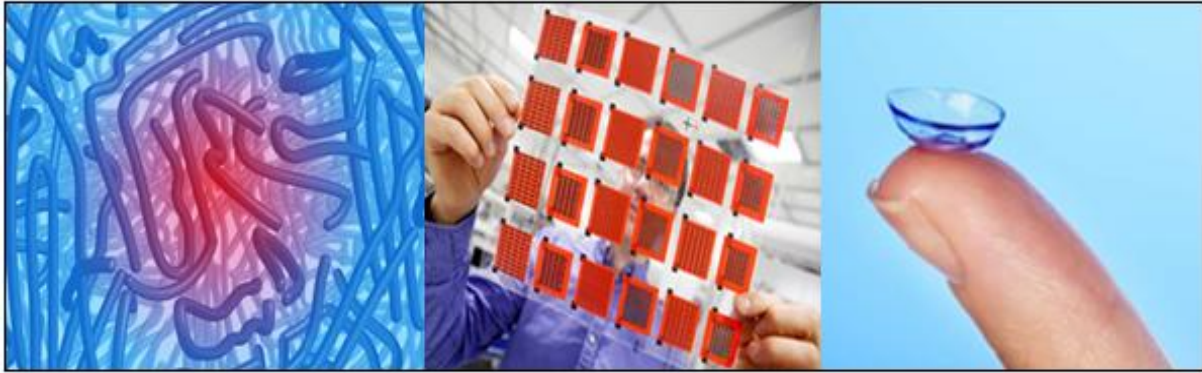
Kendi kendini onaran/iyileştiren polimerler, herhangi bir hasar durumunda bağımsız veya uyarılmış onarım kavramını uygulayarak yapıların veya sistemlerin ömrünü uzatmayı amaçlar. Bu nedenle, kendi kendini onaran/iyileştiren polimerler, herhangi bir hasar durumunda kendi kendini otomatik olarak onarma/iyileştirme özelliğine sahip uzun ömürlü mühendislik malzemeleri olarak tanımlanabilir.

Kendi kendini onaran/iyileştiren polimerler enerji, biyomedikal vb. sektörler için biyouyumluluk, maliyet, verimlilik, ürünün kullanım ömrünün uzaması gibi büyük avantajlar sağlamaktadır. Kovalent bağlı kendi kendini onaran/iyileştiren polimerler, ilaç ve protein dağıtım sistemlerinde, doku-materyal bariyerlerinde, tıpta ve yara pansuman uygulamalarında da tercih edilmektedirler [4,5].

4. İletken Polimerler

İletken polimerler uygun maliyetli, hafif ağırlıklı ve esnek özellikleri ile tüm dünyanın ilgisini çekmişlerdir. 2000 yılında keşfedilen iletken polimerlerin elektriği neredeyse metaller kadar iyi iletmeleri, korozyona karşı dayanıklı olmaları ve kolay metotlar kullanılarak elde edilebilmeleri gibi başlıca avantajları iletken polimerlerin bilim ve teknoloji alanındaki gelişmelere bağlı olarak üzerlerine cektikleri bu ilginin daha farklı alanlara kaymasına neden

olmuştur [12]. İletken polimerlerin elektriksel iletkenliği metallere karşılaştırılabilir nitelikte olup, iletkenlik yük taşıyıcı görevi gören boşluklara ve birbirini izleyen tek ve çift bağlardan oluşan konjuge karbon zincirlerine dayanır (Şekil 5). Polimerler kimyasal yapıları ve demir, bakır gibi metal tozları, karbon siyahı, grafen, grafen oksit vb. iletken dolgu maddelerine bağlı olarak yalıtkan, yarı iletken veya iletken olabilirler. Polimerlerde kullanılacak iletken dolgu maddeleri arasında; Grafit, grafen, karbon fiberler (CF), karbon nanotüpler (CNT), altıgen boron nitrür (hBN), metal ve seramik tozları vb. bulunmaktadır [4].



Şekil 5. İletken polimerler [13]

Bazı iletken polimerler esnek ve biyouyumlu olmanın yanında üretim ve uygulama kolaylığına da sağlamaktadır. Bu nedenle, iletken polimerler medikal uygulamalar, robotik sistemler, tekstil ürünleri, transistörler, sensörler, biyosensörler vb. alanlarda yaygın olarak kullanılmaktadır [4].

SONUÇ

Akıllı malzemeler akıllı davranış sergileyen ürünlerde, sistemlerde veya yapılarda kullanılabilen, kendi kendini algılama, kendi kendini iyileştirme, kendi kendini harekete geçirme, kendi kendine teşhis ve şekil değiştirme gibi dış uyaranlara verilen tepkiler gibi belirli içsel özellikler sergileyen malzemelerdir. Son otuz ila kırk yılda, akıllı malzemelerle ve özellikle akıllı polimerlerle ilgili yapılan çalışmalarda büyük bir artış yaşanmıştır ve gelecekte akıllı malzemeler sayesinde çok daha üst seviyeye çıkacağı tahmin edilmektedir. Bu da insanoğlunun hayal gücü sınırını zorlamasına bağlıdır.

Polimerleri akıllı yapan karakteristik özellikleri, çevrelerindeki çok küçük değişikliklere tepki verme yetenekleridir. Bu malzemelerin üstünlüğü, sadece yapılarında meydana gelen hızlı makroskopik değişikliklerde değil, aynı zamanda bu geçişlerin geri dönüşümlü olmasına bağlıdır.

Çevreye duyarlı polimerler olarak da bilinen akıllı polimerler, biyoteknoloji, tıp ve mühendislik alanında yaygın olarak kullanılmaktadır. Akıllı polimerlerden;

- Akıllı hidrojeller, çevresel koşullarda küçük dış uyaranlara maruz kalınca, yanıt olarak ani tersinir faz geçişleri sergileyen üç boyutlu ağ yapı özelliğine sahip hidrojellerdir. Akıllı hidrojeller, biyo Akıllı hidrojeller, çevresel koşullarda küçük dış uyaranlara maruz kalınca, yanıt olarak ani tersinir faz geçişleri sergileyen üç boyutlu ağ yapı özelliğine sahip hidrojellerdir. Akıllı hidrojeller, biyoyumlulukları, fonksiyonel ve esnek yapıları gibi özelliklerinden dolayı, doku mühendisliği protezlerinde, sensör/ biyosensörlerde, ilaç/gen dağıtım sistemlerinde, aktüatörlerde büyük bir potansiyel kullanıma sahiptir.
- Şekil hafızalı akıllı polimerler, ışık, ısı, nem, mekanik stres, manyetik alan, elektrik alan vb. gibi bir dış uyarıcı uygulandığında şekil ve renk gibi makroskobik özelliklerini değiştirebilen ve uyarıcı etkisi ortadan kaldırıldığında geçici şeklinden kalıcı şekline geri dönebilen polimerlerdir. Şekil hafızalı akıllı polimerler, sahip olduğu bu özellik nedeniyle, tıbbi uygulamalarda, havacılıkta, tekstilde ve ev ürünlerinde kullanılmaktadır.
- Kendi kendini onaran/iyileştiren malzemeler, herhangi bir hasar durumunda kendi kendini otomatik olarak onarma/iyileştirme özelliğine sahip uzun ömürlü mühendislik malzemeleridir. Bu tür malzemeler, hasar oluşumunu algılayan ve hasarın ilerlemesini durdurarak tamir edebilen yapıdadırlar. Bu nedenle hasarın önlenmesinin ve ürünün kullanım ömrünün uzamasının istendiği ilaç dağıtım sistemlerinde, doku-materyal bariyerlerinde, onarıcı tıpta, yara pansuman uygulamalarında ve enerji alanında tercih edilmektedir.
- İletken polimerler, elektriksel iletkenliğe ve metallerle karşılaştırılabilir özelliklere sahip konjuge karbon zinciri içeren polimerlerdir. Elektriksel iletkenlik, yük taşıyıcı görevi gören boşluklara ve birbirini izleyen tek ve çift bağlardan oluşan konjuge karbon zincirlerine dayanır. İletken polimerler esneklik, biyoyumluluk, üretim ve uygulama kolaylığı gibi avantajları nedeniyle tekstilde, medikal uygulamalarda, robotik sistemlerde, sensör ve biyosensörlerde, transistörlerde vb. alanlarda yaygın bir kullanıma sahiptir. uyumlulukları, fonksiyonel ve esnek yapıları gibi özelliklerinden dolayı, doku mühendisliği protezlerinde, sensör/biyosensörlerde, ilaç/gen dağıtım sistemlerinde, aktüatörlerde büyük bir potansiyel kullanıma sahiptir. Akıllı polimerlerin gerek özelliklerinin ve gerekse kullanım alanlarının geliştirilebilmesi için birlikte kullanılacağı malzemelerle etkileşim mekanizmasının daha iyi anlaşılması ve akıllı polimerlerin rasyonel sentezini sağlamak için yapı-özellik ilişkisinin çok iyi anlaşılması gerekmektedir.

KAYNAKLAR

1. Bahl, S., Nagar, H., Singh, I., Sehgal, S. 2020. Smart materials types, properties and applications: A review. *Materials Today: Proceedings*, 28(3): 1302-1306.
2. Bogue, R. 2014. Smart materials: A review of capabilities and applications. *Assembly Automation*, 34(1): 16-22.
3. Bogue, R. 2012. Smart materials: A review of recent developments. *Assembly Automation*, 32 (1): 3-7.
4. Mutlu, D., Karagöz, İ. 2023. Akıllı malzeme olarak polimerler ve uygulamaları. *Konya Mühendislik Bilimleri Dergisi*, 11(1): 274-299.
5. Qader, I.N., Kök, M., Dağdelen, F., Aydoğdu, Y. 2019. A Review of Smart Materials: Researches and Applications. *El-Cezeri Journal of Science and Engineering*, 6(3):755-788.
6. Shukla, U., Garg, K. 2023. Journey of smart material from composite to shape memory alloy (SMA), characterization and their applications-A review. *Smart Materials in Medicine*, 4: 227-242.
7. Tüylek, Z. 2019. Sağlık alanında kullanılan akıllı polimerler. *İnönü Üniversitesi Sağlık Hizmetleri Meslek Yüksekokulu Dergisi*, 7(1): 81-95.
8. <https://www.google.com/search,hidrojeller>
9. *İnovatif Kimya Dergisi*, Yıl:3 Sayı:26, 2015.
10. <http://www.acikbilim.com/2014/03/dosyalar/her-dervrin-malzemesi-akilli-polimerler.html>
11. Yue, H., Wang, Z., Zhen, Y. 2022. Recent Advances of Self-Healing Electronic Materials Applied in Organic Field-Effect Transistors. *ACS Omega*, 7:18197-18205.
12. Carbas, B.B. 2016. Conjugated polymers and their energy applications. *3rd Anatolia Energy Symposium Special Issue*, 3(1): 46-60.
13. <https://www.google.com/iletken-polimerler>

**EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT WITH
GGBS IN CONCRETE**

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ABSTRACT

In recent years the applications of high strength concrete have been increased in many parts of the world. This growth has been possible, as a result of recent developments in technology and created demand for high strength concrete. There are many advantages in using high strength concrete in building construction. As in the case of conventional concrete, the use of steel fibers substantially increases the energy at break of high strength concrete. Although the initial cost may be high. Significant long-term saving would be ensured in reducing the needs for maintenance, repair and rehabilitation. The experimental program was designed to the effect of steel fibers on compressive strength, split tensile strength of high strength concrete and testing of cubes of size (150mmX150mmX150 mm), cylinders of 150 mm diameter, height of 300 mm for normal strength. In this study number of cubes are casted by adding steel fiber's with volume fraction of cube by 0.5%, 1.0% and 1.5 % and is compared with the properties of standard mix of M30 grade concrete.

Keywords: Steel Fibers, Concrete, strength.

INTRODUCTION

The most extensively used construction material in the world is probably Concrete with about six billion tones being produced every year. In terms of per capita consumption, it is only next to water. The most massive individual material element in the built environment is concrete. Significant environmental and economic benefits may be realized if the embodied energy of concrete can be reduced without decreasing the performance or increasing the cost. Concrete is primarily comprised of Portland cement, aggregates, and water. Although Portland cement typically comprises only 12% of the concrete mass, still it accounts for approximately 93% of the total embodied energy of concrete and 6% to 7% of the worldwide emissions of CO₂. Some remedial measures can be taken to minimize some bitter properties of concrete.

Formation of GGBS and its compositions

The Ground Granulated Blast Furnace Slag is a by-product of iron manufacturing industry. Iron ore, coke and limestone are fed into the furnace and molten slag floats above the molten iron at a temperature of about 15000C to 16000C as a resultant. The composition of molten slag about 30% to 40% SiO₂ and about 40% Cao, which is almost equal to the chemical composition of Portland cement. The molten slag, is water-quenched rapidly, after the molten iron is trapped off which results in the formation of a glassy granulate. The molten slag consists of mainly siliceous and aluminous residue. This glassy granulate is dried and ground to the required size, which is known as Ground Granulated Blast Furnace Slag (GGBFS). The production of GGBFS requires more energy as compared with the energy needed for the production of Portland cement. By replacing the Portland cement with GGBFS will results in 1 reduction of carbon dioxide gas emission. It is therefore an environmentally friendly construction material. GGBFS from modern thermal power plants generally does not require processing prior to being incorporated into concrete and is therefore considered to be an environmentally free input material. We can replace about 80% of the Portland cement by using GGBFS in concrete. GGBFS has characteristics of better water impermeability as well as improved resistance to corrosion and sulphate attack. Due to lower heat hydration .it reduces the risk of thermal cracking. It has higher durability, workability, reduces permeability to external agencies, which helps in making, placing and compaction easier. As a result, the service life of a structure is enhanced and the maintenance cost reduced.

Application of GGBS in concrete

1. Greener and stronger foundation.
2. Controlling and reducing thermal cracking.

3. Reducing heat hydration. Long term strength development.
4. Increased resistance to acid peaty solids.
5. Increased resistance to sulphates, and salt marine environment.
6. Major applications of GGBS concrete for today are highways, bridges, and high-rise buildings.

2. LITERATURE REVIEW

T. Vijayagowri, P. Sravana, P. Srinivasa Rao (2014).

‘Studies on strength behaviour of high volumes of slag in concrete’ Investigated the effects on compressive strength, split tensile strength and flexural strength of concrete at 28, 90, 180 and 360 days by partial replacement of cement with GGBFS on. He used 50% GGBFS as replacement material of cement and also used various water/binder ratios are 0.55, 0.50, 0.45, 0.40, 0.36, 0.32, 0.30 and 0.27. He observed that the strength gain by replacement of slag is inversely proportional to the water/ binder ratio and slag concrete gains appreciable amount of strength at later ages (90 days onwards). He found out that the strength of high volume of slag concrete is more at later ages because rate of hydration of slag with $\text{Ca}(\text{OH})_2$ and water is slow. He concluded that on replacement of cement by 50% GGBFS helps to reduce the cement content of concrete, thereby reducing the cost of concrete and also protecting the environment from pollution.

Reshma Rughooputh and Jaylina Rana (2014)

‘Partial replacement of cement by ground granulated blast furnace slag in concrete’ Studied the effects on various properties of concrete including compressive strength, tensile strength, splitting strength, flexure strength, modulus of elasticity, drying shrinkage and initial surface absorption by partial replacement of OPC by GGBFS on. The tests were conducted with replacement ranging from 30 % to 50% at 7 and 28 days. It was found that compressive strength is lower at the early age but increase after the later age time. Flexural strength of test specimens increased by 22% and 24%, tensile strength increased by 12% and 17% for 30% and 50% replacement respectively. Drying shrinkage increased by 3% and 4%. Static modulus of elasticity increases by 5% and 13%. Based on the results the optimum mix was the one with 50% GGBFS.

Mohammed Shariq, Janaka prasad, A.K. Ahuja (2008)

‘Strength development of cement mortar and concrete incorporating GGBFS’ Studied the effect of curing procedure on the cement mortar and concrete incorporating ground granulated

blast furnace slag compressive strength development. The compressive strength development of cement mortar is calculated by the 20, 40 and 60 percent replacement of GGBFS for different types of sand. Similarly, the strength development of concrete is investigated with 20, 40 and 60 percent replacement of GGBFS on two grades of concrete. Tests results show that the incorporating 20% and 40% GGBFS is highly significant to increase the compressive strength of mortar after 28 days and 150 days, respectively.

Santosh Kumar karri, G.V. Rama Rao, P. Markandeya Raju (2015)

‘Partial replacement of cement with GGBS in concrete’ researched by using 30%, 40% and 50% as cement replacement levels and cured the specimens of M20 and M40 grade of concrete for 28 and 90 days. He tested various properties of concrete and found that the compressive strength and tensile strength of mortar mixes with slag when determined at the ages of 7, 14, 28 and days decreases at early ages of curing (3 and 7 days). The specimens showed increase in compressive strength when tested at 7 and 28 days, for 20% replacement of cement. Concrete cubes were also exposed to H₂SO₄ and HCl of 1% and 5% concentration and were tested for compressive strength at 90 days and 28 days respectively.

C. Sabeer Alavi, I. Bhaskar, R. Venkata Subramani (2013).

‘Strength and durability characteristics of GGBFS based SSC’ Studied the effects of partial replacement of cement with 10 - 50% of GGBFS and found that 30% GGBFS replacement is good as beyond that the compressive strength starts decreasing. He also concluded that the split tensile strength and flexural strength conducted at 7 and 28 days increases with increase in GGBFS content. It was also found that the workability increases with the increase 4 in percentage of GGBFS.

Magandeeep , Ravikanth Pareek and Varinder Singh (2015).

‘Utilization of ground granulated blast furnace slag to improve properties of concrete’ In there paper observed that when replacement of GGBFS increases from 10 to 40 %, the slump values of various mix proportions of GGBFS concretes increased. Compressive strength and flexural strength decrease with increase in percentage of GGBFS at the age of 7 and 28 days but it increases with the increase in percentage of GGBFS at the age of 56 days. He also observed that the split tensile strength of the mix with 20% and 30% cement replacement better performed than at age of 56 days where as the mix with 40% cement replacement showed a decrease in strength at 56 days. The sulphate resistance and chloride resistance increased in the specimens with 30% GGBFS content than the specimens without GGBFS. This is because of the strength gain which takes longer time for the GGBS concrete because the pozzolanic

reaction is slow and depends on the calcium hydroxide availability.

Yogendra O. Patil, Prof P.N. Patil, Dr, Arun Kumar Dwivedi (2013).

‘GGBS as partial replacement of OPC in cement concrete’ Researched on the effects on compressive strength and flexural strength of concrete when cement is partially replaced with various percentages of GGBS. The tests were conducted with replacement ranging from 10 % to 40 % at 7, 28 and 90 days. It was observed that the strength of concrete is inversely proportional to the percentage of replacement of cement with GGBS. The result shows the marginal reduction of 4 – 6 % in compressive and flexural strength for 90 days curing with replacement of OPC by GGBS up to 20% and beyond that of more that 15%. He concluded that, the cost of concrete reduces at the current market rate by 14% by 20% replacement of OPC with GGBS.

3. OBJECTIVE OF STUDY

- To Check the feasibility of GGBS as a replacement of Cement in the construction of concrete.
- To cast number of cubes, by replacing Cement with GGBS by 20%,30%,40% and to compare their property with standard mix M35.
- Study the behaviour of compressive strengths of concrete cubes.
- Compare the result with conventional normal concrete.
- To find which percentage replacement is much cost Efficient without affecting its strength.
- To provide economical construction cost.

4. MATERIALS USED IN THIS INVESTIGATION

1. Cement
2. Fine aggregate
3. Coarse aggregate
4. Ground Granulated Blast Furnace Slag



5. TEST ON MATERIALS

1. TESTS OF CEMENT

- **Standard Consistency of Cement**



S.no	Percentage of water	Quantity of water added(ml)	Vi-cats plunger penetration (mm)
1	26%	104 ml	36
2	28%	112 ml	28
3	30%	120 ml	16
4	32%	128 ml	7

- **Specific Gravity of Cement**

➤ Specific Gravity is normally defined as the ratio between the weight of a given volume of material and weight of an equal volume of water.



➤ Specific Gravity of cement is 3.04

- **Fineness of cement**

- The fineness of cement is a measure of cement particles and is denoted as terms of the specific surface area of the cement..



- Fineness of cement sample is 4%.

2. TESTS ON FINE AGGREGATE AND COARSE AGGREGATE

S.No	Test Name	Result
1	Fineness Modulus of Fine Aggregate	2.70
2	Specific Gravity of Fine Aggregate	2.6
3	Specific Gravity of Coarse Aggregate	2.78
4	Flaky and elongation test on coarse aggregate	20.36% & 20.16%.

3. TESTS ON GGBS

S.No	Test Name	Result
1	Specific Gravity of GGBS	2.9
2	Fineness of GGBS	6%

Preparation and casting of cubes

Ingredients of concrete mix



Mixing the concrete



Filling the concrete in mould



Cubes under the curing



Cubes after curing



Finding out strength of cube



6. TEST ON HARDENED CONCRETE

Compression test is the most common test conducted on hardened concrete, partly because most of the desirable characteristic properties of concrete are quantitatively related to its compressive strength.



Digital compressive strength testing machine

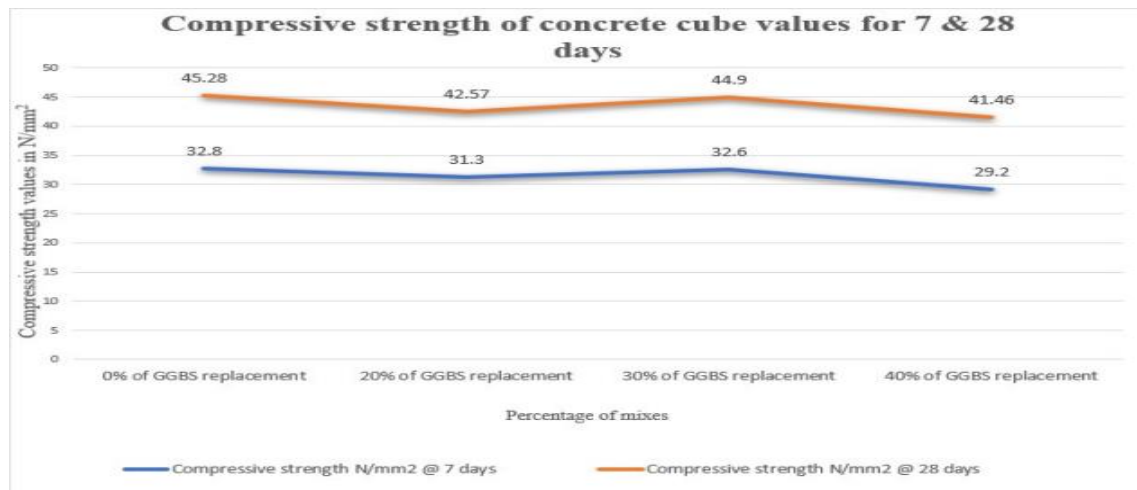
Compressive strength of cubes

Percentage of GGBS replacement	Compressive Strength N/mm ² @7Days	Compressive Strength N/mm ² @28days
0% GGBS	32.80	45.28
20% GGBS	31.30	42.57
30% GGBS	32.60	44.90
40% GGBS	29.20	41.46

7. RESULTS AND DISCUSSIONS

Compressive Strength of Concrete with Various Proportions of GGBS

The Compressive Strength of Concrete cubes are prepared With Different Proportions of GGBS. The cube specimen sizes are 150mm x 150 mm x 150 mm. The measured compressive strength of the specimen shall be calculated by dividing the maximum load applied to the Specimen During the test by the cross sectional Area calculated from mean dimensions of the section and shall be expressed to the nearest kg/cm²



From the above graph it is clear that

1. The Compressive strength of concrete for 7 days and 28 days for 0% of Replacement of GGBS is 32.80 and 45.28 N/mm²
2. The Compressive strength of concrete for 7 days and 28 days for 20% of Replacement of GGBS is 31.30 and 42.57 N/mm²
3. The Compressive strength of concrete for 7 days and 28 days for 30% of Replacement of GGBS is 32.60 and 44.90 N/mm²
4. The Compressive strength of concrete for 7 days and 28 days for 40% of Replacement of GGBS is 29.20 and 41.46 N/mm²

REFERENCES

1. Reshma Rughoopath and Jaylina Rana (2014) 'Partial replacement of cement by ground granulated blast furnace slag in concrete' Journal engineering trends in engineering and applied sciences (JETEAS), Vol. 5, Issue 5
 2. T. Vijayagowri, P. Sravana, P. Srinivasa Rao (2014) 'Studies on strength behaviour of high volumes of slag in concrete' International journal of research engineering and technology (IJRET), Vol.3, Issue 4
 3. C. Sabeer Alavi, I. Bhaskar, R. Venkata Subramani (2013) 'Strength and durability characteristics of GGBFS based SSC' International journal of engineering trends in engineering and development (IJETED), Vol. 2, Issue 3
 4. Santosh Kumar karri, G.V. Rama Rao, P. Markandeya Raju (2015) 'Strength and durability studies on GGBS concrete' International journal of civil engineering (IJCE), Vol. 2, Issue 10
 5. Magandeeep , Ravikanth Pareek and Varinder Singh (2015) 'Utilization of ground granulated blast furnace slag to improve properties of concrete' International journal of engineering and technologies (IJET), Vol. 6, Issue 2
 6. Yogendra O. Patil, Prof P.N. Patil, Dr, Arun Kumar Dwivedi (2013) 'GGBS as partial replacement of OPC in cement concrete' International journal of scientific research (IJSR), Vol. 2, Issue 11
 7. A. Oner, S. Akuyz (2007) 'An experimental study on optimum usage of GGBS for the compressive strength of concrete cement and concrete compositions' Vol,3, Issue 5 34
- Code Books IS 456-2000 (code of practice for plain and reinforced concrete).
IS 10262-2009 (Concrete Mix proportioning-guidelines).
IS 383-1970 (Specifications for fine and coarse aggregate from natural sources for concrete)

PORTAKAL ÜRETİCİLERİNİN SU KAYNAKLARININ DEĞERLENDİRİLMESİ
ÜZERİNE İNCELEME

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ABSTRACT

Köyceğiz Dalyan Special Environmental Protection Area has different ecosystems. The existence of water resources is of great importance in Köyceğiz Dalyan SEPA, which is one of the most important wetlands of Turkey. Citrus fruits are the most produced plant. Within the scope of this study, the water resources of orange producers were evaluated in terms of household and agricultural use. With the study, a face-to-face survey was conducted with 258 agricultural holdings in Köyceğiz Dalyan SEPA. In the study, household water use resources and agricultural water use resources were examined. While the data obtained indicate that there is no decrease in the main water source used for the household needs of the agricultural holdings, 34.5% of the agricultural holdings stated that the water source they use in agriculture decreased, 6.6% increased, and 57.8% remained the same.

Keywords: Orange producers, water resources, Muğla, Türkiye

Giriş

Bugün dünya çapında yaklaşık iki milyar insan güvenli içme suyuna erişememekte (UNSTAT, 2023) ve dünya nüfusunun kabaca yarısı yılın en azından bir bölümünde ciddi su kıtlığı yaşamaktadır (IPCC, 2022). Bu sayıların, iklim değişikliği ve nüfus artışı (WMO, 2023) nedeniyle daha da artması beklenmektedir.

Bugün, çoğu ülke su kaynakları üzerinde benzeri görülmemiş bir baskı uygulamaktadır. Küresel nüfus hızla artmaktadır. Mevcut uygulamalarla dünyanın 2030 yılına kadar talep edilen su miktarı ile mevcut su kaynağı arasında %40'lık bir eksiklik olacağı tahmin edilmektedir. Ayrıca, kronik su kıtlığı, hidrolojik belirsizlik ve aşırı hava olayları (sel ve kuraklık) küresel refah ve istikrara yönelik en büyük tehditlerden biri olarak algılanmaktadır. Su kıtlığı ve kuraklığın artan kırılganlık ve çatışmalarda oynadığı rolün kabulü artıyor. 2050 yılına kadar 10 milyar insanı beslemek için (günümüzde kaynağın %70'ini tüketen) tarımsal üretimde %50 ve su çekimlerinde %15 artış gerçekleşeceği beklenmektedir. Tahminler, dünya nüfusunun %40'ından fazlasının su kıtlığı olan bölgelerde yaşadığını ve dünya GSYİH'sının yaklaşık 1/4'ünün bu zorluğa maruz kaldığını göstermektedir (WB, 2023).

Köyceğiz Dalyan Özel Çevre Koruma Bölgesi (ÖÇKB) Muğla ili sınırları içerisinde yer almaktadır. Köyceğiz ve Ortaca ilçelerindeki köyleri kapsamaktadır.



Şekil 1. Köyceğiz Dalyan ÖÇKB sınırları (ÖÇKB, 2023)

ÖÇKB toplam genişliği 461.5 km²'dir (ÖÇKB, 2023). Alanın 55.8 km²'si denizel alandır (SAD, 2010; Bann ve Başak, 2013). Sulak alanlar ekosistem çeşitliliği açısından zengin alanlardır ve pek çok türün üreme alanıdır (UNSTAT, 2023). Bölgenin sahip olduğu farklı ekosistemler biyolojik çeşitliliğin de yüksek olmasını sağlamaktadır. Köyceğiz Dalyan ÖÇK içerisinde yer alan İztuzu kumsalı Akdeniz'deki deniz kaplumbağalarının (*Caretta caretta* ve *Chelonia mydas*) ve Nil kaplumbağasının (*Trionyx triunguis*) en önemli üreme alanlarından birisidir. Bununla birlikte, su samuru türünün (*Lutra lutra*) yaşam ve üreme alanıdır. ÖÇK içerisinde, 282 denizel fauna ve flora türü ve 126 kuş türü olduğu tespit edilmiştir (ÖÇKB, 2023).



Şekil 2. İztuzu kumsalı (ÖÇKB, 2023)

Köyceğiz Dalyan ÖÇKB turizm açısından önemli bir noktadır. Artan turist sayısı su kaynakları kalite ve miktarını olumsuz yönde etkilemektedir (Kaya ve ark. 2011). Bölgenin cazibesin şehirleşmeyi beraberinde getirmekte ve su kaynakları üstündeki baskıyı artırmaktadır.

Bölgede turizm en önemli ekonomik faaliyetken tarım da ikinci en önemli ekonomik faaliyettir. Alanda en fazla üretime bitkisel ürünler turunçgillerdir. Turunçgiller içinde ise portakal en fazla üretim alanına sahiptir (TOB, 2023).

Materyal Metot

Materyal

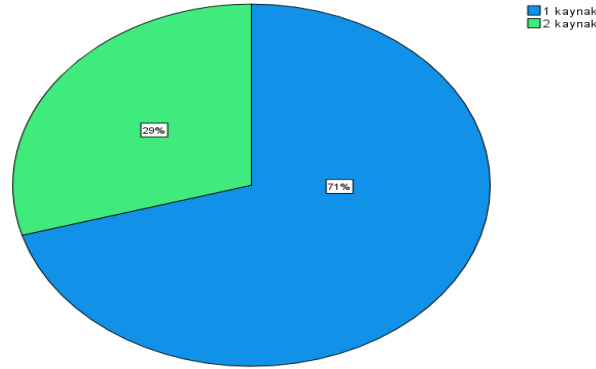
Araştırmada materyal olarak birincil ve ikincil veriler kullanılmıştır. Araştırmada kullanılan birincil verileri çiftçilerle yapılan yüz yüze yapılan anketlerden elde edilen bilgiler, ikincil verilerini ise ilgili literatürden derlenen bilgiler oluşturmaktadır.

Metot

Örneklemede tabakalı örnekleme yöntemi kullanılmıştır. Örnekleme sonucunda 258 portakal üreticisi ile anket yapılmıştır. Araştırmada verilerin değerlendirilmesinde frekans ve ortalama değerler belirlenmiştir. Analiz ve grafiklerin oluşturulmasında SPSS 27 yazılımı kullanılmıştır.

Bulgular

Araştırmada portakal üreticilerinin hanehalkı tüketimi ve tarımda kullanılan su kaynakları incelenmiştir. Hanehalkı tüketiminde üreticilerin %71'i tek kaynak, %29'u 2 kaynak kullanmaktadır (Şekil, 3)



Şekil 3. Son 12 ayda hane tüketiminde kullanılan su kaynağı sayısı

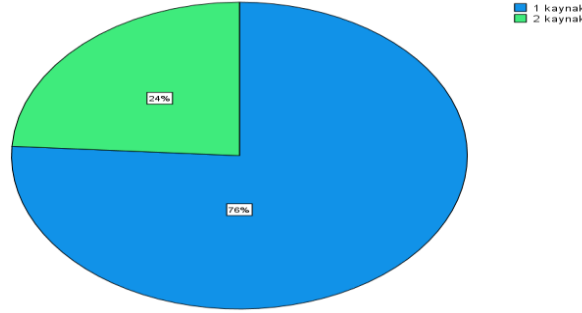
Hanehalkı su tüketiminde kullanılan kaynaklar incelendiğinde üreticilerin %88'i musluk suyu, %18'i sondaj, %2,7'si şişelenmiş su kullanmaktadır (Çizelge 1).

Çizelge 1. Hanehalkı su ihtiyaçlarının ana su kaynağı

	Frekans	Oran (%)
Musluk suyu (klorlu)	227	88,0
Sondaj	18	7,0
Özel kuyu	1	0,4
Şişelenmiş su	7	2,7
Diğer (belirtiniz)	5	1,9
Total	258	100,0

Son 3 yılda hane halkı su ihtiyacını karşılayan su kaynaklarında son 3 yılda su miktarının değişmediği belirtilmiştir.

Tarımsal amaçlı su kaynakları incelendiğinde üreticilerin %76'sı tek su kaynağı, %24'ü iki su kaynağı kullandığı tespit edilmiştir (Şekil 4).



Şekil 4. Tarımda kullanılan su kaynağı sayısı

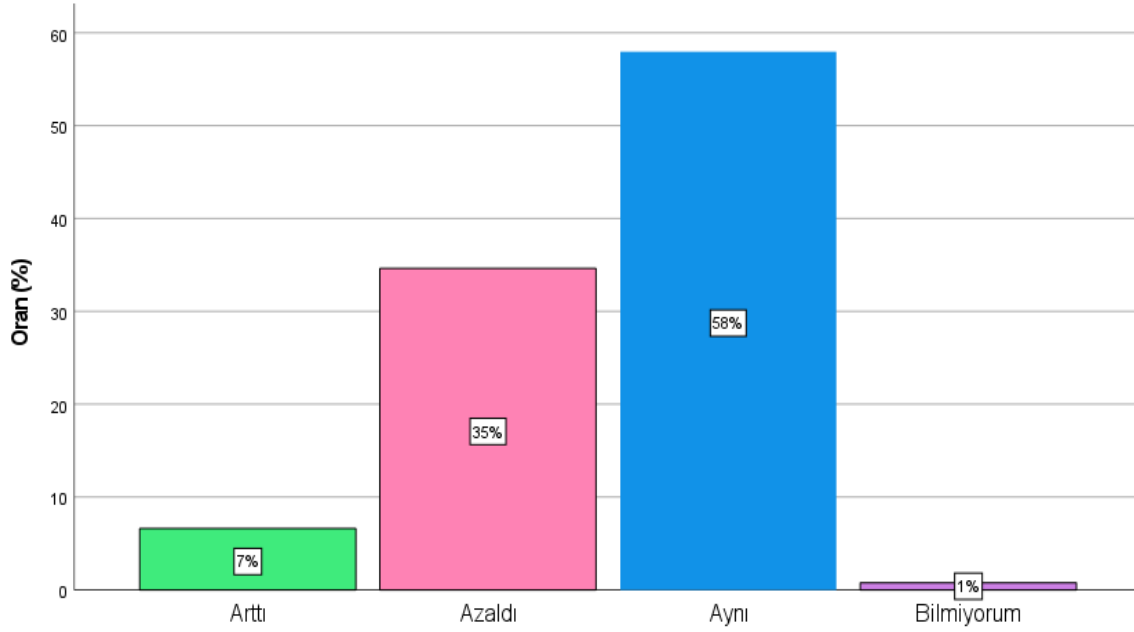
Üreticilerin %37,2'si ana tarımda su kaynağı olarak sondaj, %29,8'i sulama kanalı, %12'si nehir/akarsu/göl, %3,9'u kuyu, %13,8'i ise diğer kaynakları kullanmaktadır (Çizelge 2).

Çizelge 2. Tarımda kullanılan ana su kaynağı

	Frekans	Oran (%)
Sondaj	96	37,2
Baraj	1	0,4
Boru Hattı	5	1,9
Nehir/akarsu/göl	31	12,0
Kuyu	10	3,9
Yağmur	1	0,4
Musluk Suyu	2	0,8
Gölet	1	0,4
Sulama Kanalı	77	29,8
Diğer (Belirtiniz)	34	13,2
Total	258	100,0

Tarımda kullanılan diğer su kaynakları içerisinde akarsu, artezyen en yüksek orana sahip olan su kaynaklarıdır. Alanda tarımda kullanılan su kaynaklarının son 3 yıldaki değişimleri incelendiğinde üreticilerin %35'i azaldığını, %58'i azaldığını, %7'si arttığını belirtmiştir (Şekil

5). Üreticilerin %35'inin su kaynağında azalma olduğunu belirtmesi üzerinde dikkatle durulması gereken bir durumdur.



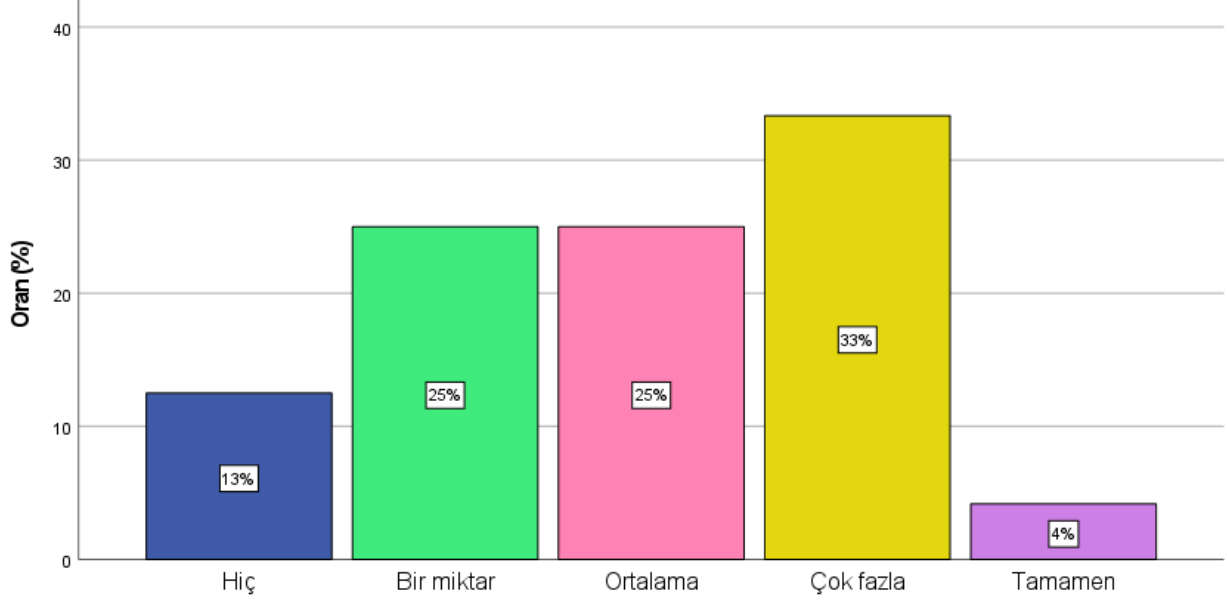
Şekil 5. Son 3 yılda tarımda kullanılan su miktarının değişimi

Üreticilerin su kaynaklarını korumak için herhangi bir faaliyette bulunup bulunmadığı tespit edilmeye çalışılmıştır. Üreticilerin %90,7'si su kaynaklarını korumak için herhangi bir faaliyet bulunmadığını belirtirken %4,3'ü sabah erken veya gece geç saatlerde sulama yaptığını, %1,2'si su tutma hendekleri, taş setler, bitki örtüsü şeritleri, kontur çizgiler ve hendekler yaptığını belirtmiştir.

Çizelge 3. Su kaynaklarını korumak için yapılan faaliyetler

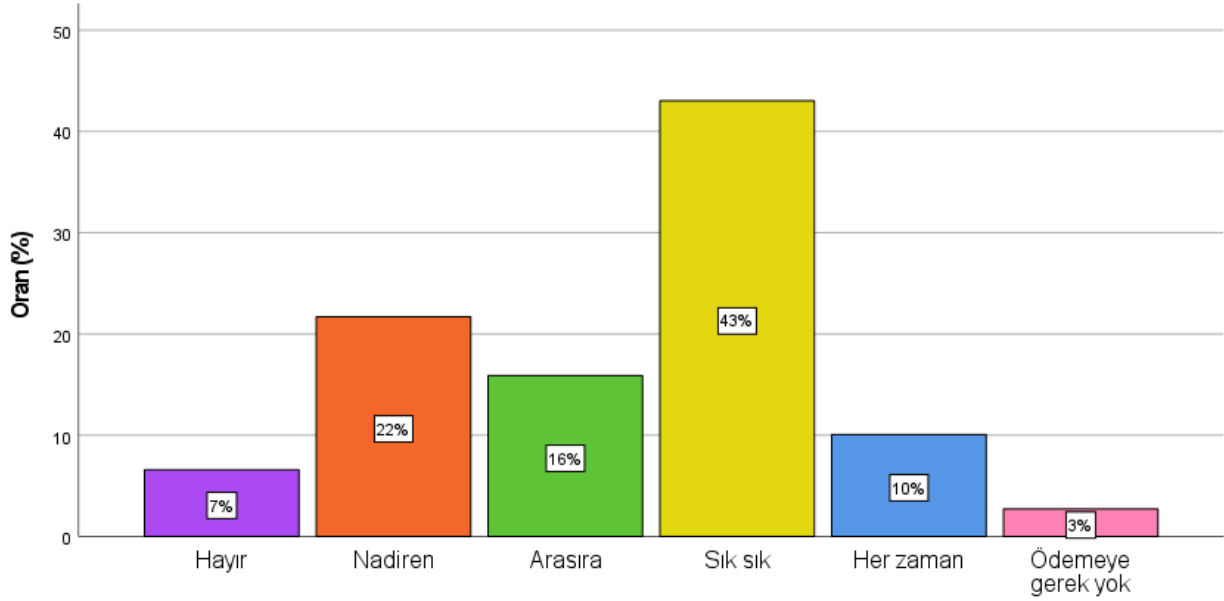
	Frekans	Oran (%)
Hayır, hiçbir şey yapmadım	234	90,7
Su tutma hendekleri, taş setler, bitki örtüsü şeritleri, kontur çizgileri ve hendekler (oluklar)	3	1,2
Sabah erken veya gece geç saatlerde sulama (sıcaklık daha düşük olduğunda)	11	4,3
Teraslama	1	,4
Yerel sulama	1	,4
Diğer (belirtiniz)	8	3,1
Total	258	100,0

Üreticilerin su kaynakları korumak için aldığı önlemlerin ne düzeyde etkili olduğu belirlenmeye çalışılmıştır. Üreticilerin %13'ü aldığı önemlerin hiç etkisi olmadığını, %25'i bir miktar etkisi olduğunu, %25'i orta düzeyde etki ettiğini, %33'ü çok etkili olduğunu ve %4'ü tamamen etkili olduğunu belirtmiştir (Şekil 6).



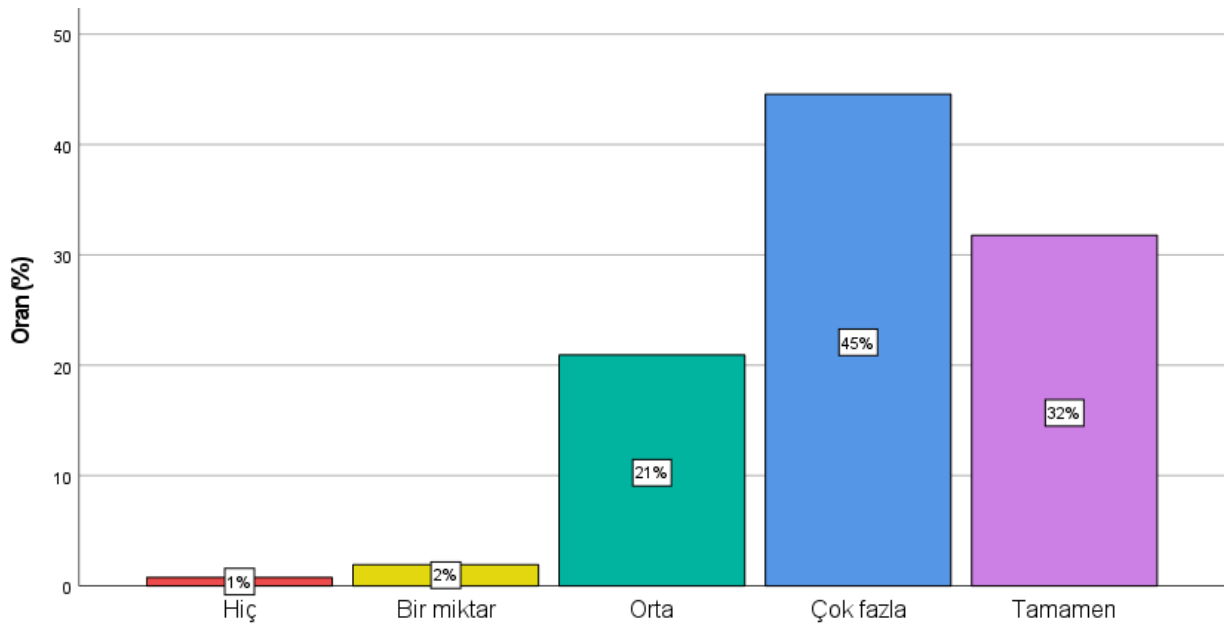
Şekil 6. Su kaynağını korumak için alınan önlemlerin etkisi

Tarımda kullanılan suyun su ücreti, elektrik, bakım-onarım gibi diğer masrafları bulunmaktadır. Tüm bu masrafların üreticiler tarafından karşılanabilme düzeyleri araştırılmıştır. Üreticilerin %7'sinin bu ücretleri karşılayamadığı, %22'sinin nadiren karşıladığı, %16'sının ara sıra karşıladığı, %43'ünün sık sık karşıladığı, %10'nun her zaman karşılayabildiği tespit edilmiştir. Üreticilerin %3'ü herhangi bir ödeme yapmaya gerek olmadıklarını belirtmişlerdir (Şekil 7).



Şekil 7. Tarımda kullanılan suyun masrafını karşılayabilme durumu

Üreticilerin ve hanelerindeki diğer kişilerin yeterli suya erişip erişemedikleri belirlenmeye çalışılmıştır. Üreticilerin %1'i suya hiç erişemediklerini, %2'si bir miktar erişebildiğini, %21'i orta düzeyde erişebildiklerini, %45'i çok fazla erişebildiklerini ve %32'si suya tamamen erişebildiklerini belirtmiştir (Şekil 8).



Şekil 8. Yeterli suya erişebilme durumu

Sonuç

Su güvenliğini güçlendirmek için, su kaynaklarının gelecekteki planlaması ve yönetimi için kapasite, uyarlanabilirlik ve dayanıklılık oluşturulması gerekmektedir. Alanda su

kaynakları üzerinde turizm ve şehirleşme baskısı ile birlikte tarımsal faaliyetler de yer almaktadır. Turizm faaliyetlerinden elde edilen önemli olmakla birlikte başta su kaynakları olmak üzere alanın taşıma kapasitesi dikkate alacak şekilde turizm planlaması yapılmalıdır. Alandaki şehirleşme kısıtlanarak su kaynakları varlığı ve kalitesi üzerindeki baskı azaltılmalıdır.

Tarım alandaki en önemli ikinci ekonomik faaliyettir. Üreticilerin %35'i tarımda kullandıkları su kaynaklarının azaldığını belirtmişlerdir. Bu azalmanın ne düzeyde olduğu tespit edilerek, azalmayı engelleyecek önlemler acilen alınmalıdır.

Üreticilerin üçte birinden fazlası tarımsal su kaynağının azaldığını belirtmesine karşın üreticilerin %90,7'si su kaynaklarını korumak için herhangi bir önlem almadıklarını belirtmişlerdir. Alanda üreticilerin su kaynaklarını korumaya yönelik bilinçlendirme çalışmaları yapılmalı, en etkili koruma yöntemlerinin yaygınlaştırılması sağlanmalıdır.

Not: Bu çalışma TÜBİTAK SOBAG tarafından desteklenen 121K572 numaralı “Tarım İşletmelerinin İklim Değişikliğine Dayanıklılığının Belirlenmesi- Köyceğiz-Dalyan Özel Çevre Koruma Bölgesi-“Projesi kapsamında elde edilmiştir. TÜBİTAK’a verdiği destek için teşekkür ederiz. Bununla birlikte, Tabiat Varlıklarını Koruma Genel Müdürlüğü’ne çalışma alanı olan Köyceğiz Dalyan Özel Çevre Koruma Bölgesinde çalışmamıza izin verdikleri için teşekkür ederiz.

Kaynaklar

- Bann, C. Ve Başak, E. 2013. Economic Analysis of Köyceğiz-Dalyan Special Environmental Protection Area. Project PIMS 3697: The Strengthening the System of Marine and Coastal Protected Areas of Turkey. Technical Report Series 12: 52 pp.
- IPCC, 2022. Intergovernmental Panel on Climate Change, Six Assessment Report, Working Group II- Impacts, Adaptation and Vulnerability. (https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_FoodAndWater.pdf) 12 Mart 2023.
- Kaya, L. G., Aslan, F. Ve Yılmaz, B. 2011. Muğla Dalyan Turizminin Özel Çevre Koruma Bölgesi Üzerine Etkileri. İnönü Üniversitesi Sanat ve Tasarım Dergisi, 1(3): 255-266.
- ÖÇKB, 2023. <https://ockb.csb.gov.tr/koycegiz-dalyan-ozel-cevre-koruma-bolgesi-i-2753> (18 Mart 2023)
- SAD. 2010. Köyceğiz-Dalyan Özel Çevre Koruma Bölgesi Deniz ve Kıyı Alanlarında Biyolojik Çeşitliliğin Tespiti Projesi Sonuç Raporu. Ankara.
- TOB, 2023. Tarım ve Orman Bakanlığı. Köyceğiz ve Ortaca İlçe Tarım ve Orman Müdürlükleri basılı olmayan verileri.
- UNSTAT, 2023. United Nations Statistic Division. https://unstats.un.org/sdgs/report/2022/Goal-06/?_gl=1*1jjsoc*_ga*NDE3MTU3MDEuMTY4Mjc5MTEwMA..*_ga_TK9BQL5X7Z*MTY4Mjc5MTA5OS4xLjAuMTY4Mjc5MTA5OS4wLjAuMA.. (14 Nisan 2023)
- WB, 2023. World Bank <https://www.worldbank.org/en/topic/waterresourcesmanagement> (15 Nisan 2023)
- WMO, 2023. World Meteorological Organization. <https://public.wmo.int/en/media/press-release/protect-our-people-and-future-generations-water-and-climate-leaders-call-urgent> (1 Nisan 2023)

**STUDY ON THE MECHANICAL PROPERTIES OF CONCRETE BY PARTIAL
REPLACEMENT OF AGGREGATES WITH CERAMIC WASTE**

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Introduction

Concrete is a composite material consist of mainly water, aggregate, and cement. In concrete production, a large amount of natural aggregates, water, and sand are being consumed. Consequently to minimize the use of natural aggregates researchers have concentrated on the use of various waste materials as alternatives in the construction industry, especially in concrete construction. One of the prime research interests is the utilization of ceramic waste material like Crushed tiles, granites, glass sheet, etc. in concrete construction. This waste is not recycled in any form at present, however the ceramic waste is durable, hard and highly resistant to biological, chemical and physical degradation forces so, we selected these waste materials as a replacement material to the basic natural aggregate. Waste tiles and granites, glass sheets is collected from the surroundings.

Crushed tiles are replaced in place of coarse aggregate by the percentage of 10%,20%30%,and glass powder is in place of fine aggregate by the percentage of 10% along with coarse aggregate. The addition of waste material in concrete reduces the cost of construction and more or less maintains the properties of concrete such as impact value, water absorption, and specific gravity of natural aggregates. If we add ceramic waste material properly processed, it is effective as construction material and meets the design specifications. The study focuses on producing concrete of acceptable strength with ceramic waste as an alternative

material for coarse aggregates and fine aggregate by determining the mechanical properties of different percentages of aggregates.

Construction Waste in India

- In the present construction world, the solid waste is increasing day by day from the demolitions of constructions. There is a huge usage of ceramic tiles in the present constructions is going on and it is increasing in day by day construction field. Ceramic products are part of the essential construction materials used in most buildings. Some common manufactured ceramics include wall tiles, floor tiles, sanitary ware, household ceramics and technical ceramics. They are mostly produced using natural materials that contain high content of clay minerals.
- However, despite the ornamental benefits of ceramics, its wastes among others cause a lot of nuisance to the environment. And also in other side waste tile is also producing from demolished wastes from construction. Indian tiles production is 100 million ton per year in the ceramic industry, about 15%- 30% waste material generated from the total production. This waste is not recycled in any form at present, however ceramic waste is durable, hard and highly resistant to biological, chemical and physical degradation forces so they can be used as a replacement material to the basic natural aggregate to reuse them and to decrease the solid waste produced from demolitions of construction.

Objectives

- This study focuses on finding the satisfactory level of the concrete mix made by replacing ceramic waste with coarse aggregates and fine aggregates by evaluating its mechanical properties.
- Use of various ceramic waste materials in construction units.
- To reduce the cost of aggregates.

Literature Review

- **Mr.Akshay, B. Rahane, Vrushali, S. Jagtap, Papiha, R. Wade, Mohammad Ismail (2021)** have studied replacing ceramic tile waste with coarse aggregate. The ceramic coarse aggregate is used in concrete by replacing coarse aggregate by 25%,35%, and 45%. To compare the results of conventional concrete with Ceramic coarse aggregate concrete a concrete design mix of M20 is produced with various proportions of ceramic coarse aggregate material. Due to the good bonding nature of ceramic material with cement it increases the strength of concrete.

From the study, it is found that the percentage of replacement of coarse aggregate with ceramic coarse aggregate material is 45%, within which the performance of concrete is better, and all the results are attained within the designed limit.

- **Mr.Amjad Ali and K.Sharba, (2020)** investigated crushed gravels in concrete mixes that were replaced by ceramic tile. Their ratios were 15%, 30%, 45%, and 60%. On the other hand, glass powder was used to replace fine aggregate at a percentage of 15%, 30%, and 45%. The mixtures were examined in their fresh and hardened states in terms of workability, density, compressive, tensile strength, and flexural beam tests. The results pointed out that applying waste glass powder in the concrete mixture that contained waste ceramic tiles have enhancement the strength properties. The best result was obtained with a mix containing 25% glass powder and 15% ceramic tile.

- **Dr.K.Chandramouli, J.Sree Naga Chaitanya, Dr.Shaik.Bifathima, Dr.D.Vijaya Kumar, J.Deeksha, (2022)** studied on properties of concrete by proportions of the coarse aggregates that were substituted by the crushed ceramic waste tiles as 10%, 20%, 30%, 40%, and 50% and 10% of the fine aggregate was replaced with granite powder and ceramic tile powder in addition to the coarse ceramic tile. The M20 concrete grade was created and put to the test. It has been found that workability rises along with the Replacement rate of broken tiles and granite powder. The specimens were prepared and tested to compressive strength, and split tensile. The properties of concrete are attained by 30% of replacement with ceramic tiles and 10 % of replacement with granite powder at the age of 7 days and 28 days.

- **Mr.S.O. Ajamu , J. R. Oluremi and E. S. Ogunyemi, (2018)** have focused on the structural effect of the partial inclusion of Ceramic Tile Waste (CTW) as coarse aggregates in concrete production. Different samples of concrete were produced with 0 - 40 % in step content of 10% as a partial replacement of granite with CTW as well as 100% CTW as coarse aggregates. Tests were carried out on both coarse aggregates, CTW, and fresh and hardened concrete. The results of the tests showed that the workability of the mixes increased with a percentage increase in the CTW content up to 30% and thereafter decreased. There was a gradual decrease in the compressive strength of the test samples with an increase in the CTW content having a minimum permissible value of 20.03 N/mm² at 28 days for 40% inclusion of CTW. The water absorption rate of the samples increased with an increase in the CTW content by up to 30%. Based on the result obtained, a concrete mix ratio that contains not more than 40% CWT content is therefore recommended for use in the concrete mix.

- **Mr.Ravindra R, Anand Kumar BG, Patil Rooparchana, (2014)** studied on physical characterization and comparison of ceramic fine aggregates with natural fine aggregates were carried out and the strength properties of cement mortar with ceramic fine aggregate were studied. The result was promising for a replacement ratio of natural fine aggregate with a ceramic fine aggregate of 10%.
- **N.Naveen Prasad, P.Hanitha, N.C.Anil, (2016)** has investigated crushed waste tiles and granite powder as a replacement to coarse aggregates and fine aggregates. The combustion of waste crushed tiles were replaced in place of coarse aggregates by 10%, 20%, 30% and 40% and Granite powder were replaced in place of fine aggregate by 10%, 20%, 30% and 40%. Variations in the workability for these different mixes were studied and observed with the increase in the percentage of replacement of granite powder and crushed tiles, workability increases. For 10% of granite powder and 30% crushed tiles are replaced in place of fine aggregates and coarse aggregate, there is a increment in compressive strength, split tension strength, flexural strength and bond strength when compare to the conventional concrete strength results after 7 and 28 days curing period.
- **Prof. Shruthi, Prof. Gowtham Prasad, M. Samreen Taj, Syed Ruman Pasha (2016)** investigated on the reuse of ceramic waste as a substitute for coarse aggregate in concrete. They studied on properties of concrete mix with ceramic tile waste as a replacement in concrete for natural coarse aggregate with 0%, 10%, 20%, and 30% of the substitution and M20 grade concrete was used. The concrete moulds were casted and tested for Compressive Strength and Split Tensile Strength after a curing period of 3, 7 & 28 days. Results showed that the maximum compressive strength is obtained for the 30% replacement of ceramic tile aggregate with natural coarse aggregate.
- **Mr.A.O.Yiosese, A. R. Ayoola, M.C.Ugonna , A.K Adewale (2018)** has done experimental investigation on the suitability of the use of broken tiles as partial replacement for crushed granite in concrete production. The percentage replacement varied from 0% to 40% at intervals of 5%. The slump test was used to assess the workability of the fresh concrete. The compressive strengths and densities of cured concrete cubes of sizes were evaluated at 7 days, 21days, and 28days. A total of 81 concrete cubes were cast and tested. An increase in the percentage replacement of crushed granite with broken tiles reduces workability, density, and compressive strength. The compressive strength and density increased with days of curing. The compressive strength and density are maximum for concrete cubes with 100% crushed granite and minimum when broken tiles content is 40% with equivalent strength of (23.5N/mm² and

20.3N/mm²) and density of (2622 and 2441kg/m³) respectively. Compressive strength tests showed that variation up to 40% of the broken tiles in replacement for crushed granite was quite satisfactory with no compromise in compressive strength requirements (20N/mm²).

Materials and Test on Materials

CEMENT

- Cement is the most important material to be used in concrete. Ordinary Portland Cement of 53 Grade of brand name Ultra Tech Company, available in the local market was used for the investigation. Care has been taken to see that the procurement was made from single batching in airtight containers to prevent it from being affected by atmospheric conditions. The cement thus procured was tested for physical requirements

TESTS ON CEMENT

- **FINENESS OF CEMENT**

Fineness defines the surface area of cement particles per unit weight, which implies that more fineness means more particles in unit weight. This enhances the reaction rate which in turn will result in a faster gain of strength at earlier stages.

Fineness of cement

S.No	Weight taken(gms)	Weight of Residue retained(gms)	Fineness(%)
1	100	4	4
2	100	5	5
3	100	4	4

$$\text{Average} = \frac{4+5+4}{3} = 4.33$$

$$\text{Fineness of cement} = 4.33\%$$

- **SPECIFIC GRAVITY OF CEMENT**

Specific Gravity is the ratio of the substance to the density of the reference substance. To determine the specific gravity of the cement, kerosene which does not react with cement is used.

$$\text{Weight of cement taken} = 64 \text{ grams}$$

The volume of cement in flask= 21.4

Density of liquid at 100 ° temperature = 0.8

$$\text{Specific Gravity} = \frac{\text{specific weight of cement}}{\text{specific weight of kerosene}}$$

$$\text{Specific weight of cement} = \frac{\text{weight of cement}}{\text{Volume of cement}}$$

$$= \frac{64}{21.4} = 2.99$$

$$\text{Specific Gravity} = \frac{2.99}{0.8} = 3.73$$

Specific gravity is found to be 3.73

• **STANDARD CONSISTENCY OF CEMENT**

The standard consistency of the cement paste is defined as the consistency of the cement which will permit the Vicat plunger to penetrate to a point of 5 to 7 mm from the bottom of Vicat's mould. The following readings were obtained:

Trial No.	Quantity of water(ml)	Initial reading (mm)	Final Reading (mm)	Height not penetrated (mm)
1	120	40	33	07
2	128	40	23	17
3	132	40	7	33

$$\text{Standard consistency of cement} = \frac{W_2}{W_1} \times 100$$

W1 = Quantity of water taken

W2 = Weight of water corresponding to penetration of 5mm to 7mm

$$\text{Standard consistency} = \frac{132}{400} \times 100 = 33\%$$

FINE AGGREGATE

• Sand is a natural granular material that is mainly composed of finely divided rocky material and mineral particles. The most common constituent of sand is silica (silicon dioxide, or SiO₂), usually in the form of quartz, because of its chemical inertness and considerable hardness, is the most common weathering-resistant mineral. Hence, it is used as fine aggregate

in concrete. The aggregate sizes lesser than 4.75 mm is considered as fine aggregates.

Grain size distribution of fine aggregate

$$\begin{aligned} \text{Fineness Modulus} &= \frac{\sum f}{100} = \frac{276.5}{100} \\ &= 2.765 \end{aligned}$$

Graph of Grain Distribution of Fine Aggregate



- **Specific Gravity of fine aggregate**

$$= \frac{500}{(1122-622)-(1826-1518)} = 2.604$$

- **BULKING OF SAND**

Bulking of sand is the increase in the volume of sand due to an increase in moisture. Specific gravity is the ratio of the density of a substance to the density of a reference substance, equivalently It is the ratio of the mass of a substance to the density of a reference substance for the same given volume.

Determine the weight of the empty pycnometer (W1). Take about 500 grams of fine aggregate and pour it into a pycnometer. The weight (W2) of the pycnometer along with the fine aggregate is determined. Fill the pycnometer with water along with the fine aggregate and take the

weight(W3). Empty the pycnometer and fill it with water and take weight(W4).

$$\text{Weight of pycnometer (W1)} = 622 \text{ g}$$

$$\text{Weight of pycnometer + F.A (W2)} = 1122 \text{ g}$$

$$\text{Weight of pycnometer + F.A + water (W3)} = 1826 \text{ g}$$

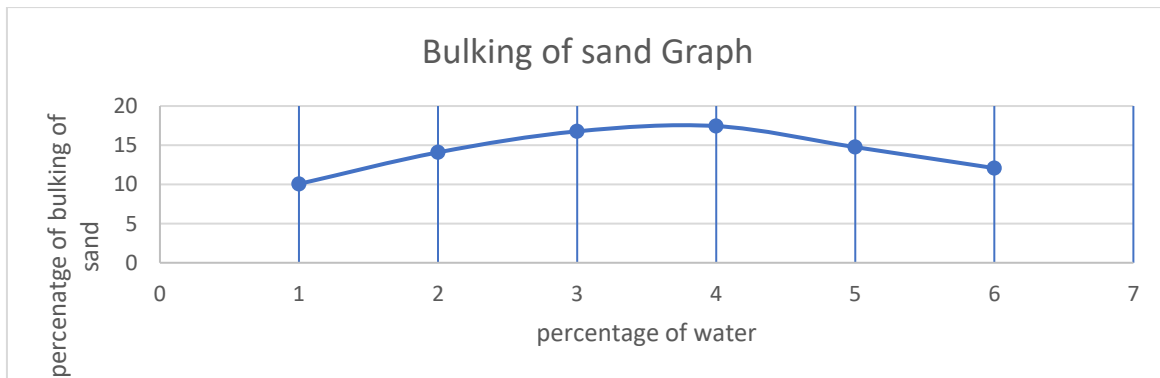
$$\text{Weight of pycnometer + water (W4)} = 1518 \text{ g}$$

$$\text{Weight of Oven dry sample (W5)} = 500 \text{ g}$$

$$\text{Specific Gravity} = \frac{W5}{(W2-W1)-(W3-W4)}$$

content. The readings obtained are:

Percentage of water added by weight of sand	Height of moist sand (mm)	Percentage of bulking of sand
1	164	10.06
2	170	14.09
3	174	16.77
4	175	17.44
5	171	14.76
6	167	12.08



The maximum amount of 17.44 bulking was obtained at a moisture content of 4 %.

$$\text{Weight of pycnometer + C.A + water (W3)} = 1805 \text{ g}$$

$$\text{Weight of pycnometer + water (W4)} = 1520 \text{ g}$$

$$\text{Weight of Oven dry sample (W5)} = 500 \text{ g}$$

$$\begin{aligned} \text{Specific Gravity} &= \frac{W5}{(W2-W1)-(W3-W4)} \\ &= \frac{500}{(1120-620)-(1805-1520)} \\ &= 2.325 \end{aligned}$$

- **Water Absorption test for Coarse Aggrega**

The water absorption determines the water holding capacity of aggregates. The water absorption of an aggregate is the percentage by weight of water absorbed in terms of oven dry

weight of the specimen and it is accepted measure of porosity.

Weight of surface dry coarse aggregate in air = 2000 g

Weight of aggregate placed in water for 24 hours = 2002 g

$$\text{Water absorption} = \frac{2002-2000}{2000} \times 100$$

$$= 0.1 \%$$

• **IMPACT VALUE OF COARSE AGGREGATE**

Impact value is the ability of aggregates that resist sudden impact or shock load on it. Also, it can be defined as the resistance of aggregate to failure by impact load is known as the Impact Value of Aggregate.

The impact test on aggregate is carried out to know the response of aggregates to different kinds of loads that the aggregates will be subjected to during their service life.

Details	Trail No.1 (gms)	Trail No.2 (gms)	Average (gms)
Total weight of aggregate sample W1 (gms)	319	335	327
Weight of aggregate retained on 2.36 mm sieve after the test W2 (gms)	248	266	257
Weight of aggregate passing 2.36 mm sieve after the test W3 (gms)	70	67	68.7
Aggregate impact value percent fines $\frac{W3}{W1} \times 100$	21.94	20	20.97

WATER

Water plays a vital role in achieving the strength of concrete. For complete hydration it requires about 3/10th of its weight of water. It is practically proved that minimum water-cement ratio 0.35 is required for conventional concrete. Water participates in chemical reaction with cement and cement paste is formed and binds with coarse aggregate and fine aggregates. If more water is used, segregation and bleeding takes place, so that the concrete becomes weak, but most of the water will absorb by the fibers. Hence it may avoid bleeding. If water content exceeds permissible limits it may cause bleeding. If less water is used, the required workability is not achieved. Potable water fit for drinking is required to be used in the concrete and it should have pH value ranges between 6 to 9.

CERAMIC TILE AGGREGATE

Broken tiles were collected from the solid waste of ceramic manufacturing unit and from demolished building. The waste tiles were crushed into small pieces by manually. The required size of crushed tile aggregate was separated to use them as partial replacement to the natural coarse aggregate. The tile waste which is lesser than 4.75 mm size was neglected. Crushed tiles were partially replaced in place of coarse aggregate by the percentages of 10%, 20% and 30%.

TESTS ON CERAMIC TILES

- **SPECIFIC GRAVITY OF CRUSHED TILES**

Weight of pycnometer (W1) = 555 g

Weight of pycnometer + Crushed tiles(W2) = 1055 g

Weight of pycnometer + Crushed tiles + water (W3) = 1685 g

Weight of pycnometer + water (W4) = 1430 g

Weight of Oven dry sample (W5) = 500 g

$$\begin{aligned}\text{Specific Gravity} &= \frac{W5}{(W2-W1)-(W3-W4)} \\ &= \frac{500}{(1055-555)-(1685-1430)} \\ &= 2.04\end{aligned}$$

- **WATER ABSORPTION OF CRUSHED TILES**

Weight of surface dry crushed tile aggregate in air = 2000 g

Weight of crushed tile aggregate placed in water for 24 hours = 2002.9 g

Considering 2002.9 as 2003 grams

$$\text{Water absorption} = \frac{2003-2000}{2000} \times 100 = 0.15 \%$$

- **IMPACT VALUE OF CRUSHED TILE AGGREGATE**

Details	Trail No.1 (gms)	Trail No.2 (gms)	Average (gms)
Total weight of aggregate sample W1 (gms)	255	270	262
Weight of aggregate retained on 2.36 mm sieve after the test W2 (gms)	206	227	207
Weight of aggregate passing 2.36 mm sieve after the test W3 (gms)	49	67	55
Aggregate impact value percent fines $\frac{W3}{W1} \times 100$	19.2	16.23	20.99

The impact value of aggregate = 20.99 %

GLASS POWDER

Sheet glass powder (SGP) used in concrete making, leads to greener environment. Many sheet glass cuttings go to waste, which are not recycled at present and are usually delivered to landfills for disposal. Using SGP in concrete is an interesting possibility for economy on waste disposal sites and the conservation of natural resources. Natural sand was partially replaced by 10 % with SGP along with ceramic tiles.

TESTS ON GLASS POWDER

• SPECIFIC GRAVITY OF GLASS POWDER

Weight of pycnometer (W1) = 621g

Weight of pycnometer + Glass powder (W2) = 1130 g

Weight of pycnometer + Glass powder + water (W3) = 1705g

Weight of pycnometer + water (W4) = 1408 g

Weight of Oven dry sample (W5) = 500 g

$$\text{Specific gravity} = \frac{W5}{(W2-W1)-(W3-W4)}$$

$$= \frac{500}{(1130-621)-(1705-1408)} = 2.35$$

Procurement of materials

We have collected coarse aggregate, fine aggregate, cement, tiles from our local area. We crush the tiles for the use of replacement in coarse aggregates. We are collecting the glass powder from online (Amazon). We have placed an order of it.

Mix design

Design stipulations for proportioning:

- i) Grade designation : M 25
- ii) Type of cement : OPC of grade 53
- iii) Maximum nominal size of aggregates : 20mm
- iv) Maximum cement content : 394 kg/m³
- v) Water cement ratio : 0.50
- vi) Exposure condition : Moderate

- vii) Method of concrete placing : Placing and casting manually
- viii) Type of aggregate : Angular aggregates
- ix) Specific gravity of fine aggregate : 2.5
- x) Specific gravity of coarse aggregate : 2.74
- xi) Specific gravity of cement : 3.13
- xii) Fine aggregate (sand) : Confirming to zone II table 5 of IS 10262-2019

MIX DESIGN FOR M25 GRADE CONCRETE

1. Target Strength:

$$f'_{ck} = f_{ck} + 1.65 * S \quad (\text{or}) \quad f'_{ck} = f_{ck} + X$$

Assumed standard deviation S = 4.0 (IS 10262 – 2019 table 2)

X = 5.5 for M 25 (from IS 10262 – 2019 table 1)

$$f_{ck} = 25 \text{ N/mm}^2$$

$$f'_{ck} = 25 + (1.65 * 4) \\ = 31.6 \text{ N/mm}^2$$

$$f'_{ck} = 25 + 5.5 \\ = 30.5 \text{ N/mm}^2$$

Considering greater value of f'_{ck}

$$\text{Therefore, } f'_{ck} = 31.6 \text{ N/mm}^2$$

2. Selection of water-cement ratio

For OPC , adopting a water-cement ratio of 0.50

As per table 4 IS 10262 – 2019

Water content = 186 kg/m³ (for 50mm slump)

For 100mm slump, 3% for each 25mm increase after 50mm

$$\begin{aligned}\text{water content} &= \left(186 + \frac{6}{186}\right) \times 186 \\ &= 197 \text{ kg/m}^3\end{aligned}$$

Therefore, 197 liters of water for 1 m³

3. Calculation of cement content

$$\begin{aligned}\text{cement content} &= \frac{\text{water content}}{\text{water-cement ratio}} \\ &= \frac{197}{0.5} \\ &= 240 \text{ kg/m}^3\end{aligned}$$

for moderate condition 394 kg/m³ > 240 kg/m³

Therefore, considering the cement content of 394 kg/m³

4. Volume Proportions for fine aggregate and coarse aggregate

The volume of coarse aggregate corresponding to the unit volume of total aggregate for different zones of fine aggregate is given in the IS 10262-2019 table 5.

From table 5 IS 10262-2019, the volume of coarse aggregate corresponding to 20mm size aggregate and fine aggregate (zone 2) for the water cement ratio of 0.50 is 0.62

$$\begin{aligned}\text{Volume of fine aggregate} &= 1 - 0.62 \text{ m}^3 \\ &= 0.38 \text{ m}^3\end{aligned}$$

Volume of concrete = 1 m³

$$\text{Volume of cement} = \frac{\text{mass}}{\text{specific gravity}} \times \frac{1}{1000} = \frac{394}{3.13} \times \frac{1}{1000} = 0.125 \text{ m}^3$$

$$\text{Volume of water} = \frac{\text{mass}}{\text{specific gravity}} \times \frac{1}{1000} = \frac{197}{1.0} \times \frac{1}{1000} = 0.192 \text{ m}^3$$

$$\begin{aligned}\text{Volume of total aggregates} &= 1 - (0.125 + 0.01 + 0.192) \\ &= 0.673 \text{ m}^3\end{aligned}$$

5. Mass of Aggregates

Coarse aggregate = (Volume of coarse aggregate * volume of total aggregate * specific gravity * 1000)

$$\begin{aligned}&= (0.673 * 0.62 * 2.74 * 1000) \\ &= 1143.29\end{aligned}$$

Therefore, considering 1144 kg/m³ quantity of coarse aggregate

Fine aggregate = (Volume of fine aggregate * volume of total aggregate * specific

gravity*1000)

$$\begin{aligned}\text{Fine aggregate} &= (\text{Volume of fine aggregate}^{\text{*volume of total aggregate*specific gravity*1000}}) \\ &= (0.38*0.673*2.5*1000) \\ &= 636.5\end{aligned}$$

Therefore, considering 637 kg/m³ of fine aggregate

6.Final Mix proportions

C	:	FA	:	CA	:	WATER
394	:	637	:	1144	:	197
1	:	1.61	:	2.90	:	0.5

EXPERIMENTAL DETAILS

MIXING

CASTING OF SPCIMENS

CURING

TESTS ON MECHANICAL PROPERTIES OF CONCRETE

MIXING

CASTING OF SPCIMENS

CURING

TESTS ON MECHANICAL PROPERTIES OF
CONCRETE



MIXING

Mixing is done with the required quantity of cement, natural aggregate, and water present in concrete. Machine mixing is adopted throughout the experiment work. The mixing should be done in a process where firstly sand is added, then cement, then coarse aggregate, and finally water.

CASTING OF SPECIMENS

Concrete specimens are cast of cubes, cylinders, and beams,



where after casting they are kept aside for 24 hours. After which, they are demoulded and sent for curing.

Cubes of 100mm × 100mm × 100mm

Cylinders of 100 mm diameter and 200 mm height

Beams of 500mm × 100mm × 100mm were casted

CURING

Curing is the process of preventing the loss of moisture from concrete while maintaining a satisfactory temperature. The potential strength and durability of concrete will be fully developed only if the concrete is properly cured. After the period of casting the specimens are removed from the moulds and immediately submerged in clean, oil-free, and fresh water. The specimens are cured for 7 days, 14 days, and 28 days in the present work.



TESTS ON MECHANICAL PROPERTIES OF CONCRETE WORKABILITY

The property of fresh concrete is indicated by the amount of useful internal work required to fully compact the concrete without bleeding or segregation in the finished product. Workability is one of the physical parameters of concrete which affects the strength and durability as well as the cost of labour and the appearance of the finished product.

The workability is determined by the slump cone method.



Work Ability by slump cone Test Workability by slump cone method readings:

S.No	Aggregate Replacements % (TILES, GLASS POWDER)	Workability (mm)
1	0+0	62
2	10+10	64
3	20+10	70
4	30+10	73

COMPRESSIVE STRENGTH

Compressive strength is the capacity of a material or structure to withstand loads. It is a key value for the design of structures. After curing of specimens they are tested with a compression testing machine.



Broken specimen when the load is applied

**Compressive strength testing machine
showing cube subjected to loading**

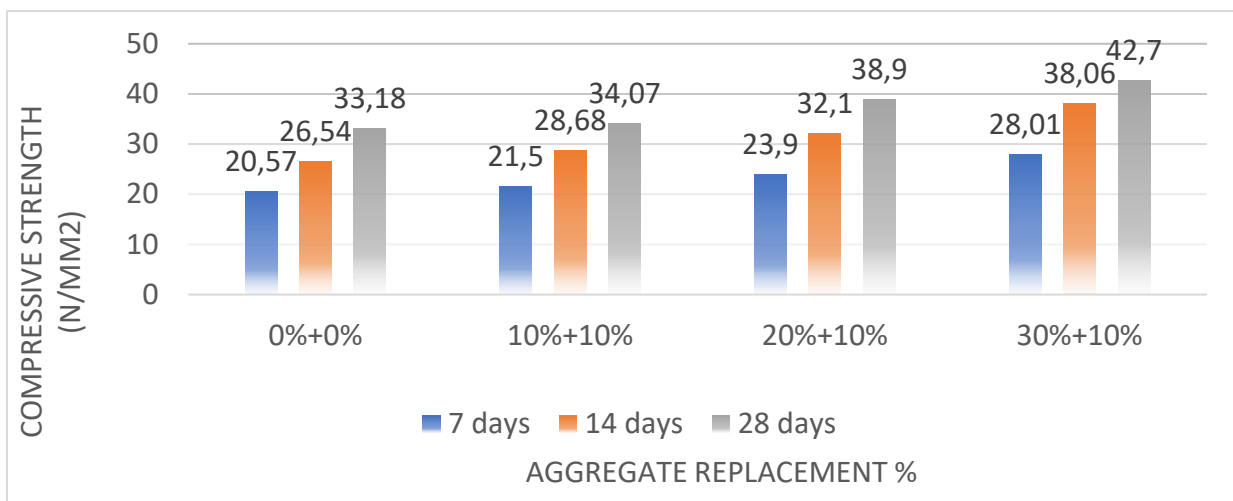
Compressive strength test results

The cubes of size 150 x 150 x 150mm were cast and tested for 7 days, 14 days and 28 days, after conducting the workability tests. The results are as follows:

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S.No	Aggregate Replacements % (Ceramic tile aggregate, Glass Powder)	Compressive strength in N/mm ²		
		7 days	14 days	28 days
1	0+0	20.57	26.54	33.18
2	10+10	21.50	28.68	34.07
3	20+10	23.9	32.10	38.90
4	30+10	28.01	38.06	42.70

GRAPH FOR COMPRESSIVE STRENGTH



SPLIT TENSILE STRENGTH

Tensile Strength is one of the basic and important properties of concrete. A knowledge of its value is required for the design of concrete structures. The tensile strength of concrete is determined using a cylinder.



Cylinder specimens after being subjected to loading



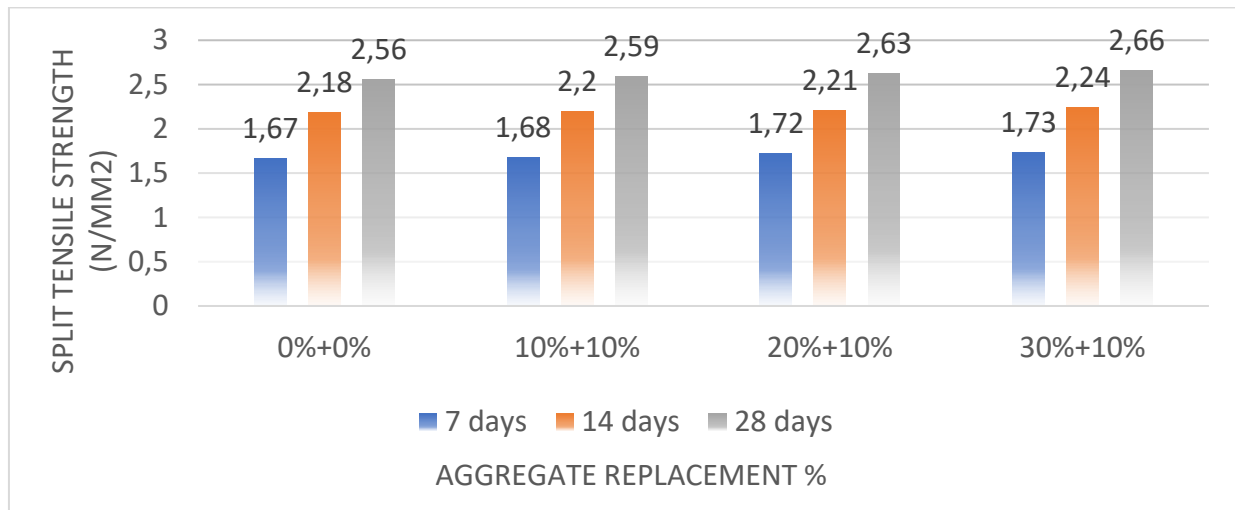
Compressive strength testing machine showing cylinder subjected to loading

Split tensile strength test results

The split tensile strength obtained by testing the cylindrical specimen for M25 grade of concrete to all the mixes for various replacements are as follows:

S.No	Aggregate Replacements % (Ceramic tile aggregate, Glass Powder)	Split tensile strength in N/mm ²		
		7 days	14 days	28 days
1	0+0	1.67	2.18	2.56
2	10+10	1.68	2.20	2.59
3	20+10	1.72	2.21	2.63
4	30+10	1.73	2.24	2.66

Graph FOR SPLIT TENSILE STRENGTH



FLEXURAL STRENGTH TEST

The flexural strength of the specimen is determined using a universal testing machine and the specimen used is of the beam shape.

Beam subjected to flexural testing under universal testing machine Universal testing machine

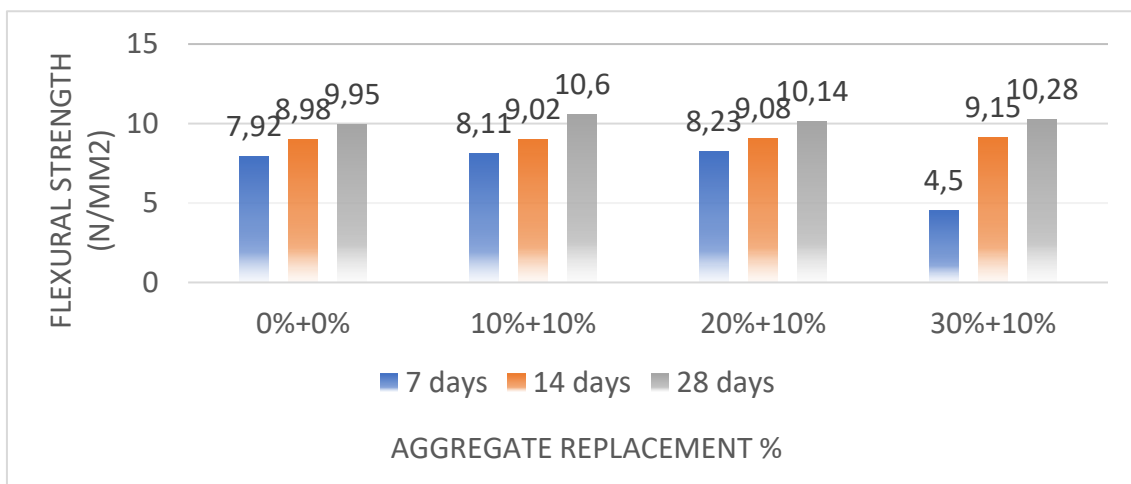
Flexural Strength test results

The flexural test was conducted for beam and the results obtained are as follows:

S.No	Aggregate Replacements % (Ceramic tile aggregate, Glass Powder)	Flexural Strength in N/mm ²		
		7 days	14 days	28 days
1	0+0	7.92	8.98	9.95
2	10+10	8.11	9.02	10.6
3	20+10	8.23	9.08	10.14
4	30+10	8.56	9.15	10.28



Graph For flexural strength



Report work

- Study of mechanical properties of concrete i.e compressive strength, split tensile strength, flexural strength.
- Comparing the results with a conventional mix.

BÜYÜKBAŞ VE KÜÇÜKBAŞ İŞLETMELERİNDE BİYOGÜVENLİK
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ÖZET

Biyogüvenlik, hastalık oluşturabilecek etmenlerin yetiştiricilik işletmelerine girişini ve yayılmasını önlemeye yönelik alınacak tedbirlerin tamamını içermektedir. Biyogüvenlik aksaklıkları işletmelerde hayvan kaybına ve ilerleyen dönemlerde ise verim kaybına sebebiyet vermektedir. Hayvan refahının sağlanması, verim kaybının önlenmesi ve tedavi masraflarının azaltılması özellikle biyogüvenlik uygulamalarının sağlanması ile mümkündür. Biyogüvenlik uygulamalarının eksik bir şekilde yapılması; işletmelerde yavru kayıplarının daha fazla yaşanmasına, mastitis ve topallık sorunlarının artmasına, üreme performansı ve süt üretiminin düşmesine sebebiyet verecektir. İşletmelerde revir ve karantina bölmelerinin bulunması, hayvanların dinlenme ve gezinti alanlarına ait zeminin kuru tutulması, yeterli havalandırmanın sağlanması, hayvanlara temiz yem ve su temini, işletmelerin yabancı hayvanların (fare, kuş, tavşan vb.) girişini engelleyecek şekilde planlanması, işletmelerin giriş ve çıkışlarında araçların dezenfektan uygulamasından geçmeleri, işletme girişlerinde kireç ve dezenfektanlı küvetlerin konulması, işletmeye dışarıdan alınacak hayvanların öncelikle karantina bölmelerinde tutulmaları, gübre temizliğinin düzenli yapılması, güvenlik kameraları ile işletme içerisinde ve dışarısında düzenli olarak gözlem yapılması ve hastalık kayıtlarının tutulması, aşı takvimine düzenli bir şekilde uyulması, parazit kontrollerinin ve ilaçlamaların düzenli bir şekilde yapılması gerekmektedir. Sonuç olarak, biyogüvenlik uygulamaları hem büyükbaş hem de küçükbaş işletmede hayvan sağlığı, insan sağlığı ve çevre koruma açısından son derece önemlidir. Bu nedenle mevzuata uygun bir şekilde işletme planlamalarının yapılması yanı sıra yetiştiricileri bilinçlendirecek eğitimlerin verilmesi hastalıkların yayılma riskini ve işletmelere hastalık getirilme olasılığını azaltacak ve bu da doğrudan işletmelerin hayvan refahını ve karlılığını arttıracaktır.

Anahtar Kelimeler: Biyogüvenlik, Hayvan refahı, Büyükbaş, Küçükbaş

IMPORTANCE OF BIOSAFETY PRACTICES IN CATTLE AND OVINE FARMS

ABSTRACT

Biosecurity includes all measures to be taken to prevent the entry and spread of disease-causing agents into bovine and ovine breeding enterprises. Biosecurity failures cause loss of animals in farms and loss of yield in the following periods. Ensuring animal welfare, preventing loss of productivity and reducing treatment costs are possible especially with the full implementation of biosecurity practices. Incomplete implementation of biosecurity practices will lead to more offspring losses, increased mastitis and lameness problems, decreased reproductive performance and milk production. Having infirmary and quarantine compartments in the enterprises, keeping the floor of the resting and walking areas of the animals dry, providing adequate ventilation, providing clean feed and water to the animals, planning the enterprises in a way to prevent the entry of wild animals (mice, birds, rabbits, etc.), disinfecting the vehicles at the entrance and exit of the enterprises, placing lime and disinfectant bathtubs at the entrances of the enterprises, keeping the animals that will be taken to the enterprise from outside in quarantine compartments, regular cleaning of manure, regular observation inside and outside the enterprise with security cameras and keeping disease records, regular compliance with the vaccination schedule, regular parasite controls and spraying. In conclusion, biosecurity practices are extremely important in terms of animal health, human health and environmental protection in both bovine and ovine enterprises. For this reason, in addition to making enterprise planning in accordance with the legislation, providing trainings to raise awareness of breeders will reduce the risk of spreading diseases and the possibility of bringing diseases to enterprises, which will directly increase animal welfare and profitability of enterprises.

Keywords: Biosecurity, Animal welfare, Cattle, Ovine

1.GİRİŞ

Büyükbaş ve küçükbaş hayvan yetiştiriciliğinde biyogüvenlik, işletme, bölge ya da ulusal düzeyde salgın hastalık etkenlerinin hayvan sürülerine geçişini engellemek amacıyla alınan bir dizi önlemleri kapsar. Biyogüvenlik terimi özellikle çiftlik hayvanlarının korunması ve güvenliği ile ilgilidir (Cullor, 2004). Bu nedenle biyogüvenlik, çiftlik yönetimi, günlük bakım, besleme, sağlık vb. rutin uygulamalar açısından önem taşımaktadır (Anderson, 2010). Kıt kaynaklar bilimi olarak da adlandırılan ekonomi biliminin son günlerde üzerinde durduğu en önemli konu verimlilik ve karlılıktır. Karlılığı artırabilmek için işletmelerde biyogüvenliği sağlamak ve hayvan refahı kurallarına uyarak sağlıklı hayvanlarla yetiştiricilik yapmak önem taşımaktadır (Yener ve ark., 2013).

Büyümeyi ve gelişmeyi düşünen süt sığırı işletmeleri, hastalıktan arı sürüleri oluşturmak ve yüksek verimin sürdürülebilir olmasını sağlamak için biyogüvenlik önlemlerine uymak zorundadırlar. Birçok bulaşıcı hastalık dışarıdan satın alınan hayvanlar ile sürüye girebilir, çiftliğe taşınması ile hayvanlar ve insanlarda olumsuz etkilere neden olabilir (Wallace, 2003). Tarım işletmelerinde biyogüvenliğin uygulanmasını uluslararası düzeyde araştıran birçok çalışma yapılmıştır. Bu çalışmaların büyük bir çoğunluğunda ortaya çıkan ortak görüş, biyogüvenlik konusunda bir farkındalığın olmasına rağmen, çiftlik düzeyinde biyogüvenlik önlemlerinin uygulanmasının genellikle zayıf olduğunu şeklindedir (Delabbio, 2006; Pol ve Ruegg, 2007; Brandt ve ark. 2008).

Yapılan çalışmalarda işletmelerde biyogüvenlik önlemlerinin alınmış olmasının çiftçiler için maliyet ve faydalarla ilişkili olduğu konusunda genel bir fikir birliği vardır (Jarvis ve Valdes-Donoso, 2018). Hayvan hastalıkları ciddi ekonomik kayıplara yol açarken, aşılama, kapalı sürüler, işletmelere alınan hayvanların test edilmeleri vb. biyogüvenlik önlemleri yoluyla hastalıkların önlenmesi ek maliyetler oluşturmakta ve dolayısıyla çiftlik karımı azaltabilmektedir. Ancak biyogüvenlik önlemlerini uygulamak ilk maliyetlerine rağmen, hastalıkların önlenmesi ile daha üretken ve daha yüksek kar elde edilebilecek sağlıklı sürülerin oluşmasına kolaylık sağlayabilir (Bennett, 2003; Stott ve ark., 2012; Belay ve Jensen, 2022).

Biyogüvenlik uygulamalarının çiftlikler üzerindeki faydalarından bazıları şunlardır: artan üretkenlik ve dolayısıyla daha fazla verimlilik ve karlılığa dönüşen hayvan sağlığı ve refahının iyileştirilmesi; güvenli, sağlıklı ve kaliteli et, süt ve türevleri üretmek; aşılar veya diğer yönetim stratejileri kullanılarak tedavi olmayan veya kontrolü zor olan hastalıkların ekonomik kayıplarını azaltmak; enfeksiyöz ajanların çiftlik veya çiftlik dışı yayılımını engellemek veya azaltmak; hastalık tedavi maliyetlerini azaltmak; ilaç kullanımını azaltmak;

tüketici ve alıcı güvenini artırmak; insan sağlığını korumak, hem hayvan hem insan hem de işletme açısından pozitif fayda sağlayacaktır (Clark ve ark., 2012; Shortall ve ark.,2016).

2. BİYOGÜVENLİK UYGULAMALARINDA TEKNOLOJİK GELİŞMELER

Biyogüvenlik, hayvancılık işletmelerinde üretimin sürdürülebilir olmasını sağlayan, bulaşıcı hastalıkların sürü içerisinde yayılımını önlemek amacıyla yapılan tüm önlemler olarak tanımlanabilir. Genellikle biyogüvenlik, iyi hijyen uygulamaları ve aşılama gibi etkili programlarla sağlanmaktadır. Son yıllarda teknolojinin hayatımıza girmesiyle biyosensör, nanoteknoloji gibi kavramların hastalıkların tanımlanmasını ve erken müdahale edilmesinde rol oynamaktadır (Laanen ve ark., 2014; Neethirajan ve ark., 2017). Enfeksiyöz ajanların girişini önlemeye yönelik herhangi bir yatırım, hayvanların, insanların ve çevrenin korunmasını ve hayvanların verimliliğini arttırmayı sağlayarak finansal açıdan fayda sağlayacaktır (Laurence ve ark., 2014).

Teknolojinin gelişmesiyle birlikte sabit sensör sistemleri, giyilebilir sensör, biyosensör, görüntü işleme gibi gelişmeler hayvan sağlığını sürekli/gerçek zamanlı olarak takip edilmesine olanak sağlamaya başlamıştır. Bu teknolojik ürünlerin hayvan hastalıklarının tespit edebilmesi sürü içerisindeki ekonomik ve refah açısından oluşabilecek sorunlara müdahale edilebilmesi, hayvanların bireysel takibinin sağlanması ve buna yönelik yapılacak tıbbi müdahalenin tüm sürü yerine ilgili hayvan üzerine odaklanması, ekonomik açıdan işletmeye pozitif fayda sağlayacaktır. Bu teknolojik gelişmeler hayvanlarda ter metabolitleri, vücut ısısı ölçme, stresi tespit etme, ses analizi, pH kontrolü, virüslerin ve patojenlerin varlığını tespit etme kapasitelerinin başarısı, gereksiz ilaç kullanımını düşürmesi, et ve süt gibi ürünlerin kalitesinin artırılması ve hayvanlarda refah üzerindeki sorunlarının önüne geçmesinde potansiyel taşımaktadır (Neethirajan, 2017).

3. İŞLETMELERDE BİYOGÜVENLİK YÖNETİMİ VE UYULMASI GEREKEN KURALLAR

Ülkemizde yapılan çalışmalarda biyogüvenlikle ilgili sorunların daha çok geleneksel yöntemlerin ve alışkanlıkların devam ettirilmesi, hayvanlara uygun çevre şartlarının sağlanılmamış olması, teknolojik gelişmelerin gerisinde kalınmış olması ve yetiştiricilerin biyogüvenlik konusunda yeterli bilgi ve pratiğe sahip olmadıklarına bağlı olarak ortaya çıktığını göstermiştir (Yener ve ark, 2013; Özdemir ve Özdemir, 2018; Yılmaz ve Koyuncu, 2022).

İşletmelerin biyolojik risk yönetim planına sahip olmaları ve bunu uygulamaları verimlilik açısından büyük önem taşımaktadır ve bu kapsamda uyulması gereken kurallar şu şekilde sıralanmaktadır (Hersom ve ark., 2017);

- a. Biyogüvenlik uygulamaları ile tehditlerin öncelikle belirlenmesi ve doğru yönetim uygulamalarının ne olduğunun bilinmesi gerekmektedir.
- b. Hastalık belirtileri (öksürük, kilo kaybı, burun ve göz akıntısı, nefes darlığı, abortus, ölü doğumlar, vb.) konusunda sürekli gözlem yapılmalı ve koruyucu hekimlik çerçevesinde planlı bir aşı takvimi oluşturulmalıdır.
- c. Çiftlik sınırları içinde yetkisiz araç ve personel trafiğini kontrol etmek için işletme içi ulaşım güzergahları belirlenmelidir. Gereksiz ziyaretçilerin işletmeye girişleri en aza indirilmeli, aksi taktirde farkında olmadan birçok hastalık etmeninin işletmeye girebilir. Kontrollü araç giriş ve çıkış noktaları belirlenmelidir. Giriş ve çıkış noktalarında araçlar dezenfekte uygulamasından geçmelidir.
- d. Sürüde görülebilecek yüksek düzeyde ölümler veya hastalık olguları rapor edilmeli ve takibe alınmalıdır. Kayıplar ve hastalıklar bilgisayar paket programları kullanarak kaydedilmeli ve bakanlığa bildirilmelidir.
- e. Dışarıdan getirilen hayvanlar sürüye katılmadan en az üç hafta karantinaya alınmalıdır. Hasta hayvanlar diğer hayvanlara bulaşı önlemek amacıyla ayrı bir bölmede tutulmalıdır. İşletmeye alınacak hayvanlar, hastalık yönünden kontrol edilmeli ve sağlıklı hayvanlar seçilmiş olmalıdır. Çiftlikler farklı işletmelerden uzak ve karantina bölmeleri de yine sağlıklı hayvanların bulunduğu bölmelerden uzak yerlere inşa edilmeli.
- f. Rasyon içeriklerini doğrulama ve yasaklanmış hammaddelerin işletmeye girişini önlemek için yem kalite ve içeriği hakkında yem tedarikçilerinden bilgi alınmalıdır. İşletmeye getirilen yemler nemli ve havasız ortamlarda bulundurulmamalıdır. Yem deposu, yem silosu gibi yerler tamamen dış ortamlara kapalı olmalı, evcil hayvan, tavşan fare, yılan ve kuşların girişleri engellenmelidir. Ayrıca böcek popülasyonlarının hayvanlara ve yem kaynaklarına hastalık bulaştırmaları engellenmelidir. Hayvana temin edilecek suyun temiz ve kaliteli olmasına dikkat edilmeli, suluk ve yemliklerin düzenli olarak temizlenmesi ve dezenfekte edilmesi gerekmektedir.
- g. Çiftliklerin içerisinde ve dışarısında tehdit oluşturabilecek canlıların hayvanlara zarar vermemesi, hastalık getirmemesi ve aynı zamanda beklenmedik araçların girişlerini engellemek amacıyla güvenlik kameraları ile düzenli olarak gözlem yapılmalıdır.

- h. İşletme personelleri ve dışarıdan gelecek misafirler için işletme girişlerinde ayakkabı ve çizme dezenfeksiyonu için kireç, dezenfektanlı sünger kabı ve küvet kullanılmamalıdır. İşletme personelleri hastalık bulaşma riskini arttıracak uygulamalarda (doğum, sağım vb.) tek kullanımlık giysiler giymeli, kişisel temizliklerine dikkat etmelidirler. İşletme personellerine ait giyinme odası bulunmalıdır. Barınak ve ünite girişlerine mutlaka duş ve kıyafet değişim odaları yapılmalı, günlük kıyafetler burada bırakıldıktan sonra hayvana müdahale edilmelidir.
- i. İşletme içerisinde uygun teknikler kullanılarak gübre temizliği gerçekleştirilmeli, özellikle büyükbaş işletmelerinde otomatik gübre sıyırıcı sistemler kullanılmalıdır. İşletme etrafındaki atıklar kontrollü bir şekilde uzaklaştırılmalı ve biriktirilmemelidir.

4. SONUÇ VE ÖNERİLER

Türkiye’de biyogüvenlik uygulamalarının aksaklığından kaynaklı birçok kuzu ve buzağı ölümü gerçekleşmekte, işletmelerde şap, mastitis, çiçek, brusella, kuduz, veba gibi bulaşıcı hastalıklar çok sık görülmektedir. Günümüzde özellikle bulaşıcı hayvan hastalıklarının sık sık görülmeye başladığı ve bu hastalıklarında hem hayvan sayısında hem de kırmızı et üretiminde azalmalara yol açtığı bilinmektedir. Aynı zamanda yetiştiriciler ve aileleri zoonoz hastalıklarla karşı karşıya gelmektedir. Bu aksaklıklar ilerleyen dönemlerde işletmelerde hayvan kaybına, verim kaybına, işletme de veteriner hekim ve ilaç masraflarının artmasına ve sürü yenileme maliyetlerinin artmasına sebebiyet vermektedir. Biyogüvenlik uygulamalarının büyükbaş ve küçükbaş işletmelerinde tam olarak uygulanmamasının sonucu olarak da ülke hayvancılığında ciddi ekonomik kayıplar söz konusu olmaktadır.

Büyükbaş ve küçükbaş işletmelerinde biyogüvenlik uygulamaları arttırılmalı ve titizlikle uygulanmalı, işletmeler kurulurken mevzuata uygun ve biyogüvenlik önlemleri dikkate alınacak bir şekilde planlanmalı, yetiştiricileri biyogüvenlik konusunda bilinçlendirecek uygulamalı eğitimler verilmeli, Tarım ve Orman Bakanlığı’na büyükbaş ve küçükbaş işletmelerine yapılacak denetimler arttırılmalı, yetiştiricilerle, Zooteknist ve Veteriner Hekimler arasındaki iş birlikleri arttırılmalı, yetiştiricilere biyogüvenlik uygulamalarının sağlanması koşulu ile desteklemeler verilmeli, hayvan satış bölgelerindeki denetim ve kontrol arttırılmalı, sınır bölgelerdeki kaçak hayvanların girişleri engellenmeli, çiftlik hayvanlarında biyogüvenlik mevzuatları ve yönergeleri genişletilerek arttırılmalıdır.

5. KAYNAKÇA

- Anderson, D.E. 2010. Survey of biosecurity practices utilized by veterinarians working with farm animal species. *Online J. Rural Res. Policy* 5 (7) :1- 13.
- Belay, D. G., & Jensen, J. D. (2022). Quantitative input restriction and farmers' economic performance: Evidence from Denmark's yellow card initiative on antibiotics. *Journal of Agricultural Economics*, 73(1), 155-171.
- Bennett, R. 2003. The 'direct costs' of livestock disease: the development of a system of models for the analysis of 30 endemic livestock diseases in Great Britain. *Journal of Agricultural Economics*, 54(1), 55-71.
- Brandt, A. W., Sanderson, M. W., DeGroot, B. D., Thomson, D. U., Hollis, L. C. 2008. Biocontainment, biosecurity, and security practices in beef feedyards. *Journal of the American Veterinary Medical Association*, 232(2), 262-269.
- Clark, S., Daly, R., Jordan, E., Lee, J., Mathew, A., & Ebner, P. 2012. Extension education symposium: the future of biosecurity and antimicrobial use in livestock production in the United States and the role of extension. *Journal of animal science*, 90(8), 2861-2872.
- Cullor, J.S. 2004. Applied Biosecurity for Dairy Farms. Proceedings of the WBC Congress Quebec Canada 2004 Veterinary Medicine Teaching and Research Center University of California. Available at: <http://www.ivis.org>.
- Delabbio, J. 2006. How farm workers learn to use and practice biosecurity. *Journal of extension*, 44(6), 6FEA1.
- Hersom, M., Irsik, M., Thrift, T. 2017. Biosecurity and Biological Risk Management for Livestock Enterprises. UF/IFAS Biosecurity and Biological Risk Management for Livestock Enterprises Handbook.
- Jarvis, L. S., Valdes-Donoso, P. 2018. A selective review of the economic analysis of animal health management. *Journal of agricultural economics*, 69(1), 201-225.
- Laanen, M., Maes, D., Hendriksen, C., Gelaude, P., De Vliegher, S., Rosseel, Y., & Dewulf, J. 2014. Pig, cattle and poultry farmers with a known interest in research have comparable perspectives on disease prevention and on-farm biosecurity. *Preventive Veterinary Medicine*, 115(1-2), 1-9.
- Laurence, M., Cottle, D., Kahn, L. 2014. 13 Biosecurity and beef cattle health, husbandry and welfare. *Beef Cattle Production and Trade*, 251.
- Neethirajan, S. 2017. Recent advances in wearable sensors for animal health management. *Sensing and Bio-Sensing Research*, 12, 15-29.

- Özdemir, G., Özdemir, A. 2018. Bingöl İli Manda İşletmelerinde Bazı Yetiştiricilik Uygulamalarının Biyogüvenlik Kuralları Açısından Değerlendirilmesi. *Manas Journal of Agriculture Veterinary and Life Sciences*, 8(1), 1-8.
- Pol, M., Ruegg, P.L. 2007. Treatment practices and quantification of antimicrobial drug usage in conventional and organic dairy farms in Wisconsin. *Journal of dairy science*, 90(1), 249-261.
- Shortall, O., Ruston, A., Green, M., Brennan, M., Wapenaar, W., & Kaler, J. 2016. Broken biosecurity? Veterinarians' framing of biosecurity on dairy farms in England. *Preventive Veterinary Medicine*, 132, 20-31.
- Stott, A. W., Humphry, R. W., Gunn, G. J., Higgins, I., Hennessy, T., O'Flaherty, J., Graham, D. A. 2012. Predicted costs and benefits of eradicating BVDV from Ireland. *Irish veterinary journal*, 65(1), 1-11.
- Yener, H., Atalar, B., Mundan, D. 2013. Şanlıurfa İlindeki sığırcılık işletmelerinin biyogüvenlik ve hayvan refahı açısından değerlendirilmesi. *Harran Üniversitesi Veteriner Fakültesi Dergisi*, 2(2), 87-93.
- Yılmaz, Ş., Koyuncu, M. 2022. Evaluation on Biosecurity Practices of Dairy Farms in Bursa Province-I. *Bursa Uludağ Üniversitesi Ziraat Fakültesi Dergisi*, 36(2), 317-336.
- Wallace, R.L. 2003. Practical and sensible dairy farm biosecurity. Proceedings of the 6th Western Dairy Management Conference _March 12- 14 2003_ Reno NV- 202.

**BÜYÜKBAŞ İŞLETMELERİNDE HAYVAN REFAHINA BAĞLI BUZAĞI
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ÖZET

Ülkemizde her yıl çok sayıda buzağı ölümleri gerçekleşmektedir. Ölen her buzağı hem çiftlikler hem de ülke ekonomisini açısından büyük önem arz etmektedir. Buzağı ölümlerinin artması, süt endüstrisi ve süt hayvancılığının geleceğini tehdit etmektedir. Ülkemiz süt endüstrisi ve süt hayvancılığının geleceği açısından buzağı ölümleri büyük önem arz etmektedir. Fakat son yıllarda ne yazık ki ülkemizde binlerce buzağı farklı nedenlerden dolayı yaşamlarını yitirmektedir. Bu kayıpların önlenmesi için öncelikle ölümleri oluşturan şartların belirlenip, bu şartlara karşı önlem almak gerekmektedir. Özellikle ülkemizde görülen buzağı kayıplarının başında sürü yönetiminin yanlış uygulanması, doğum öncesi kayıplar, gerekli hijyen kurallarına uyulmaması sonucu oluşan kayıplar, buzağı beslenmesinde uygulanan yanlışlıklardan kaynaklanan kayıplar şeklinde sıralayabiliriz. Bu derleme ile buzağı kayıplarını oluşturan sebepleri tespit ederek, bunlara karşı alınacak önlemleri belirlemektir.

CALF LOSSES RELATED TO ANIMAL WELFARE IN CATTLE FARM

ABSTRACT

Many calf deaths occur every year in our country. Each calf that dies is of great importance for both farms and the national economy. The increase in calf deaths threatens the future of the dairy industry and dairy farming. Calf deaths are of great importance for the future of our country's dairy industry and dairy farming. However, unfortunately, in recent years, thousands of calves in our country have lost their lives due to different reasons. In order to prevent these losses, it is necessary to determine the conditions that cause deaths and take measures against these conditions. The main causes of calf losses, especially in our country, can be listed as misapplication of herd management, pre-natal losses, losses caused by non-compliance with the necessary hygiene rules, losses caused by inaccuracies in calf feeding. The aim of this review is to determine the causes of calf losses and to determine the measures to be taken against them.

GİRİŞ

Hayvan refahı, hayvanların verim kabiliyetlerini tam olarak kullanabildiği ve doğal ihtiyaçlarını karşılayarak doğal yaşantısı için gereken sağlık standartlarında yaşadığı, aynı zamanda sosyal ilişkilerini devam ettirmelerini sağlayan organize edilmiş bir sistem olarak tanımlanmakta olup, hayvanların açlık ve susuzluk gibi temel ihtiyaçlarından mahrum kalmadığı, önlerinde sürekli olarak kolaylıkla ulaşabilecekleri taze yem ve su bulundurulmuş, hayvanlara uygun barınak ve çevre koşulları sağlandığı ve onların korku ve stresten uzak bir ortamda yetiştirilmelerinin sağlanmasıdır. Hayvan refahı birçok araştırmacı tarafından farklı tanımlanmış olup bazı araştırmacılar hayvan refahını, hayvanın fiziksel ve duygusal bakımdan iyi olma durumu şeklinde tanımlanırken, bazıları da sadece hayvanın bulunduğu fiziksel koşulları değil aynı zamanda duygularını da kapsamaktadır şeklinde tanımlanmaktadır (Duncan, 2002; Ünal, 2010).

Tüm hayvancılık işletmelerinde unutulmaması gereken en önemli konu refah ve verim ilişkisidir. Bu yüzden hayvancılığın başarılı bir şekilde yapılmasının temeli ancak bu ilişkinin korunması ve uygulanması ile gerçekleştirilebilir. Özellikle de büyükbaş işletmelerindeki buzağı kayıplarının önlenmesi her şeyden önce bu kurallara uymaya bağlıdır (Göncü, 2019) Buzağı hastalıklarının neden olduğu kayıplar; tedavi masrafları ve performans üzerindeki uzun dönem etkileri nedeniyle sığırcılık işletmelerinin ekonomisi açısından büyük bir etkiye sahiptir. Dünyada buzağı kayıpları %8.7 – 67 arasında değişiklik gösterirken hayvancılığı ileri ülkelerde bu oran %2-3 ülkemizde ise buzağı kayıp oranları farklı bölge ve işletmelere göre değişmekte olup bu oranın % 10 - 15 arasında olduğu bilinmektedir. TÜİK 2020 yılında rakamlarına göre ülkemizde yaklaşık 921 bin buzağının öldüğü bildirilmektedir (Karlı ve Evcı, 2018; Yurdakul ve ark.,2021).

Buzağı kayıpları doğum öncesi, doğum anında ve sonrası kayıplar olarak ele alınırken, bu kayıpların en aza indirilmesinde; sürü idaresi en önemli yeri tutmaktadır. Yeni doğan buzağının içinde bulunduğu çevrenin hijyeni, ısı, nemi, ayrı bir yerde tutulması ve özellikle altıklarının temiz ve bakımlı olması, yeterli ve kaliteli ağız sütüyle beslenmesi hayvanın bağışıklık sistemi ve hastalıklara karşı korunmasında etkili faktör olarak bilinmektedir (Hoffmann ve ark. 2012).

BUZAĞI KAYIPLARININ NEDEN OLDUĞU EKONOMİK ZARARLAR

Buzağı kayıpları işletmeye olumsuz yönde etkilerde bulunmaktadır, bu durum toplam süt veriminde azalmalara, veteriner hekim ve tedavi masrafları ve ikame düve yetiştirme masraflarını artırması gibi sonuçlar doğurmaktadır. Buzağı ölümleri, işletmeleri önemli bir gelir kaleminden mahrum bıraktığı gibi sürü büyüklüğünün korunması için dışarıdan zorunlu damızlık adayı genç hayvanların satın alınmasına neden olabilmektedir. Nitekim yapılan araştırmalarda süt sığırcılığında buzağılardan elde edilen gelirin, toplam gelirin yaklaşık %40'ına tekabül ettiği ifade edilmiştir (Aydoğdu, 2017). Buzağılarda görülen doğum sonrası ölümleri sadece yetiştiriciler için bir ekonomik kayıp oluşturmaz, aynı zamanda sürü yenileme oranını olumsuz etkilediği gibi (Wathes ve ark., 2008; Zucali ve ark., 2013) hayvan sağlığı ve refahı ile ilgili sorunların da ortaya çıkmasına neden olur.

Türkiye'de yıllık 6.000.000 buzağı doğduğu ve buzağı ölümlerine bağlı kaybın en az %10-15 olduğu düşünülürse (600.000-900.000), bir buzağının ortalama 3500 TL olduğu kabul edildiğinde, Türkiye için yıllık ekonomik kayıp yaklaşık 3.15 milyar TL / 525 Milyon Euro civarında olmaktadır (Şahal ve ark., 2018).

BUZAĞI KAYIPLARININ SINIFLANDIRILMASI

Sığırlarda buzağı kayıplarını doğum öncesi, doğum sırasında ve doğum sonrası kayıplar olarak üç başlık altında sınıflandırabiliriz. Bu durum ilk önce ineğin tohumlanması ile başlayan süreç, daha sonra doğumla devam eden süreç ve doğumdan sonra yaklaşık 6 ay sonrasına kadar süren süreç olarak tanımlana bilinir. Kayıplara bu açıdan bakıldığında nasıl bir sorunla karşı karşıya olduğumuz daha iyi anlaya biliriz. Bunlar;

- a- Doğum öncesi kayıplar
- b- Doğum anındaki kayıplar
- c- Doğum sonrası kayıplar

DOĞUM ÖNCESİ KAYIPLARI VE ÇÖZÜMLERİ

İneklerde dölleme ile başlayan gebelik, ortalama 280 günlük bir süreç sonunda tamamlanmakla birlikte gebelik sürecinde önemli kayıplar meydana gelmekte ve her gebelik doğumla sonuçlanmamaktadır. Dölleme-doğum arasındaki bu kayıplar; erken/geç dönemdeki embriyo kayıpları ve atıklardan dolayı meydana gelmektedir. Erken dönem embriyonik kayıplar gebeliğin ilk 24 gününe kadar, geç dönem embriyonik kayıplar ise gebeliğin 24-42. günleri arasında meydana gelen kayıplardır. Gebeliğin 42-280 günleri arasında meydana gelen

kayıplar ise yavru atıkları olarak bilinmektedir. Bu yüzden sağlıklı bir buzağı, tohumlama sonrası döllemenin gerçekleşmesi, dölleme sonrası embriyo kayıplarının ve yavru atıklarının olmamasıyla ve sorunsuz bir doğumla sağlanabilir (Erdem, 2020).

Doğumdan önceki dönemde abort (atık) olmasının sebepleri net bir şekilde doğru tespiti yapılmalı ve atığa neden olan sorunun çözülmesi sağlanmalıdır. Sürüde yapılacak olan koruyucu hekimlik sayesinde hem sorunların daha kolay bir şekilde çözülmesini sağlanacak hem de daha ekonomik olacaktır. (Roberts, 1971).

DOĞUM ANINDAKİ KAYIPLARI VE ÇÖZÜMLERİ

Doğum anında yapılacak olan müdahalenin erken veya geç olması doğum anındaki buzağı kayıpları üzerine önemli derecede etkisi söz konusudur. Buzağının doğum kanalında uzun süre kalması sonucunda oksijen yetmezliği sonucu ölümler oluşabilir. Doğumun başlaması yani yavru suyunun akması ve buzağının normal doğuş pozisyonunda yani ayak uçlarının görünmesinden sonra bir saat içerisinde buzağının dışarıya alınması gerekmektedir. İneklerde gebelik süresi 275-289 arasında olup ortalama 283 gündür. Verilen bu sınırların altında ve üstündeki gebelik süreleri risk oluşturmaktadır. Çiftleşmede kullanılan veya suni tohumlama da kullanılan boğa spermalarının da ölü doğan buzağılarla ilgisi olduğu bilinmektedir (Öcal ve Kalkan, 2012).

İneklerin, özellikle ineklerin refahına özen gösterilmelidir. Barınak içi ve dış ortamlarda yazın oluşabilecek olan sıcaklık stresine karşı önlemler alınmalı, fan ve duş sistemleri ile strese karşı yem katkı maddeleri kullanılmalıdır. Ayrıca İz-minerallerin hayvanların kolaylıkla ulaşabilecekleri yerlerde olmasına dikkat edilmelidir. Sıcaklık stresinin hayvanların hormonal dengesini bozabileceğini, hormon salgılanması ve vücut direncini baskılayacağını unutulmamalıdır. Doğuma yaklaştığı günlerde nakil yapılmaması, hayvanları stres sokacak davranışlardan kaçınılması gerekmektedir. Ölü doğan buzağıkların oranı artış göstermiş ise sorunu tespit edip hemen çözümünün belirlenmesi özellikle de enfeksiyon yönünden sorun olup olmadığını araştırılması gerekmektedir (Alaçam, 1997).

DOĞUM SONRASI KAYIPLARI VE ÇÖZÜMLERİ

Doğum sonrasındaki buzağı kayıplarının sebeplerinin başında yetiştiricilerin yanlış sürü yönetimi uygulamaları yapmalarından kaynaklandığı bir gerçektir. Bu kayıpların önlenmesi öncelikle bilinçli yetiştiricilerin sayılarının artırılması ve ancak işletmelerin küçük işletme yapılarından, entegre işletmelere dönüşümü ile sağlanabilir. Yetiştiriciler için buzağı

kayıpları sorunları da beraberinde getirmekte olup işletmelerdeki boş günlerin sayısı artmasının yanı sıra süt veriminin azalmasına da neden olarak işletmenin ekonomik olarak da gelirlerinin düşmesine sebep olmaktadır (Zucali ve ark. 2013). Buzağı ölümlerinin minimum seviyelere düşürmek, buzağı bakım ve kontrollerinin eksiksiz yapılması ile sağlana bilinir. Barınakların hijyen koşullarının sağlanması ve ısı, nem, havalandırma koşullarının sağlanarak onların strese neden olan faktörlerin dikkate alınır bir şekilde planlanması, buzağılar için optimum koşulların sağlanması gerekmektedir. Doğum ve buzağı bölmelerindeki altlıkların temiz olmasını sağlamak, buzağı bölmelerinde ve buzağılara paraziter mücadelenin yapılması, doğumdan hemen sonra buzağının ısı kaybını engelleyecek ortamın sağlanamaması, doğum sonrasında buzağının solunum yolu kontrol edilmeli ve yüzüne bulaşmış sıvıların temizlenmesinin yapılması, göbek kordonu bakımının yapılması, buzağılara doğumdan hemen sonra yeterli miktarda kolostrum almasını sağlamak, buzağıyı erken sürede anadan ayırmamak, buzağının özellikle üç aylık dönemde proteince zengin gıdalarla beslenmesinin sağlanması, yetiştiricilere bakım ve besleme konusunda eğitimler verilmesi, özellikle de buzağı bakım kulüpleri kurmaya teşvik edilmesi sağlanmalıdır. İşletmelerde biyogüvenlik önlemlerinin yetersiz olması, buzağılar için aşı takviminin bulunmaması ve takvime uyulmaması, sağlık kontrollerinin düzenli olarak yapılmaması gibi kriterler buzağı kayıplarının doğum sonrası oluşumunun nedenleri olarak sayıla bilinir (Kaygısız ve ark. 2023).

SONUÇ VE ÖNERİLER

Ülkemizde büyükbaş hayvan yetiştiriciliğinin en önemli gelir kaynaklarından biride buzağı yetiştiriciliğidir. Sürü yönetiminin ve işletme biyogüvenlik önlemlerinin işletmelerde tam olarak uygulanmamasının sonucu olarak her yıl binlerce buzağı kaybedilmektedir. Bu da ülke hayvancılığına ve milli ekonomiye ciddi zararlar vermektedir. Buzağı kaybı ekonomik zararın yanı sıra işletmelerde sürüye yeni bir hayvan dahil edilmesi ihtiyacını doğuracak bu da işletmeler için hem maliyet hem de birtakım riskler ortaya çıkacaktır. Yeni bir hayvanın sürüye dahil olması diğer hayvanların sağlığını da tetikleyecektir. Yetiştiricilerin buzağı yetiştirme konusunda ki eksiklikleri temel sorunların başında gelmektedir.

Kayıpların önüne geçilebilmesi için işletmelerde buzağılara ait bölmelerin şartlarının iyileştirilmesi, Buzağı bakım ve beslemenin doğru bir şekilde yapılması, Yetiştiricilere, buzağı bakım ve besleme ile ilgili eğitimlerin verilmesi İşletmelerde düzenli ve zorunlu sağlık kontrollerinin gerçekleştirilmesi Özellikle yurtdışında araştırmacılar tarafından gerçekleştirilen APGAR ve VİGOR skorumla ile buzağının doğum sonrası canlılıklarının tespitinin

gerçekleştirilmesi, erken süttten kesim konusunda yetiştiricinin bilinçlendirilmesi, yeterli miktarda kolostrumun yavruya verilmesinin sağlanması, doğum sonrası buzağular temiz ve dezenfekte edilmiş bir ortama alınmalı, doğum sonrasında buzağının solunum yolu kontrol edilmeli ve yüzüne bulaşmış sıvıların temizlenmesi, buzağı başlangıç yeminin en uygun sürede buzağıya verilmesi sağlanarak işkembe gelişimi kolaylaştırılmalıdır. İşletmelere nitelikli eleman yetiştirilmelidir.

KAYNAKLAR

- Alaçam E (1997). Evcil Hayvanlarda Doğum ve İnfertilite, Medisan Yayınları, Ankara.
- Duncan, I.J.H., 2002. Poultry welfare: science or subjectivity. Br Poult Sci, 43, 643-652.
- Aydoğdu M (2017). Probiyotik Kullanmanın Süt Emen Simental Buzağılarda Performans ve Sağlığı Üzerine Etkileri. Kırıkkale Üniversitesi, Hayvan Besleme ve Beslenme Hastalıkları Anabilim Dalı Yüksek Lisans Tezi, Kırıkkale.
- Erdem, H. (2020). Buzağı kayıplarının önlenmesinde buzağı sağlığı ve yetiştiriciliği. T.C. Sanayi ve Teknoloji Bakanlığı Konya Ovası Projesi Bölge Kalkınma İdaresi Başkanlığı. Sayfa 3.
- Göncü,S., 2019. Buzağı Büyütme Metodları, Çukurova Üniversitesi Ziraat Fakültesi, Zootekni Bölümü, <http://traglor.cu.edu.tr/objects/objectFile/As1FxITm-222013-45.pdf>
- Hoffmann B, Scheuch M, Höper D, Jungblut R, Holsteg M, Schirrmeier H, Eschbaumer M, Goller KV, Wernike K, Fischer M, Breithaupt A, Mettenleiter TC, Beer M (2012). Novel orthobunyavirüs in Cattle, Europe, 2011. Emerging Infectious Diseases, 18(3):469-72.
- Karslı, M.A., Evcı, Ş. 2018. Buzağı Kayıplarının Önlenmesinde İnek ve Buzağı Beslenmesinin Önemi. Lalahan Hay. Araş. Enst. Dergisi 2018, 58 (Özet sayı), 23-34.
- Kaygısız, A., Aydın, R., & Özdemir, C. Y. (2023). Gümüşhane İli Torul İlçesi Süt Sığırcılığı İşletmelerinde Buzağı Yetiştirme İle İlgili Yönetimsel Uygulamalar. Journal of the Institute of Science and Technology, 13(1), 713-725.
- Öcal. H, Kalkan C. 2012. Puerperal dönem fizyolojisi. Semacan A, Kaymaz M, Fındık M, Rişvanlı A, Köker A, editörler. Çiftlik Hayvanlarında Doğum ve Jinekoloji. 1. Baskı. Malatya: Medipres Matbacılık Yayıncılık Ltd. Şti; 2012. p.313-43.
- Roberts SJ. 1971. Veterinary Obstetrics and Genital Diseases. Edwards Brothers, Inc., Ann Arbor, Michigan, 1971.
- Ünal N. 2010. Yetiştiricilikte hayvan refahının ölçülmesi. III. Ulusal Veteriner Zootekni Kongresi, Afyon, s. 100.
- Şahal, M., Terzi, O. S., Ceylan, E. ve Kara, E. (2018). Buzağı ishalleri ve korunma yöntemleri. Lalahan Hayvancılık Araştırma Enstitüsü Dergisi, 58, 41-49.

- Yurdakul, İ. B. R. A. H. İ. M., Kulualp, K., & YALÇIN, M. (2021). Buzağılarda Tespit Edilen Cerrahi Hastalıkların Değerlendirilmesi: 350 Olgulu Retrospektif Bir Çalışma. *Turkish Veterinary Journal*, 3(1), 21-25.
- Zucali, M., Bava, L., Tamburini, A., Guerci, M. & Sandrucci, A. (2013). Management risk factors for calf mortality in intensive Italian dairy farms. *Italian Journal of Animal Science*, 12(2), 162-166.
- Wathes, D. C., Brickell, J. S., Bourne, N. E., Swali, A. & Chen, Z. (2008). Factors influencing heifer survival and fertility on commercial dairy farms. *Animal*, 2, 1135-1143.

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ÖZET

Bu derleme, buzağı ve düveler üzerine ısı stresinin etkisi ve etkiyi azaltmak için çeşitli yöntemler önermek amacıyla yapılmıştır. Süt sığırcılığı işletmelerinde göz ardı edilse de sürünün geleceği için en önemli bireyler buzağı ve düvelerdir. Dişi hayvanlar doğuruncaya kadar işletmeler için ek gider unsurları olarak görülmektedir. Ancak sürü yenilemede kullanılacak olmaları bu yaş grubu hayvanların önemini daha da artırmaktadır. Bunun farkında olan işletmeler genç hayvanların bakım beslenmesine önem vermeleri yanında son yıllarda değişen iklim koşulları içerisinde sıcak mevsimlerde maruz kaldıkları ısı stresinin etkilerine karşı da hayvanları korumak için çaba harcamaktadırlar. Isı stresi, buzağı ve düvelerin sağlığını ve üretkenliğini etkileyebilen bir durumdur. Hayvanlar yüksek sıcaklıklara ve neme maruz kaldıklarında, vücut sıcaklıklarını düzenleme yetenekleri tehlikeye girerek çeşitli olumsuz etkilere yol açabilir. Buzağılar ve düveler, daha yüksek metabolik hıza sahip oldukları ve ineklere göre daha fazla ısı ürettikleri için ısı stresine karşı özellikle hassastırlar. Bunun yanı sıra, daha düşük bir vücut kütlelerine ve daha küçük bir yüzey alanına sahiptirler, bu da ısıyı dağıtmalarını zorlaştırır. Buzağılarda ve düvelerde ısı stresinin bazı semptomları arasında artan solunum, nefes nefese kalma, terleme ve artan su alımı yer alır. Şiddetli vakalarda, hayvanlar dehidrasyon, azalan yem alımı ve gelişme geriliği yaşayabilir. Isı stresi ayrıca bağışıklık sistemini tehlikeye atarak hayvanları hastalığa karşı daha duyarlı hale getirebilir. Isı stresi nedeniyle azalan hormonlar normal östrus siklusunu bozar, folikül gelişimini baskılar, dolayısıyla gebe kalma oranında düşüş olur. Ayrıca ısı stresi hipoksi ve yetersiz beslenme ile sonuçlanan bozulmuş plasenta tarafından embriyonik gelişimi baskılamakla kalmamakta, aynı zamanda yeni doğan buzağuların büyümesini, bağışıklığını ve gelecekteki süt üretimini de geciktirebilmektedir. Buzağı ve düvelerde ısı stresinin önlenmesi, sağlık ve verimliliklerinin korunması açısından önemlidir. Isı stresini önlemek amacıyla gölge alanlar sağlamak, temiz suya erişimi kolaylaştırmak ve günün en sıcak saatlerinde beslenmekten kaçınmak için beslenme programlarını ayarlamak alınabilecek tedbirler arasındadır. Ek olarak, fanlar veya sprinkler sağlamak, hayvanları soğutmaya ve ısı stresinin etkilerini azaltmaya yardımcı olabilir. Genel olarak, hayvan üreticilerinin buzağılarda ve düvelerde ısı stresi risklerinin farkında olmaları ve bu durumun oluşmasını önlemek için proaktif adımlar atmaları önemlidir.

Anahtar Kelimeler: Isı stresi, Buzağı, Düve, Üreme

HEAT STRESS ON CALVES AND HEIFERS IN FARM OF CATTLE

ABSTRACT

This review was made to suggest various methods to reduce the effect of heat stress on calves and heifers. Although it is ignored in dairy cattle farms, the most important individuals for the future of the herd are calves and heifers. It is seen as an additional cost element for businesses until the female animals give birth. However, the fact that they will be used in herd renewal increases the importance of animals in this age group. Aware of this, businesses not only attach importance to the care and nutrition of young animals, but also try to protect animals against the effects of heat stress that they are exposed to in hot seasons in the changing climatic conditions in recent years. Heat stress is a condition that can affect the health and productivity of calves and heifers. When animals are exposed to high temperatures and humidity, their ability to regulate their body temperature is compromised, leading to various adverse effects. Calves and heifers are particularly susceptible to heat stress as they have a higher metabolic rate and produce more heat than cows. Besides that, they have a lower body mass and a smaller surface area, making it harder for them to dissipate heat. Some symptoms of heat stress in calves and heifers include increased respiration, panting, sweating and increased water intake. In severe cases, animals may experience dehydration, reduced feed intake and growth retardation. Heat stress can also compromise the immune system, making animals more susceptible to disease. Decreased hormones due to heat stress disrupt the normal oestrus cycle, suppress follicle development, and therefore, a decrease in the rate of conception. Moreover, heat stress not only suppresses embryonic development by the impaired placenta resulting in hypoxia and malnutrition, but can also delay the growth, immunity and future milk production of newborn calves. Preventing heat stress in calves and heifers is important in terms of maintaining their health and productivity. To prevent heat stress, to provide shaded areas, to facilitate access to clean water, and to adjust feeding programs in order to avoid feeding during the hottest hours of the day are among the measures that can be taken. Additionally, providing fans or sprinklers can help cool animals and reduce the effects of heat stress. In general, it is important for livestock producers to be aware of the risks of heat stress in calves and heifers and to take proactive steps to prevent this from occurring.

Keywords: Heat stress, Calf, Heifer, Reproduction

1.GİRİŞ

Isı stresi, hayvanların aşırı sıcak hava ve neme maruz kaldıklarında yapıları gereği normal vücut sıcaklıklarını koruyamadıkları yerlerde yaşadıkları bir davranıştır. Isı stresi, özellikle yüksek sıcaklık ve nemin bir arada olduğu iklim bölgelerindeki hayvanların korunmasında önemli bir sorun olarak kabul edilir.

Hayvanlar termonötral bölge (TB) olarak bilinen belirli bir çevresel sıcaklık aralığında vücut sıcaklıklarını koruyabilir ve bu aralıkta minimum fizyolojik maliyetle maksimum üretkenlik elde edilebilir. Bir aylık buzağının termonötral bölgesi 13-25 °C arasında iken, günlük 800 gr ağırlık kazancı sağlayan düvenin TB'si 0-15 °C'dir. Isı stresi, hayvanların yüksek hava sıcaklığı ve nem ile yavaş hava hareketinde TB'nin üzerindeki yüksek ortam sıcaklığına bağlı olarak vücut sıcaklığını korumak için vücut ısısını dağıtamadığı noktada ortaya çıkar.

Buzağı ve düveler daha az metabolik ısı üretir ve vücut kütesine göre daha büyük vücut yüzey alanına sahiptir, bu nedenle vücut ısısını verimli bir şekilde dağıtır ve ergin sığırlara göre ısı stresine karşı daha toleranslı oldukları düşünülür. Başka bir deyişle ergin hayvanlarla karşılaştırıldığında genç hayvanlar, vücut ağırlıklarına göre geniş yüzey alanları ve ineklere kıyasla genç hayvanlar tarafından üretilen çok daha az ısı miktarı nedeniyle daha yüksek sıcaklıklarla daha iyi başa çıkabilir. Sağmal inekler, kaba yemlerin sindirimi ve yüksek düzeyde süt üretimini desteklemek için gereken metabolik aktivite nedeniyle artan miktarda ısı üretirler. Bununla birlikte ısı stresi genç hayvanlarda da vücut sıcaklıklarını korumak için solunum ve kalp atış hızlarının artması, gelişim, büyüme, sağlık ve üremelerini olumsuz etkiler. ABD hayvancılık sektöründe ısı stresi sonucu performans ve üremenin tehlikeye girmesi ve hayvanların ölüm oranlarının artması sonucu yıllık toplam ekonomik kaybın 1.69-2.36 milyar dolar arasında olduğu tahmin edilmektedir.

Buzağı ve düvelerde ısı stresinin bazı semptomları arasında sonulum, nefes nefese kalma, terleme ve artan su alımı yer alır. İleri düzeyde hayvanlarda dehisrasyon, azalan yem tüketimi ve düşük büyüme oranları yaşayabilir. Isı stresi ayrıca bağışıklık sistemini tehlikeye atarak hayvanları hastalıklara karşı daha duyarlı hale getirebilir.

Bu derleme ısı stresinin buzağı ve düveler üzerindeki etkisini vurgulamak ve ısı stresini hafifletmek için yöntemler önermek amacıyla yapılmıştır.

2. ISI STRESİNİN ETKİSİ

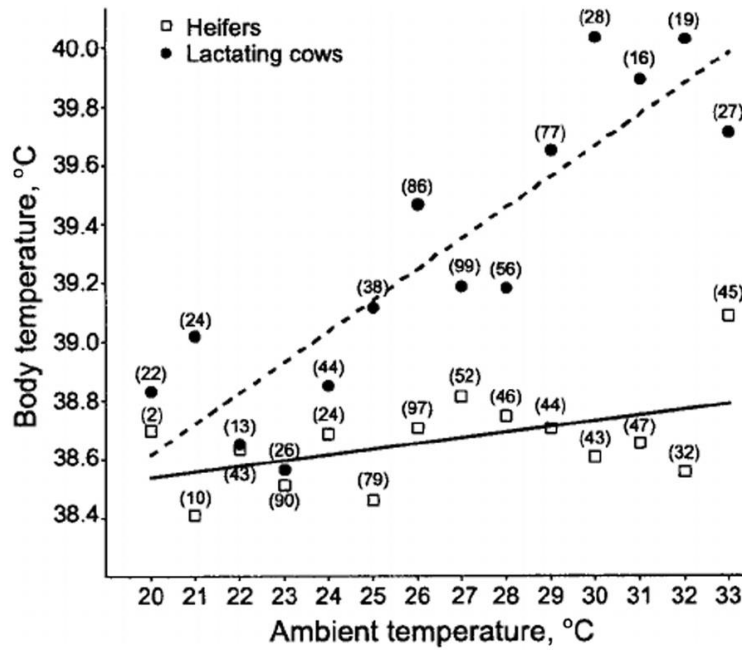
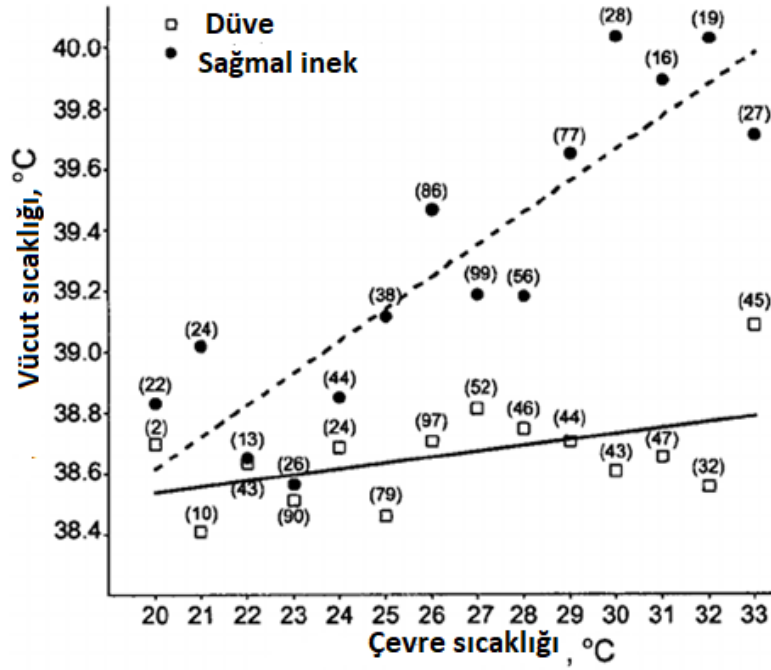
Sığırlardaki ısı stresi ilk olarak Thom (1959) tarafından ortaya atılan sıcaklık-nem indeksi (SNİ) kullanılarak tahmin edilmiştir. Bu indeks, sığırlarda ısı stresine neden olan ortam sıcaklığını ve nemi tanımlamak için uyarlanmıştır (Dikmen ve Hansen, 2009).

Isı stresi, buzağı ve düvelerin kuru madde alımı ve büyüme performansları üzerinde olumsuz etki yapmaktadır. Yaz aylarında doğan buzağuların, kış aylarında doğanlara göre daha düşük ortalama günlük ağırlık kazanca sahip olma eğiliminde olduğu bildirilmiştir (Place ve ark.,1998). Rauba ve ark. (2019), yazın doğan buzağuların kış aylarında doğan buzağulara göre daha düşük başlangıç kuru madde tüketimi değerlerine sahip olduğunu bildirmiştir. Broucek ve ark. (2009), ısı stresi koşullarındaki (SNİ=74,8) buzağuların, normal koşullar altında yetiştirilenlere (SNİ=59,7) kıyasla buzağı başlangıç yemi tüketiminin azaldığını göstermiştir. Colditz ve Kellaway (1972), ısı stresi koşullarında (38°C ortam) yetiştirilen düvelerin, serin ortam koşullarında (17°C ortam) yetiştirilen düvelere kıyasla yem tüketimi ve günlük ağırlık kazancının azaldığını göstermiştir. Benzer şekilde, Baccari ve ark. (1983) ısı stresi koşullarında (32.5 - 34°C) Holstein düvelerde yem tüketimi, günlük canlı ağırlık artışı ve yemden yararlanmanın daha serin şartlar altındaki düvelere göre (18-20°C) daha düşük olduğunu bildirmiştir.

Bunlara ek olarak Nonaka ve ark. (2008) pubertasa ulaşmamış Holstein düvelerde çevre sıcaklığı 28 °C den 33 °C'ye yükseldiğinde günlük kuru madde tüketimi ve günlük ağırlık kazancının sırasıyla %9 ve %22 düştüğünü, terleme vb. sebeplerle su kaybı arttığından su tüketiminin %23 arttığını bildirmiştir.

Isı stresi sırasında, buzağuların ve düvelerin çevreden ve metabolik süreçlerden ısı kazanımı, radyasyon, konveksiyon, buharlaşma ve iletim yoluyla ısı kaybını aşacaktır. Böylece buzağularda ve düvelerde ısı birikerek vücut sıcaklığında bir artışa neden olacaktır. Düvelerin 30 °C ortamdaki ısı üretimi ve rektal sıcaklığının 15 °C ortamdakilere göre anlamlı derecede yüksek olduğu bildirilmiştir (Purwanto ve ark., 1993). Benzer sonuçlar farklı çalışmalarda da tespit edilmiştir. (Baccari F ve ark., 1983, Nonaka ve ark., 2008)

Sartori ve ark (2002), yayınladıkları linear regresyon denklemi ile 11-17 aylık yaştaki doğum yapmamış düvelerin vücut sıcaklıkları ile ortam sıcaklığı arasındaki pozitif ilişkiyi göstermiş, ısı stresi altındaki düvelerin vücut sıcaklığındaki değişimin daha az olması sebebiyle düvelerin ısı stresine karşı toleransının sağmal ineklere oranla daha yüksek olduğunu belirtmiştir (Şekil 1). Buzağı ve düveler ısı stresine adapte olmak için ısı kazancını sınırlamakta ısı kaybını yükseltmektedir.



Şekil 1. İneklerde ve düvelerde ortam sıcaklığı (AT) ile vücut sıcaklığı (BT) arasındaki ilişki (Sartori et al. 2002).

Çevre sıcaklığı yükseldikçe kuru madde tüketiminin azalması nedeniyle buzağı ve düvelerde enerji tüketimi azalırken ısı yükünü hafifletmek için metabolizma ve yaşam için enerji harcamaları artar. Isı stresi altındaki buzağı ve düveler ısıyı düzenlemek için büyüme enerjisinin bir kısmını feda eder ve bu da büyüme performansının ve üretken verimlilikteki azalmayı kısmen açıklamaktadır. Ayrıca ısı stresi altındaki (çevre sıcaklığı 33 °C) pubertasa

ulaşmamış yaklaşık 7 aylık yaştaki düvelerin vücut enerjisi depolama şeklini değiştirebileceği örneğin protein birikimini azaltacağı ve yağ tabakasının kalınlığının artabileceği bildirilmiştir (Nonaka ve ark, 2008). Ancak bu mekanizma henüz tam olarak bilinmemektedir.

Çevre sıcaklığı yükseldikçe, kuru madde nedeniyle buzağuların ve düvelerin enerji alımı azalırken, ısı yükünü kaldırmak için bakım ve metabolizma için harcanan enerji artar. Sonuç olarak, ısı stresi altındaki buzağular ve düveler, ısı düzenlemesi için büyüme enerjisinin bir kısmını feda eder, bu da büyüme performansının azalmasını ve üretken verimliliği kısmen açıklayabilir (Nonaka ve ark., 2008, Purwanto ve ark, 1993).

2.1 Isı Stresinin Fizyoloji Üzerine Etkisi

Buzağular ve düveler ısı stresine maruz kaldıklarında kan akışında, asit-baz kimyasında ve hormonlarda önemli fizyolojik değişiklikler meydana gelir.

Düvelerin ısı stresi sırasında kalp atış hızının arttığı bildirilmiştir (Purwanto ve ark., 1993, Pandey ve ark., 2017). Bu, ısı stresinin neden olduğu yüksek vazodilatasyona ve artan kan akışına bir yanıt olarak kan basıncının korunmasına yardımcı olur (Purwanto ve ark., 1993). Ayrıca, kan akışı periferik dokulara yeniden dağıtılır, bu da vücut ısısının organlardan vücut yüzeyine taşınmasını sağlar (Hooda ve Upadhyay, 2015). Böylece, kalp atış hızındaki değişiklik, düvelerin ısı dengesini korumaları için koruyucu bir mekanizma görevi görebilir.

Isı stresi altındaki düvelerde solunum hızında artış ve nefes nefese kalma görüldüğü tespit edilmiştir (Baccari ve ark., 1983, Nonaka ve ark., 2008, Neuwirthve ark., 1979, O'Brien ve ark., 2010). Hormonların ısı stresine katkısı daha fazla çalışma gerektirse de, hücresel ve doku açısından makul bir açıklama vardır. Birkaç çalışma, ısıya maruz kalmanın hücresel reaktif oksijen türleri (ROS) üretimini artırabileceğini ve sitotoksisteye yol açan oksidatif stresi indükleyebileceğini ortaya koymuştur (Bernabucci ve ark., 2002).

Düveler için metabolik ısyı azaltmak için daha düşük bir ruminasyon oranı bildirilmiştir. Nonaka ve ark. (2008), 33 °C'de gebe düvelerin, 20 °C'deki düvelere kıyasla %56 daha düşük ruminasyon hızına sahip olduğunu bildirmektedir. Bernabucci ve ark. (1999) ayrıca SNİ değerinin 64'ten ve 84'e yükseldiğinde 10 aylık yaştaki dişi hayvanların ruminasyon hızlarında önemli fark olduğunu göstermiştir.

Isı stresi düvelerin östrus döneminden buzağılama dönemine kadar tüm üreme evresini etkilemekle kalmaz, aynı zamanda yeni doğan buzağılarda kalıcı etki oluşturur. Kızgınlığın süresi ve yoğunluğu, ısı stresi (Gangwar ve ark., 1965, Bolocan 2009) tarafından azaltılır, bu da sakin kızgınlık veya zayıf östrus olarak ifade edilir ve dolayısıyla üremede zorluk yaşanır (De Rensis ve Scaramuzzi, 2003). Ayrıca, ısı stresi, folikül seçimini bozarak, oositlerin

kalitesinin düşmesine yol açar (Badinga ve ark., 1993, Howell ve ark., 1994, Wilson ve ark., 1998, Hansen ve ark., 2001, Roth ve ark., 2001). Başarılı tohumlama olasılığı düşer (Roman-Ponce ve ark., 1978). Bu nedenle, ısı stresi sırasında gebe kalma oranı büyük ölçüde düşer. Isı stresinin üreme üzerindeki etkisini düzenleyen fizyolojik mekanizma belirsizdir.

3. ISI STRESİNİ HAFİFLETME STRATEJİLERİ

Buzağular ve düveler üzerindeki ısı stresinin derecesini etkileyen faktörler arasında genetik, üreme, çevre ve beslenme gibi faktörler yer alır. Bu faktörlere dayalı olarak geliştirilen stratejiler, buzağı ve düveler üzerindeki ısı stresini iyileştirebilir.

3.1 Genetik ve Üreme

Buzağuların ve düvelerin ısı stresi toleransı üzerindeki genetik etkide ırk önemli bir rol oynar. Bu nedenle, ısı stresi koşulları altında Holstein inekleri yerli süt ırkları ile melezlemek ısı stresi toleransını potansiyel olarak artıracığı bildirilmiştir. Bununla birlikte, bu melez ırkların süt endüstrisinin ihtiyaçlarını karşılamaya yetecek kadar verimli olup olmadığı tartışılır. Genel olarak süt inekleri, süt üretimi metabolik ısı üretimini yükselttiği için ısı stresine karşı daha duyarlı görünmektedir.

3.2 Çevre

Buzağı ve düvelerin buldukları ortamın değiştirilmesi, ısı stresinden korumak için ısı kazanımını azaltabilir ve ısı dağılımını yükseltebilir. Isı stresini azaltmak için en yaygın önlemler olarak gölgelik sağlanması ve su ile buharlaşmalı soğutma sayılabilir (Pejman ve Shahryar, 2012). Isı stresi koşullarına (36°C ortam) maruz kalan, su püskürtülen düvelerin uygulanmayanlara kıyasla daha düşük rektal sıcaklık, solunum hızı ve %26,1 daha yüksek ağırlık artışı olduğu bildirilmiştir (Marai vd., 1995). Benzer şekilde, ısı stresi koşullarında (yaklaşık 29 °C ortam) fanların kullanılmasıyla buzağuların canlı ağırlık kazancı ve yemden yararlanma sırasıyla %23 ve %21 oranında önemli ölçüde arttığı bildirilmiştir (Hill vd., 2011). Suni tohumlamadan önce ve sonra düvelere kısa bir süre için yağmurlama ve fanla soğutulma uygulanması, ısı stresi (36.1 °C ortam) sırasında gebelik oranını artırabileceğini bildirmiştir.

3.3 Besleme Yöntemi

Besleme yöntemi, buzağuların ve düvelerin homeostazı sürdürmelerine veya Isı stresinden kaynaklanan besin eksikliklerini önlemelerine yardımcı olabilir. Buzağuların başlangıçtaki yem tüketimi ısı stresi (Hill vd., 2011) tarafından baskılanabilir ve bu da onlara yüksek enerji gereksinimlerini desteklemek için daha az enerji bırakabilir. Rasyon içeriğine bağlı olarak buzağular için sıvı yem farklı durumlara bağlı olarak yüksek enerji gereksinimlerini desteklemek için düşünülebilir. Ergin sığırlarda olduğu gibi, düvelerin kuru madde

tüketimindeki düşüşün üstesinden gelmek için rasyonun besin madde içeriğinin artırılması gerektiği bildirilmektedir (West, 2003).

4. SONUÇ VE ÖNERİLER

Yapılan çalışmalara dayanarak, buzağuların ve düvelerin Isı stresine ergin sığırlardan daha toleranslı olması beklenmesine karşın bir dereceye kadar Isı stresinden muzdarip oldukları görülmektedir.

Isı stresine uyum sağlamak için buzağular ve düveler, enerjinin yeniden dağıtımını sağlamak için bir dizi fizyolojik ve metabolik değişiklik yaşarlar, buda büyüme performansının tehlikeye girmesine neden olur.

Rumen metabolizmasında ısı stresinin neden olduğu değişiklik, yem sindirilebilirliğinin değişmesine ve rumen fermantasyon üretimine yol açar.

Isı stresi östrusun süresini ve yoğunluğunu azaltır, üreme hormonunun düzenlenmesiyle foliküler gelişimi, bozulmuş plasenta ile embriyonik gelişimi, yavruların büyümesini ve bağışıklığını baskılar. Sonuç olarak buzağı ve düvelerde ısı stresini iyileştirmek için genetik gelişim, üreme önlemleri, çevrenin fiziksel değişimi ve besleme yöntemi üzerinde durulmalıdır.

Bunun yanı sıra hayvanlara;

- gölgelik alan sağlanmalı,
- barınakta doğal hava hareketi için mümkün olduğu kadar açıklık bırakılmalı,
- kaybedilen su kaybını telafi etmeleri için önlerinde temiz ve bol su bulunmalı,
- önlerinde sürekli taze kesif yem bulunmalı,
- besleme sabah erken saatlerde yapılması önerilebilir.

KAYNAKLAR

- O'Brien MD, Rhoads RP, Sanders SR, Duff GC, Baumgard LH. Metabolic adaptations to heat stress in growing cattle. *Domest Anim Endocrinol.* 2010; 38(2):86–94.
- Baccari F, Johnson HD, Hahn GL. Environmental heat effects on growth, plasma T3, and postheat compensatory effects on Holstein calves. *Proc Soc Exp Biol Med.* 1983;173(3):312.
- Badinga L, Thatcher W, Diaz T, Drost M, Wolfenson D. Effect of environmental heat stress on follicular development and steroidogenesis in lactating Holstein cows. *Theriogenology.* 1993;39(4):797–810.
- Bernabucci U, Bani P, Ronchi B, Lacetera N, Nardone A. Influence of short and long-term exposure to a hot environment on rumen passage rate and diet digestibility by Friesian heifers. *J Dairy Sci.* 1999;82(5):967–73.
- Bernabucci U, Ronchi B, Lacetera N, Nardone A. Markers of oxidative status in plasma and erythrocytes of transition dairy cows during hot season. *J Dairy Sci.* 2002;85(9):2173–9.
- Bolocan E. Effects of heat stress on sexual behavior in heifers. *Sci Papers Anim Sci Biotechnol.* 2009;42(1):141–8
- Broucek J, Kisac P, Uhrincat M. Effect of hot temperatures on the hematological parameters, health and performance of calves. *Int J Biometeorol.* 2009;53(2):201–208.
- Colditz PJ, Kellaway RC. The effect of diet and heat stress on feed intake, growth, and nitrogen metabolism in Friesian, F1 Brahman × Friesian, and Brahman heifers. *Aust J Agric Res.* 1972;23(4):717–725
- De Rensis F, Scaramuzzi RJ. Heat stress and seasonal effects on reproduction in the dairy cow—a review. *Theriogenology.* 2003;60(6):1139–51.
- Dikmen S, Hansen P. Is the temperature-humidity index the best indicator of heat stress in lactating dairy cows in a subtropical environment? *J Dairy Sci.* 2009;92(1):109–16.
- Gangwar PC, Branton C, Evans DL. Reproductive and physiological responses of Holstein heifers to controlled and natural climatic conditions 1. *J Dairy Sci.* 1965;48(2):222–7.
- Hansen P, Drost M, Rivera R, Paula-Lopes F, Al-Katanani Y, Krininger C III, et al. Adverse impact of heat stress on embryo production: causes and strategies for mitigation. *Theriogenology.* 2001;55(1):91–103.
- Hill T, Bateman H II, Aldrich J, Schlotterbeck R. Comparisons of housing, bedding, and cooling options for dairy calves. *J Dairy Sci.* 2011;94(4):2138–46.
- Hooda O, Upadhyay R. Growth rate, hormonal and physiological responses of kids subjected to thermal and exercise stress. *J Environ Res Dev.* 2015; 9(4):1095
- Howell J, Fuquay J, Smith A. Corpus luteum growth and function in lactating Holstein cows during spring and summer. *J Dairy Sci.* 1994;77(3): 735–9.
- Marai I, Habeeb A, Daader A, Yousef H. Effects of Egyptian subtropical summer conditions and the heat-stress alleviation technique of water spray and a diaphoretic on the growth and physiological functions of Friesian calves. *J Arid Environ.* 1995;30(2):219–25.
- Neuwirth JG, Norton JK, Rawlings CA, Thompson FN, Ware GO. Physiologic responses of dairy calves to environmental heat stress. *Int J Biometeorol.* 1979;23(3):243–54.
- Nonaka I, Takusari N, Tajima K, Suzuki T, Higuchi K, Kurihara M. Effects of high environmental temperatures on physiological and nutritional status of prepubertal Holstein heifers. *Livest Sci.* 2008;113(1):14–23.
- O'Brien MD, Rhoads RP, Sanders SR, Duff GC, Baumgard LH. Metabolic adaptations to heat stress in growing cattle. *Domest Anim Endocrinol.* 2010; 38(2):86–94.

- Pandey P, Hooda OK, Kumar S. Impact of heat stress and hypercapnia on physiological, hematological, and behavioral profile of Tharparkar and Karan fries heifers. *Vet World*. 2017;10(9):1146–55
- Pejman A, Shahryar A. Heat stress in dairy cows (a review). *Res Zool*. 2012; 2(4):31–7.
- Place NT, Heinrichs AJ, Erb HN. The effects of disease, management, and nutrition on average daily gain of dairy heifers from birth to four months. *J Dairy Sci*. 1998;81(4):0–1009.)
- Purwanto BP, Nakamasu F, Yamamoto S. Effect of environmental temperatures on heat production in dairy heifers differing in feed intake level. *Asian Australas J Anim Sci*. 1993;6(2):275–279
- Raubal, J., Heins, B. J., Chester-Jones, H., Diaz, H. L., Ziegler, D., Linn, J., & Broadwater, N. (2019). Relationships between protein and energy consumed from milk replacer and starter and calf growth and first-lactation production of Holstein dairy cows. *Journal of dairy science*, 102(1), 301-310.
- Roman-Ponce H, Thatche WW, Caton D, Barron DH, Wilcox CJ. Thermal stress effects on uterine blood flow in dairy cows. *J Anim Sci*. 1978;46(1): 175–80.
- Roth Z, Meidan R, Shaham-Albalancy A, Braw-Tal R, Wolfenson D. Delayed effect of heat stress on steroid production in medium-sized and preovulatory bovine follicles. *Reprod Cambridge*. 2001;121(5):745–51.
- Sartori R, Sartor-Bergfelt R, Mertens SA, Guenther JN, Parrish JJ, Wiltbank MC. Fertilization and early embryonic development in heifers and lactating cows in summer and lactating and dry cows in winter. *J Dairy Sci*. 2002;85(11): 2803–2812.
- Thom EC. The discomfort index. *Weatherwise*. 1959;12(12):57–61
- West JW. Effects of heat-stress on production in dairy cattle. *J Dairy Sci*. 2003;86(6):2131–44.
- Wilson S, Kirby C, Koenigsfeld A, Keisler D, Lucy M. Effects of controlled heat stress on ovarian function of dairy cattle. 2. Heifers. *J Dairy Sci*. 1998;81(8): 2132–8.

**THE IMPLICIT EFFECT OF CYBER CRIMES AND ITS EXPLICIT IMPLICATION
ON MODERN SOCIETY**

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Abstract

Modernization and civilization are two major factors that have fostered the drastic influence of digital technology in the global society. Today, technology and society are inseparable but the same spectrum has infiltrated the society with not just pleasant invents but also introduced a number of unacceptable maladies or crimes popularly known as cybercrime. Hinduja and Schafer (2009) depict that cyber crime as those crimes which are committed online with the aid of computing technologies or other digital devices. This paper is a content survey on cyber crime and effect on modern society. The concepts of cyber crimes were vividly introduced in the paper. The paper discussion also examined the causes, practices and impact of cyber crimes on modern society. In order to gather relevant information that could be useful the paper work, online Google form questionnaire instrument was used to collect information from respondents which were collated and subjected to reliability analysis. Conclusively, recommendations on measures that could be taken to combat the malicious acts of cyber crimes were highlighted.

Keywords: Technology, Cybercrime, Civilization, Modern Society.

INTRODUCTION

It is a popular saying that there are two sides to life, the good and the bad. The advent of technology has positively and negatively impacted the global community. The good news is that digitalization have helped to meet a variety of needs in the entertainment, commerce, communications, and educational industry of human society but in the same vein, technology have also brought new forms of unaccepted values that threaten the order of the society and strange waves of criminal activities against humanity. These maladies working against law and orderliness with the aids of technology via the internet is what is generally referred to as Cybercrime. Cybercrimes are offences that are committed against individuals or group of individuals with a criminal motive to harm the reputation of the victim or cause mental or physical harm either directly or indirectly using modern telecommunication networks such as mobile phone or the internet. According to Akogwu (2012), The activity of Cybercrime threatens societal security and financial health.

RELATED LITERATURE



In general, Cybercrimes are the unacceptable acts committed with the use of technological tools such as the computer or telecommunication devices via the internet. According to Hinduja and Schafer (2009), cybercrimes are those crimes which are committed online with the aid of computing technologies or other digital devices. Oyenuga (2015) explained that the Internet has its good sides and bad sides. Technology has contributed positive values to the world and has also produced so many maladies that threaten the order of the society. Crime has mounted attacks times without number on the culture of our society stylishly through its corny but usual methods of propagation where time and culture acts as major instruments. According to Saban, McGivern and Saykiewicz, (2002), Cybercrime is any illegal act facilitated or fostered by a computer, whether the computer is an instrument used to commit

a crime, an object of a crime or a repository of evidence related to a crime. In line with this, Hinduja and Schafer (2009), opined that cybercrimes are those crimes which are committed in electronic environment or online. Further to this definition, Heather (2008) and Newton (2008) explained that cybercrimes occur generally in cyberspace or virtual community of the Internet.

Cyber Crime and the society

The way people and society perceive crimes differ as related to its gravity. There are innumerable societies all over different continents of the world which differ in what they accommodate in terms of behaviors, i.e. what is seen as criminal act in Africa may not necessarily be seen as such in Europe but the relativity in crime does not lower the normative standards in every society. Presdee (2000) explain that criminology reveals the currents of carnivalesque pleasure, excitement and risk experiences that animate from life but is the same so that the measure design for everyday control can contain and commodity the acts. Nwalozie (2015), explain that for an individual to be involved in group delinquency it means that the individual takes relief and delight in the protective and sympathetic comfort of the group. Walsh (1986) explained further that it is usually the decision of the group to get involved in malicious activities. The evoking technologies are the initiator of 'the world without borders' existing between countries resulting to the transmission of cultural ideas and values via social media enhancing crimes with the use of smart devices through the internet.

Major Causes of Cybercrime

The major factors for the rampancy of cyber criminology in modern society include:

1. Easy Access to the internet:

Hacker are often skilled well enough to breach access codes of computer system. They manipulate the security applications and biometric systems.

2. Negligence:

Cyber attackers actually are at the look for carelessness on the part of the original users. They seize any opportunity of negligence and perform their criminal acts.

3. Absence of concrete of Evidence:

It is not too advisable to keep vital all vital data or information in a particular location. Information are to be backed up using distributive storage locations for security sake. Hackers usually take opportunity of proof less cases for selfish attributes. Ensure that vital information are kept save on segregated units.

4. Use of Complex Code:

Errors occur most times with the use complex codes. Hackers are specialist who look for and seize the smallest opportunity of loops found in codes to exploit users.

MATERIALS AND METHODS

This paper is a content survey on cyber crimes and its effect on modern society. The paper carefully evaluates the concept of cyber crime. The causes, practices and impact of cyber crimes were systematically discussed in the paper. In order to gather useful information for the paper discussion, experts in the field of technology were interviewed; textbooks and magazines were consulted for information extraction purpose. So as to further collect relevant information that could be useful for the paper write-up, online Google form questionnaire instrument was used to collect information from respondents which were collated and subjected to reliability analysis. The result of 0.93 gave a good reliability index of the instrument. The entire exercise took place within four (4) weeks before completion.

RESULTS AND DISCUSSION

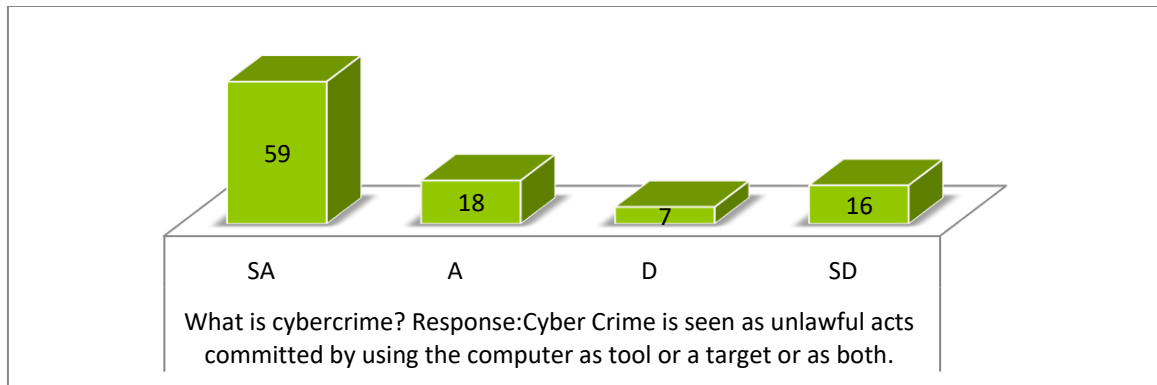


Fig.1: Chat Analysis

The graph plotted in figure 1 depicts that a significant number of the respondents were able to do justice to the question posted. The respondents opined that cyber crime is the unlawful or acceptable acts committed with the use of the computer as tool or as a target or even as both. The respondents further explain that the malicious acts by these cyber criminals usually disturbance in network, stealing important data, files or documents, bank details for monetary gain.

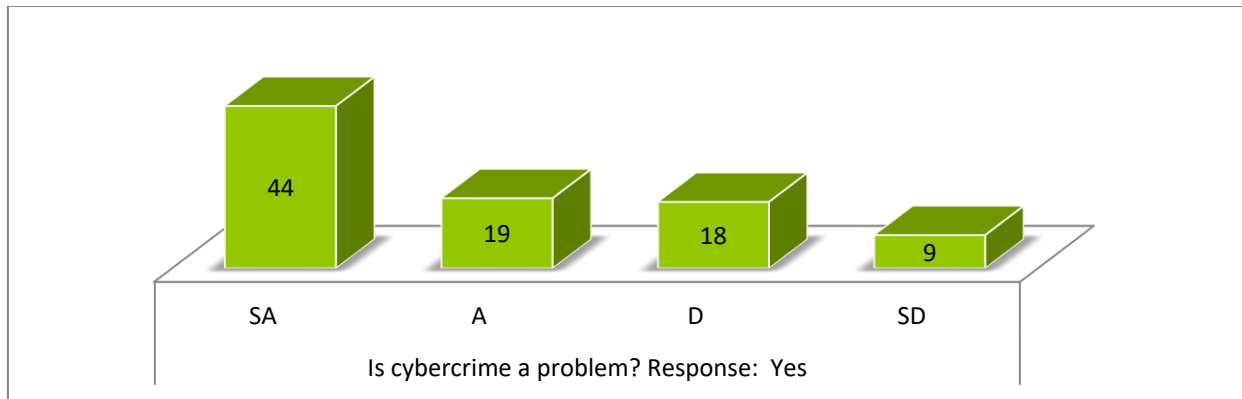


Fig.2: Chat Analysis

The graph plotted in figure 2 shows that a greater number of respondents concur with the statement that cyber crime constitutes a form of problem. The respondents denote that cybercrime violates the privacy of individuals and the security of their data, especially hacking, identity theft, malware, financial fraud and other offences against individuals that involve the breaching of personal information without their consent.

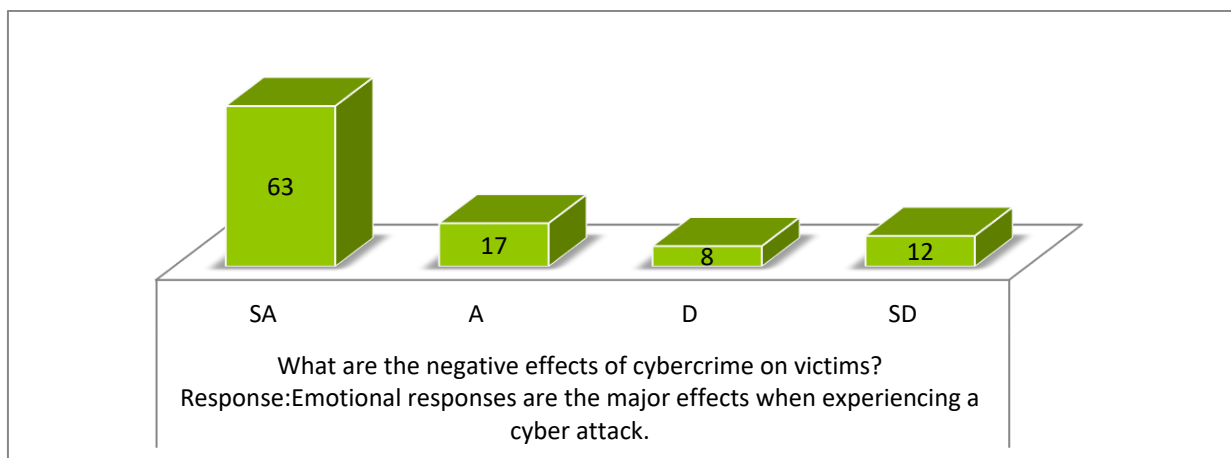


Fig.3: Chat Analysis

The chat analysis shown in figure 3 above indicates that majority of the respondents are duly informed above the implication of cyber crime on their potential victims. The respondents infer that the bad side of cyber crime is that the acts usually causes emotional responses which may include intense anger, anxiety, fear, panic and frustration on the potential victims. The respondents also stated emotional stress can result from stolen data while post traumatic stress disorder can be seen all over the victims.

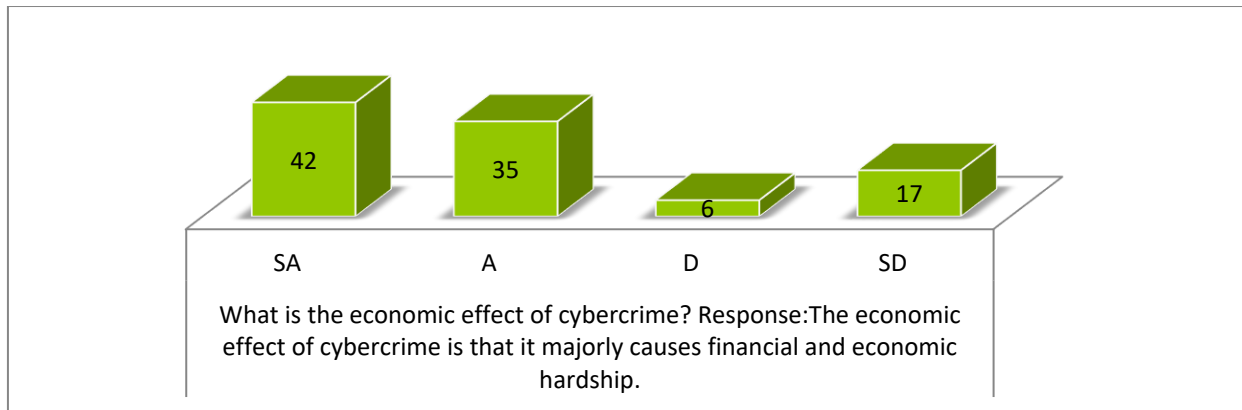


Fig.4: Chat Analysis

The graph plotted in figure 4 above shows that a higher number of the respondents agree with the statement that cyber crime can effect socio-economy. The respondents deduced that the main impact of the economic involves financial and economic hardship. The respondents further listed some other economic effects to include loss of sensitive data and critical intellectual property.

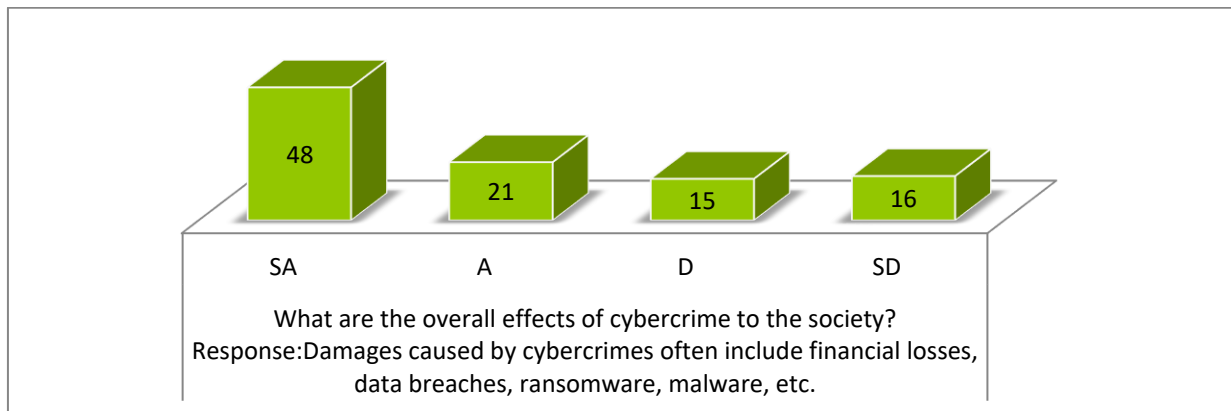


Fig.5: Chat Analysis

The graph plotted in figure 5 above indicates that most of the respondents emphasized that the overall effect of cyber crimes are harmful and dehumanizing in nature as cyber crimes can cause damages which often include data breaches, financial losses, malware, ransomware and many more to the society. The respondents further state that the cyber criminals can take people's identity to incur credit, accumulate debt and then flee without being traced. All of these evil acts are detrimental to the society.

CONCLUSION

This paper is explicitly focused on cyber crime and its effect on modern society. Basic concept of cyber crimes were vividly discussed in the paper write-up. The paper explains that malicious acts by fraudsters are correspondingly increasing as online activities are rapidly growing. Overall, the paper inferred that cybercrime is a global phenomenon while the damage done are extremely critical on not just only the financial establishments of individuals or organizations but also on the economy and infrastructures in the society such as power and many more are experiencing significant attacks by cyber criminals.

RECOMMENDATION

In order to protect the society against the fore discussed cybercrimes, this paper recommends that government and local authorities should;

1. Strengthen societal networks.
2. Enforce internet security suite.
3. Introduce strong security codes.
4. Create regular awareness.
5. Update major security breaches.

REFERENCE LIST

Akogwu, S. (2012). An Assessment of the Level of Awareness on Cyber Crime Among Internet Users in Ahmadu Bello University, Zaria. Unpublished B.Sc. project.

Heather, Newton (2008) Electronic Law: Research Starters Business. Retrieved_ <http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?hid=105andsid=0af3d1fb-4a5b-43b3-9a63-88c64b0d59f9%40sessionmgr114 andvid=1>>.

Hinduja Sameer & Schafer, Joseph. A. (2009). US Cybercrime Units on the World wide Web. Policing: An International Journal of Police Strategies and Management. Vol.32 Issue 2. Pp.278-296.

Oyenuga, Adedeji. S. (2015). Youth's Cybercrime Culture and the Challenges of Cyber Security in Lagos State, Nigeria. Paper Submitted to CODESRIA Democratic Governance Institute.

Presdee, M. (2000). Cultural Criminology and the Carnival of Crime. Routledge, London.

Saban, Kenneth. A., McGivern, Elaine, Saykiewicz, Jan Napoleon (2002). A Critical Look at the Impact of Cybercrime on Consumer Behaviour. Journal of Marketing Theory and Practice. Vol.10 Issue 2. Pp. 29.

**THE RELATIONSHIP BETWEEN HUMAN RIGHTS, AND ECONOMIC RIGHTS
WITH FOREIGN INVESTMENT**

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ABSTRACT

Human rights and economic rights are both essential for a society to function. Economic rights, or the right to just and fair wages, healthcare, and other basic needs, are essential for a society to function. These essential rights are found in human rights documents like the Universal Declaration of Human Rights and the International Covenant on Economic, Social, and Cultural Rights. Foreign investment plays an important role in economic rights. Foreign investment is when a company from one country invests money in a business located in another country. When foreign investors come into a new market, they often bring with them capital to start new businesses and create jobs. This can be beneficial for the local economy; however, it can also lead to problems if proper protections are not put into place to ensure that local workers have access to fair wages and safe working conditions. The relationship between human rights and economic rights is a complex one that has become increasingly important as the world has become more interconnected. Human rights protections are fundamental to maintaining a fair and just society, while foreign investment helps to stimulate global economic growth. However, human rights protections should not be sacrificed for the sake of economic progress and foreign investment. Governments and investors must recognize that human rights are an essential component of sustainable economic growth. On the other hand, Human rights protections mustn't be sacrificed in the name of economic progress or foreign investment. Governments and investors must recognize that human rights are a key factor in sustainable economic growth. This means that, when negotiating and implementing foreign investment agreements, governments should ensure that these investments meet international standards for labor rights, environmental protection, and other basic human rights such as freedom of speech and access to education.

Keywords: economic rights, human rights, investment, society

INTRODUCTION

Human rights are fundamental rights that all people are entitled to regardless of their race, religion, gender, or social status. These rights include the right to life, liberty and security of person, freedom from torture and slavery, freedom of opinion, and expression, the right to work and education, the right to health care and social security, the right to a fair trial and access to justice, the right to privacy, and many more. Human rights are protected by international laws such as the Universal Declaration of Human Rights (UDHR), which was adopted in 1948 by the United Nations General Assembly. The UDHR is a foundational document for all human rights laws around the world. Economic rights are a type of human rights that allow people to participate in a country's economy and enjoy its benefits. Economic rights are important because they allow people to reach their full potential and achieve self-sufficiency. Foreign investment has been a key factor in global economic growth for many years. It has helped countries to develop and has created jobs and improved living standards for people around the world. In recent years, foreign investment has become even more important as countries strive to increase their competitiveness in the global market (Baetens, 2013).

The debate over whether international investment law should protect human rights has been ongoing for many years (Baetens, 2013). In 2003, the United Nations High Commissioner for Human Rights issued a report recommending that countries take measures to protect human rights when making investment agreements. This debate has largely been about whether investment agreements make it more difficult for countries to make and keep their laws. However, there have been some new developments recently that relate to clarifying what investors' obligations are when it comes to human rights. For example, in 2012 the United Nations Guiding Principles on Business and Human Rights were adopted, which guide how businesses should respect human rights (Krajewski, 2018).

Since the 19th century, international investment has been one of the most important and controversial topics in international law. It often conflicts with and interferes with other branches of international law, especially in contemporary pluralistic international law. In recent years, there has been much debate in the literature about the relationship between human rights law and the evaluation of state compliance with international capital treaties. Some jurists have likened this two-way relationship to water and oil, which do not dissolve each other easily, while others believe the two are balanced and related (Toral & Schultz, 2010).

The way that human rights and international investment rights interact can be looked at by examining customs, treaties, documents, and declarations. All states have a responsibility to

uphold human rights principles and rules, as well as to support the development of a sustainable environment (Scott, 2001).

HUMAN RIGHTS AND ECONOMIC RIGHTS

Human rights establish a set of minimum standards that societies should provide for all individuals. These standards can be used to influence public opinion and change the balance of power in political debates (Krajewski, 2018). In 1947 and 1948, UNESCO surveyed a group of intellectuals from around the world to gain their opinions on the philosophical foundations of human rights. This survey was not widely known at the time, but has some relevance to today's debate. The right to work, social security, a living wage, the right to freedom of assembly and association, and free access to employment are the fundamental rights needed to create a charter of human rights, according to British economist Maurice Dobb. He argued this point in a letter he sent in 1947, in response to UNESCO's survey on the philosophical foundations of human rights (Goodale, 2018).

All human rights are interconnected, and one's ability to exercise their rights depends on various factors, including access to education and health care, food and shelter, and an ability to participate in political and social activities. The UDHR, ratified in 1948, recognizes no distinction between civil and political rights, and economic, social, and cultural rights were added later. However, in recent decades, with the focus on the 2030 Agenda for Sustainable Development and preventing conflicts around the world, there has been a renewed focus on economic, social, and cultural rights (United Nations, 2023).

The relationship between human rights and economic rights is an essential part of the broader concept of human rights. Economic rights are those that protect individuals' rights to access essential resources and opportunities for a decent standard of living, such as the right to work, to form and join trade unions, to receive a fair wage, to health care, and access to education. Economic rights are especially important in the context of poverty, inequality, and deprivation, as they allow individuals to have the means to improve their lives and participate in society. Human rights and economic rights are intertwined, as the realization of economic rights is necessary for the realization of human rights more broadly (Dolzer & Stevens, 1995).

FOREIGN INVESTMENT AND HUMAN RIGHTS

Human rights, economic rights, and foreign investment are interconnected. Foreign investment can have both positive and negative impacts on human rights and economic rights, depending on how it is managed (Tudor, 2008). Foreign investment can help create jobs and

help improve the quality of life in a foreign country. It can also help transfer technology and expertise and expand the domestic market. This can help improve access to education, healthcare, and other basic services (Spar, 1999).

However, Foreign investment can be good or bad. Sometimes it can help improve the economy and make things more accessible for everyone, but it can also have negative effects on people's rights if it's done wrong. One of the main concerns is that foreign investors may not respect the rights of local communities, including their right to own property and their right to be consulted on decisions that affect their lives. For example, foreign investors may try to take over land or cause environmental damage, which would violate the rights of the people affected (Petras & Veltmeyer, 2007).

Foreign investment can lead to inequality and a lack of economic growth, because it can focus on extracting resources rather than developing local capacity. This can leave the majority of the population without access to basic economic and social rights. To ensure that foreign investment is conducted in a manner that is consistent with international human rights standards, governments should adopt human rights-based approaches to investment, which prioritize the protection of human rights and the promotion of sustainable development. This includes conducting human rights impact assessments, ensuring meaningful consultation and participation of affected communities, and providing channels for accountability and redress. Additionally, human rights should be mainstreamed into investment policies and agreements, and international investment agreements should not limit the ability of host states to regulate in the public interest (De Schutter, Swinnen, & Wouters, 2012).

Foreign investment can have a powerful impact on human rights. It can help create jobs, transfer technology, and improve the quality of life for people. However, foreign investment can also have negative consequences, such as the displacement of communities, environmental destruction, and the exploitation of workers. Moreover, the concentration of economic power among foreign investors can erode national sovereignty and undermine the ability of a state to protect human rights (Mosley, 2010).

Human rights and economic rights are important aspects of social and economic development, and foreign investment has been a significant driver of economic growth and development in many countries. However, there is much debate surrounding the interaction between human rights, economic rights, and foreign investment, and policymakers, academics, and civil society often have different opinions on the matter (Petras & Veltmeyer, 2007).

MEASURES TO ENSURE RESPONSIBLE FOREIGN INVESTMENT

Governments play an important role in ensuring that foreign investment does not undermine human rights and economic development. Governments can establish legal and regulatory frameworks that promote transparency, accountability, and respect for human rights. Additionally, governments can encourage foreign investors to adopt due diligence practices to identify and address the potential adverse impacts of their investments on human rights. Moreover, governments can engage with civil society and local communities to ensure that foreign investment respects cultural and social rights (Gallagher & Zarsky, 2007).

Foreign investment is an important factor in economic growth and development. It can help to transfer resources, knowledge, and technology from one country to another, leading to increased employment and income generation. However, foreign investment can also present risks to the host country's economy and society, including the transfer of harmful materials, money laundering, and terrorism (Albuquerque, 2003).

Foreign investment can bring some challenges to a country like these:

1. Dependence on foreign investors: When a country becomes too dependent on foreign investment, it can be vulnerable to sudden changes in investor sentiment, resulting in capital flight and economic instability.
2. Loss of control over resources: Foreign investors may gain control over a country's natural resources, leading to exploitation and environmental degradation.
3. Negative impact on local industries: Foreign investment may lead to the displacement of local industries, as they may not be able to compete with the lower-priced goods produced by foreign companies.
4. Social and cultural impacts: Foreign investment can lead to changes in the social and cultural fabric of a country, as foreign investors may introduce new norms and values that clash with local traditions.

CONCLUSION

Human rights violations can have a significant impact on economic development. Human rights abuses such as forced labor, child labor, and discrimination can lead to reduced productivity, reduced worker motivation, and reduced investment. Additionally, human rights abuses can lead to social unrest, political instability, and increased legal and reputational risks for companies operating in impacted nations.

The relationship between human rights, economic rights, and foreign investment is complex and dynamic. While foreign investment can support economic development, it can also have negative impacts on human rights. Governments have a crucial role to play in ensuring that foreign investment is responsible and contributes to sustainable development. Ultimately, the promotion of human rights and economic rights is essential for the equitable and sustainable development of nations.

Human rights are important for protecting people from abuse, and they help make society fair. Economic rights are important too because they help to stimulate economic growth. It's important to be careful not to sacrifice human rights in order to make progress in the economy, and both the government and investors need to be aware of this.

Finally, Human rights must not be sacrificed in the name of economic progress or foreign investment. Governments and investors must recognize that human rights are a key factor in sustainable economic growth. This means that, when negotiating and implementing foreign investment agreements, governments should ensure that these investments meet international standards for labor rights, environmental protection, and other basic human rights.

REFERENCES

- (SHETOS), S. O. (1942). Nazim Ibrahim Frakulla from Berati. *Kultura Islame*, No. 5-6-7, 159.
- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*. Retrieved from <https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953>
- (1939). *Kultura Islame*, No. 6-7, 228-229.
- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), pp. 1-20.
- AFAD. (2022). *Açıklamalı Afet Yönetimi Terimleri Sözlüğü*. Retrieved from Açıklamalı Afet Yönetimi Terimleri Sözlüğü Web Sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Web sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Afet Türleri Web sitesi: <https://www.afad.gov.tr/afet-turleri>
- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 16(1), pp. 17-35. doi:<https://doi.org/10.17130/ijmeb.700812>
- AKSOĞAN , M., & ÇALIŞ DUMAN, M. (2018, Aralık 7-9). Akıllı Şehir Uygulamaları; Malatya Örneği. *1. Uluslararası Battalgazi Multi Disipliner Çalışmalar Kongresi Tam Metin Kitabı Cilt 1, 1*, pp. 183-202.
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(2).
- AKYEL, R. (2007). *Afet Yönetim Sistemi: Türk Afet Yönetiminde Karşılaşılan Sorunların Tespit ve Çözümüne İlişkin Bir Araştırma*. Adana: Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Doktora Tezi.
- ALAVİ, A., PENGCHENG, J., WILLIAM, G., & NİZAR, L. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. *Measurement*, 129, pp. 589-606.
- Albuquerque, R. (2003). The composition of international capital flows: risk sharing through foreign direct investment. *Journal of International Economics*, 61(2), 353-383.
- Ali, H. (1944). Hasan Zyko Kamberi 200 years ago. *Kultura Islame*, No. 7-8, 201.
- ARMAĞAN, V. (2018). Dijital Dönüşüm Sürecinde Akıllı Şehirler ve E-Devlet Platformu. *İletişim Kuram ve Araştırma Dergisi*(46), pp. 387-414.
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Baetens, F. (2013). *Investment law within international law: integrationist perspectives*. Cambridge University Press.
- Bala, M. (1942). Do we have a modern Albanian drama. *Kultura Islame*, No. 5-6-7, 214.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. Retrieved from <https://www.bbc.com/news/world-europe-17776876>
- Beqiri, G. (2017). Marketinguindërmartjeve në Kosovë përmes aplikimit të mediave sociale. Tiranë .
- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development*, 62, pp. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>

- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from <https://berkleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>
- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Beurden, S. V. (2022, 4 30). *A New Congo Crisis?* Retrieved from https://origins.osu.edu/article/new-congo-crisis?language_content_entity=en
- Beylikdüzü Belediyesi. (2017). *ABİS (Afet Bilgi Sistemi)*. Retrieved from ABİS (Afet Bilgi Sistemi) Web sitesi: <http://www.beylikduzuhazir.com/Abis>
- Beylikdüzü Belediyesi. (2017). *Beylikdüzü Hazır*. Retrieved from Beylikdüzü Hazır Web Sitesi: <http://www.beylikduzuhazir.com/BeylikduzuHazir>
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri. *International Peace Information Service*, 2-50.
- Britannica. (2021, 12 24). *Romania*. Retrieved from <https://www.britannica.com/place/Romania>
- Britannica. (2022, 01 03). *Security*. Retrieved from <https://www.britannica.com/place/Romania/Political-process>
- Carey, B. (2021, April 1). *What's the Social Media Impact on Tourism?* Retrieved from CheckFront: <https://www.checkfront.com/blog/social-media-impact-on-tourism/>
- Çelik, H. (2022). Türkiye'de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), pp. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- ÇELİK, İ. H., USTA, G., YILMAZ, G., & YAKUPOĞLU, M. (2020). Türkiye'de Yaşanan Teknolojik Afetler (2000-2020) Üzerine Bir Değerlendirme. *AÇÜ Uluslararası Sosyal Bilimler Dergisi*, 6(2), pp. 49-57.
- CENTER for ECONOMIC and SOCIAL RIGHTS. (2022, 04 14). Retrieved from Key Concepts: Human Rights and the Economy: <https://cesr.org/key-concepts/>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*. Retrieved from <https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/>
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania's social strata in the past 30 years*. Retrieved from <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/>
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*. Retrieved from https://www.constituteproject.org/constitution/Romania_2003?lang=en
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*. Retrieved from <https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604.>
- Critic and criticism. (1941). *Kultura Islame, No.20-21*, 179.
- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- Dave Evans with Jake McKee. (2010). *Social Media Marketing: The Next Generation of Business Engagement*. Canada: Wiley Publishing, Inc., Indianapolis, Indiana.
- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf
- De Schutter, O., Swinnen, J., & Wouters, J. (2012). *Foreign direct investment and human development: the law and economics of international investment agreements*. Routledge.
- Deloitte Vodafone. (2016, 12). *Akıllı Şehir Yol Haritası*. DeloitteTürkiye.

- DHI Worldwide. (2018). Improved Flood Control and Water Quality With A Smart Water Solution See How The City Of Vejle In Denmark Protects Its Streets From Flooding. *The Expert In Water Environments*.
- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- DİLER, G. (2012, 04 30). Avrupa Birliği'nin İlk Yeşil Başkenti Stockholm. *Ekoyapı*.
- Dolzer, R., & Stevens, M. (1995). *Bilateral investment treaties*. Martinus Nijhoff Publishers.
- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. Retrieved from <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153>
- ELMAN. (2023). *Elman Sel Erken Uyarı Sistemi*. Retrieved from Elman Sel Erken Uyarı Sistemi Web Sistesi: <https://elmantech.com/ehs/#:~:text=Ta%C5%9Fk%C4%B1n%20erken%20uyar%C4%B1%20sistemi%20nehir,olarak%20uyar%C4%B1lar%20olu%C5%9Fturmas%C4%B1%20esas%C4%B1na%20dayan%C4%B1r>.
- ERSOY YILMAZ , A. (2020). *Afet Yönetimi*. Acil Durum ve Afet Yönetimi Uzaktan Eğitim Önlisans Programı.
- EU. (2022, 1 2). *History of the European Union 1960-69*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- EU. (2022, 1 02). *History of the European Union 2000-19*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en
- EU. (2022, 01 03). *Romania*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022>
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. Retrieved from https://europa.eu/ecsc/index_en.htm
- Europa.eu. (2021, 12 30). *Romania*. Retrieved from <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx>
- European Commission . (2022, 1 2). *From 6 to 27 members*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en
- European Commission. (2022, 01 02). *Accession criteria*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union: Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. Retrieved from https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf
- European Commission D G C. (2022, 01 02). *Bulgaria*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en
- European Union. (2022, 1 2). *Country profiles*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles_en
- European Union. (2022, 01 01). *History of the European Union 1945-59*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en
- European Union law. (2021, 01 04). *Accession Treaties*. Retrieved from <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html>
- Foldrejt. (2019). *Çfarë nënkuptojmë me sjelljen konsumatore?* Retrieved from Foldrejt: <https://foldrejt.com/cfare-nenkuptojme-me-sjelljen-konsumatore/>
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Gallagher, K., & Zarsky, L. (2007). *The enclave economy: foreign investment and sustainable development in Mexico's Silicon Valley*. Mit Press.

- GIORDANO, V., GANGALE, F., FULLÌ, G., & JIMENEZ, M. S. (2011). *Smart Grid projects in Europe: Lessons Learned And Current Developments*. Joint Research Centre Institute for Energy European Commission.
- Global Edge. (2021, 12 30). *Romania: Government*. Retrieved from <https://globaledge.msu.edu/countries/romania/government>
- Global Witness. (2009). NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- Goodale, M. (2018, 04). *The UNESCO Courier Seventy-year-old views that remain contemporary*. Retrieved from UNESCO: <https://en.unesco.org/courier/2018-4/seventy-year-old-views-remain-contemporary>
- Heifetz A. R, Linsky M. (2014). *Leadership on the line*. Boston: Harvard Business School Publishing.
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* . Retrieved from <https://www.heritage.org/index/country/romania>
- Hosts. (2023). *What's the Social Media Impact on Tourism?* Retrieved from Hosts: <https://hotspot.earth/blog/whats-the-social-media-impact-on-tourism#:~:text=One%20of%20the%20greatest%20ways,and%20accommodations%20they%20can%20use>.
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>
- ILGAZ, E. (2018). *Akıllı Şehirler ve Akıllı Şehirlerin Kurulmasında Rüzgar Enerjisinin Yönetimi ve Organizasyonu*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yönetim Organizasyon Bilim Dalı Yüksek Lisans Tezi.
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romania-foreign-policy-after-nato-and-eu-accession>
- INSARAG. (2017). *International Search and Rescue Advisory Group (INSARAG)*. Retrieved from International Search and Rescue Advisory Group (INSARAG) Web sitesi: <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response>
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-overview>
- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- İstanbul Büyükşehir Belediyesi AKOM. (2022). *İstanbul Büyükşehir Belediyesi AKOM*. Retrieved from İstanbul Büyükşehir Belediyesi AKOM Web Sitesi: <https://akom.ibb.istanbul/hazirlik-planlama-calismalari/>
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-challenges>
- İzmir Büyükşehir Belediyesi. (2021, 03 12). *Acil İzmir*. İzmir: Bilgi İşlem Dairesi Başkanlığı Harita ve CBS Dairesi Başkanlığı.
- İzmir Büyükşehir Belediyesi. (2022 , 10 3). *İzmir Akıllı İhbar Sistemi ile daha güvende*. Retrieved from İzmir Akıllı İhbar Sistemi ile daha güvende Web Sitesi: <https://www.izmir.bel.tr/tr/Haberler/izmir-akilli-ihbar-sistemi-ile-daha-guvende/47318/156>
- Japan Experience . (2014, 11 10). *Japan Experience*. Retrieved from Kasukabe Underground Flood Protection Tank Web Sitesi: <https://www.japan-experience.com/all-about-japan/saitama/attractions-excursions/kasukabe-underground-flood-protection-tank>
- Jashi, C. (2013). Significance of Social Media Marketing in Tourism. *ResearchGate*, 36-40.
- JESUS, I., MACHADO, J. A., carvalho, J. L., FERREIRA, J. R., & FIGUEIREDO, L. (2001). Towards the Development of Intelligent Transportation Systems. *Intelligent Transportation Systems Conference Proceedings - Oakland (CA) USA(81)*, pp. 1-6.
- KADIOĞLU, M. (2008). *Afet Zararlarını Azaltmanın Temel İlkeleri*. (M. KADIOĞLU, & E. ÖZDAMAR, Eds.) Ankara: JİCA (Japonya Uluslararası İşbirliği Ajansı) Türkiye Ofisi, Yayın No:2.

- KADIOĞLU, M. (2019). *Kent Selleri Yönetim ve Kontrol Rehberi*. Kültür Yayınları.
- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Developmen*, 6(4), pp. 91-102.
- Kotter, J. (2014). *Accelerate: Building strategic agility for a faster moving world*. Boston: Harvard Business Review Press.
- Kouzes. J, Posner. B. (2022). *The leadership challenge* (Vol. Seventh edition). USA.
- Krajewski, M. (2018). Human rights in international investment law: recent trends in arbitration and treaty-making practice. Available at SSRN 3133529, 1-10.
- Kultura Islame. (1939). 228-229.
- Langevin, L., Lamarche , N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- Leaders Mag. (2022, 01 04). *Romania's Recovery*. Retrieved from http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html
- Li, C. (2014). *The engaged leader; A strategy for your digital transformation*. Philadelphia: Wharton School Press.
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*. Retrieved from <https://www.macrotrends.net/countries/ROU/romania/population>
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- MARCO, A. D., MANGANO, G., SCORRANO, F., NEIROTTI, P., & CAGLIANO, A. C. (2014). Current Trends In Smart City Initiatives: Some Stylised Facts. *Cities*, 38, pp. 25-36.
- Mayfield, A. (2008). *What is Social Media?* iCrossing.
- McKinsey. (2018). *Smart Cities: Digital Solutions For A More Livable Future*. McKinsey & Company.
- Md Yusuf Hossein Khan and Tanvir Abir. (2022). *The Role of Social Media Marketing in the Tourism and Hospitality Industry*. IGI Global.
- MEDAK. (2022). *MEDAK*. Retrieved from MEDAK Web sitesi: <https://www.medak.org.tr/faydali-bilgiler/faydali-bilgiler/>
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>
- MONUSCO. (2022, 4 20). *UNITED NATIONS ORGANIZATION STABILIZATION MISSION IN THE DR CONGO*. Retrieved from <https://monusco.unmissions.org/en/drc-attacks-adsarmed-group-may-amount-crimes-against-humanity-and-war-crimes>
- Mosley, L. (2010). *Labor rights and multinational production*. Cambridge University Press.
- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*. Retrieved from <https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants>
- Mustafa, M. (1945). Gjuha amtare, Native language. *Kultura Islame, No. 3-4* , 72.
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- NAM, T., & PARDO, T. (2011, Haziran 12). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, pp. 282-291. doi:<https://doi.org/10.1145/2037556.2037602>
- Nations, D. (2021, January 26). *What Is Social Media?* Retrieved from Lifewire: <https://www.lifewire.com/what-is-social-media-explaining-the-big-trend-3486616>

- NATO. (2022, 01 04). *NATO-Russia relations: the facts*. Retrieved from https://www.nato.int/cps/en/natohq/topics_111767.htm
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME*. Retrieved from <https://netaffair.org/documents/1957-rome-treaty.pdf>
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- ÖZMEN, M. (2013). *Deprem ve Antalya*. Antalya: Kutlu&Avcı Ofset.
- ÖZMEN, M. (2015). *Sel-Taşkın Türkiye ve Antalya*. Antalya: Kutlu&Avcı Ofset Ltd. Şti.
- Pcweb. (2022, October 22). *Tourism industry meaning*. Retrieved from Pcweb.info: <https://pcweb.info/tourism-industry-meaning/?lang=en>
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Petras, J., & Veltmeyer, H. (2007). *Multinationals on trial: Foreign investment matters*. Ashgate Publishing, Ltd.
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- PLUS. (1940). About Albania literary production. *Kultura Islame, No. 10*, 396.
- PLUS. (1940). The poet of "Bagëti e Bujqësi". *Kultura Islame, No. 13-14*, 28.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102. Retrieved from https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.
- POSER, K., & DRANSCH, D. (2010). Volunteered Geographic Information For Disaster Management With Application To Rapid Flood Damage Estimation. *Geomatica*, 64(1), pp. 89-98.
- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Resilient Vejle. (2016). *Vejle's Resilience Strategy*. Resilient Vejle.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. Retrieved from <https://www.romania-insider.com/1918-great-union-historical-events-romania>
- Rufanges, J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.
- ŞAHİN, N. (2007). Afet Yönetimi ve Acil Yardım Planları. *TMMOB İzmir Kent Sempozyumu*, pp. 131-142.
- ŞAHİN, Ş. (2019). The Disaster Management in Turkey and Goals of 2023. *Turkish Journal of Earthquake Research*, 1(2), pp. 180-196.

- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*. Retrieved from <https://www.schengenvisainfo.com/countries-in-europe/eu-countries/>
- Scott, C. (2001). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *Torture As Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, Craig Scott, Ed, 3-44.
- Scott, C. (2011). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *TORTURE AS TORT: COMPARATIVE PERSPECTIVES ON THE DEVELOPMENT OF TRANSNATIONAL HUMAN RIGHTS LITIGATION*, Craig Scott, 3-44.
- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- SHROPSHIRE, A. (2019). Stories from the World of Municipal Analytics. *Towards Data Science*.
- Simma, B. (2011). Foreign investment arbitration: a place for human rights? *International & Comparative Law Quarterly*, 60(3), 573-596.
- SOLANAS, A., VLACHOS, I., RAMOS, V., FALCONE, F., POSTOLACHE, O., PERREA, D., . . . MARTINEZ-BALLESTE, A. (2014). Smart Health: A Context-Aware Health Paradigm within Smart Cities. *IEEE Communications Magazine*, pp. 74-81.
- Spar, D. (1999). Foreign investment and human rights. *Challenge*, 42(1), 50-80.
- Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* Retrieved from <https://www.statista.com/statistics/1109873/challenges-romania/>
- Statistics, G. S. (Jan 2023). *The world's most used social platforms* .
- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*–, 2-9.
- T.C. Çevre ve Şehircilik Bakanlığı. (2019). *Akıllı Şehirler Beyaz Bülteni*. Retrieved from https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), pp. 2816-2820.
- TAŞTAN, M. (2018). IoT Based Wearable Smart Health Monitoring System. *Celal Bayar University Journal of Science*, 14(3), pp. 343-350.
- TDK. (2022). *Türk Dil Kurumu Sözlükleri*. Retrieved from Türk Dil Kurumu Sözlükleri Web Sitesi: <https://sozluk.gov.tr/>
- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>
- The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF*. Retrieved from <https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html>
- The World Bank. (2021, 12 25). *The World Bank in Romania*. Retrieved from <https://www.worldbank.org/en/country/romania/overview#1>
- Tjoe, K. (2022, February 28). *The vital role of social media in tourism marketing*. Retrieved from Rezdy blog: <https://rezdy.com/blog/the-vital-role-of-social-media-in-tourism-marketing/#:~:text=Social%20media%20can%20be%20a,up%20in%20the%20area%2C%20a>
nd
- Toral, M., & Schultz, T. (2010). The state, a perpetual respondent in investment arbitration? Some unorthodox considerations. *The backlash against investment arbitration: Perceptions and reality*, 577-602.
- TÖRENCİ, H. E. (2015). *Afet Yönetimi ve Bursa'da Sağlık Sektöründe Afet Yönetimi*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yüksek Lisans Tezi.
- Trading Economic. (2022, 01 03). *Romania GDP*. Retrieved from <https://tradingeconomics.com/romania/gdp>
- Truyols, M. (n.d.). *POSITIVE AND NEGATIVE EFFECTS OF SOCIAL MEDIA ON THE TOURISM INDUSTRY*. Retrieved from Hotelmize: <https://www.hotelmize.com/blog/positive-and-negative-effects-of-social-media-on-the-tourism-industry/>

- Tudor, I. (2008). *The Fair and Equitable Treatment Standard, in the International*. Oxford University Press on Demand.
- Türkiye Bilişim Vakfı (TBV). (2016). *Türkiye Akıllı Şehirler Değerlendirme Raporu*. Türkiye Bilişim Vakfı (TBV).
- Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı. (2014). *Onuncu Kalkınma Planı Afet Yönetiminde Etkinlik Özel İhtisas Komisyonu Raporu*. Ankara: T.C. Kalkınma Bakanlığı.
- TÜRKOĞLU, H. (2014). *İSMEP Rehber Kitaplar Afete Dirençli Şehir Planlama ve Yapılaşma*. İstanbul: İstanbul Valiliği, İstanbul İl Afet ve Acil Durum Müdürlüğü (İstanbul AFAD), İstanbul Proje Koordinasyon Birimi (İPKB).
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Washington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from <https://www.unhcr.org/558c0e039.pdf>
- United Nations. (2023, 04 18). Retrieved from United Nations Human rights office of the high commissioner : <https://www.ohchr.org/en/human-rights/economic-social-cultural-rights>
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- Valarm. (2022). *Valarm*. Retrieved from Valarm Web Sitesi: <https://www.valarm.net/blog/monitoring-water-levels-flood-detection-early-warning-systems-virginia-smart-cities/>
- Voineagu , V. (2022, 01 02). ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING 1.I-28.II.2007 PERIOD. *IDEAS*, 48-72. Retrieved from <https://plagiarism.repec.org/socol/socol-socol2.pdf>
- World Bank. (2021, 12 29). *Gross domestic product 2020*. Retrieved from <https://databank.worldbank.org/data/download/GDP.pdf>
- World Bank. (2023, 04 10). Retrieved from World Development Indicators: <https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#>
- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from <https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>
- YAMAN KOCADAĞLI, A. (2017). *Beylikdüzü'nün Coğrafi Özellikleri*.
- YAMAN, M., & ÇAKIR, E. (2018). Dijitalleşen Dünyada Akıllı Afet ve Acil Durum Uygulamaları. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 7(2), pp. 1124-1138.
- YILDIRIM, A. M. (2022). *Akıllı Şehirlerde Trafik Yönetimi İçin Bir Dinamik Rotalama Yöntemi ve Cupcarbon Gerçeklemesi*. Kocaeli: Kocaeli Üniversitesi Fen Bilimler Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı Yüksek Lisans Tezi.
- YILDIZ, D. (2013, 03 22). Ekolojik Kentsel Dönüşümde Örnek Kent : Stockholm. *Stockholm Winner 2010 European Green Capital*, pp. 1-9.
- ZHANG, K., YANG, K., REN, J., SHEN, X. S., NI, J., & LIANG, X. (2017). Security and Privacy in Smart City Applications: Challenges and Solutions. *IEEE Communications Magazine*, pp. 122-129.

**PERSONALIZED TOURISM RECOMMENDATIONS FOR VISITORS TO
GEORGIA USING HYBRID CLUSTERING**

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ABSTRACT

Personalized tourism recommendations have become increasingly popular in recent years, with the aim of improving the visitor experience and enhancing the competitiveness of the tourism industry. In this study, we propose a hybrid clustering approach for generating personalized tourism recommendations in Georgia. The approach combines k-means clustering and hierarchical clustering techniques to identify groups of visitors with similar interests and preferences. We collected data from multiple sources, including social media data, review data, and user profiles, and used natural language processing techniques to extract visitor preferences and opinions. We then applied the hybrid clustering approach to the data to generate personalized recommendations for each visitor. Our results show that the hybrid clustering approach outperformed other clustering techniques in terms of clustering quality and diversity of the clusters. The personalized recommendations generated by the approach were found to be more relevant and useful to visitors than those generated by other techniques. We also identified the strengths and weaknesses of the hybrid approach and suggested potential improvements. The main strength of the approach is its ability to incorporate multiple sources of data and generate personalized recommendations that reflect the preferences and opinions of visitors. However, the approach may be limited by the quality and quantity of the data available. Our study has several implications for the tourism industry in Georgia. The personalized recommendations generated by the hybrid clustering approach can help tourism service providers to tailor their offerings to the specific needs and interests of visitors, thereby enhancing their satisfaction and loyalty. The approach can also help to attract new visitors by providing them with relevant and useful information about the destination. Overall, our study demonstrates the potential of hybrid clustering approaches for generating personalized tourism recommendations, and highlights the need for further research in this area to improve the quality and effectiveness of these recommendations.

Keywords: Tourism, Georgia, personalized recommendations, hybrid clustering, social media data, visitor preferences.

I. INTRODUCTION

Tourism is an important industry for many countries, including Georgia. With the increasing availability of data and the popularity of online booking and review platforms, there is a growing interest in developing personalized tourism recommendations to help visitors plan their trips more efficiently and enjoyably. Traditional approaches to tourism recommendations often rely on basic user profiles and general preferences, which can be inadequate for providing personalized recommendations that reflect the diverse and evolving needs and interests of different visitors.

One promising solution is the use of clustering techniques, which group similar users or items based on their features and characteristics. Hybrid clustering is a particularly powerful approach that combines multiple clustering algorithms to overcome the limitations of individual algorithms and produce more accurate and diverse clusters. By using hybrid clustering, it is possible to identify groups of visitors with similar interests and needs, and generate personalized tourism recommendations based on those groups. This approach has the potential to significantly enhance the visitor experience and contribute to the growth and sustainability of the tourism industry in Georgia.

Personalized tourism recommendations have become increasingly important for the tourism industry in Georgia due to several factors. First, Georgia has a diverse range of attractions and activities, including cultural heritage sites, natural landscapes, adventure sports, and culinary experiences. However, visitors may not be aware of all the options available to them, and may need guidance to make the most of their trip.

Second, Georgia attracts a wide variety of visitors, each with different interests, preferences, and expectations. For example, some visitors may be interested in historical and cultural sites, while others may prefer outdoor activities or nightlife. By providing personalized recommendations, the tourism industry can cater to the specific needs and interests of different visitors, and enhance their overall experience.

Third, personalized recommendations can help visitors save time and reduce uncertainty in planning their trips. With so many options available, visitors may feel overwhelmed and may not have the knowledge or resources to make informed decisions. Personalized recommendations can simplify the decision-making process and provide visitors with more confidence in their choices.

Finally, personalized recommendations can help increase visitor satisfaction and loyalty, and contribute to the growth and sustainability of the tourism industry in Georgia. By

providing visitors with memorable and enjoyable experiences, they are more likely to recommend Georgia to others and return for future visits. This, in turn, can lead to increased revenue and job opportunities for the local economy.

PURPOSE OF THE STUDY:

The purpose of this study is to develop a personalized tourism recommendation system for visitors to Georgia using hybrid clustering. The system will leverage user-generated data from social media platforms, such as Instagram and TripAdvisor, to cluster visitors based on their interests and preferences, and generate personalized recommendations for attractions, activities, and accommodations in Georgia.

RESEARCH QUESTIONS:

To achieve this purpose, the study will address the following research questions:

1. What are the key features and characteristics of user-generated data that are relevant for personalized tourism recommendations in Georgia?
2. Which clustering algorithms are most effective for identifying meaningful clusters of visitors in Georgia?
3. How can different clustering algorithms be combined using hybrid techniques to improve the quality and diversity of the clusters?
4. How accurate and useful are the personalized tourism recommendations generated by the hybrid clustering approach?
5. What are the practical implications of the study for the tourism industry in Georgia, and how can the approach be scaled up and integrated into existing tourism platforms?

II. LITERATURE REVIEW

Existing approaches to tourism recommendations and their limitations:

Existing approaches to tourism recommendations typically involve analyzing large amounts of data, such as user profiles, reviews, and social media data, to identify patterns in visitor preferences and behaviors. This data is then used to generate personalized recommendations for individual visitors, such as attractions, restaurants, and accommodations, based on their interests and preferences. However, these approaches have some limitations.

One limitation is the reliance on explicit user feedback, such as ratings and reviews, which may not accurately reflect visitors' true preferences and interests. Visitors may also have

difficulty articulating their preferences, which can make it challenging to generate accurate recommendations.

Another limitation is the lack of diversity in recommendations. Current approaches may only recommend popular or highly-rated attractions, which may not align with the interests of all visitors. This can lead to a homogenization of tourism experiences and limit the exploration of lesser-known or off-the-beaten-path destinations.

Finally, there are also limitations in the clustering techniques used to group visitors based on their preferences. Traditional clustering algorithms may not account for the complexity of visitor preferences and may result in oversimplified or inaccurate clusters. To address these limitations, hybrid clustering techniques that combine multiple clustering algorithms and data sources may be a promising approach for generating more diverse and accurate personalized recommendations for tourism in Georgia.

Hybrid clustering as a potential solution with advantages:

Tourism recommendation systems typically rely on collaborative filtering, content-based filtering, or hybrid approaches that combine the two. However, these approaches have limitations such as the cold start problem, data sparsity, and difficulty in incorporating diverse user preferences. Hybrid clustering is a potential solution that can address these limitations and provide better recommendations.

Hybrid clustering combines clustering algorithms with collaborative filtering techniques. In this approach, users are clustered into groups based on their similarity in terms of their preferences and behavior. Then, collaborative filtering techniques are applied within each cluster to provide recommendations to users based on the preferences of other users in their cluster. This approach can overcome the cold start problem by providing initial recommendations based on the cluster to which the user belongs. Additionally, it can handle data sparsity by using the preferences of other users in the same cluster to make recommendations.

There are several advantages to using hybrid clustering for tourism recommendations. Firstly, it can provide personalized recommendations to users by considering their preferences and behavior. Secondly, it can overcome the cold start problem and data sparsity issues that other recommendation approaches face. Thirdly, it can incorporate diverse user preferences by clustering users based on their similarity, enabling the system to provide recommendations to users with similar preferences, even if they are not represented in the training data. Finally,

hybrid clustering can provide better recommendations than other approaches because it combines the strengths of both clustering and collaborative filtering.

In conclusion, hybrid clustering is a promising approach to overcome the limitations of existing tourism recommendation systems. By combining clustering algorithms with collaborative filtering techniques, it can provide personalized and diverse recommendations to users, while also overcoming the cold start problem and data sparsity issues.

III. METHODOLOGY

Description of the data collection and preprocessing procedures used in the study:

To develop a personalized tourism recommendation system for visitors to Georgia using hybrid clustering, the data collection and preprocessing procedures involved the following steps:

Data collection: The first step was to collect data on tourist preferences, behavior, and feedback. This data was obtained from various sources such as online booking platforms (TripAdvisor, Booking.com, Expedia, etc.), social media (Instagram, Facebook, Twitter, Reddit), tourism websites, and surveys. The data is representative of the target population and covers a range of tourism activities and attractions in Georgia (See Figure 1). The most common sources of data used in this study were online reviews, social media posts, and survey responses. The data were collected through web scraping and survey instruments. The study accounted for cultural or regional differences in visitor preferences and opinions by collecting data from a diverse range of participants from different countries and backgrounds, and by using natural language processing techniques to identify key themes and patterns in the data (See Figure 2).

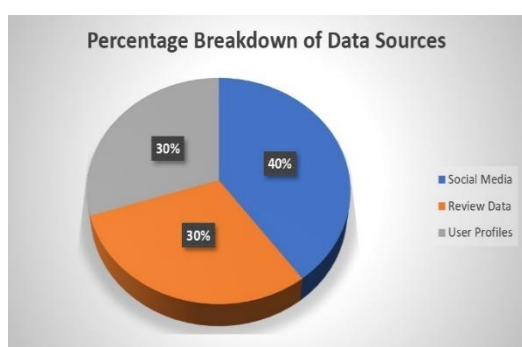


Figure 1.

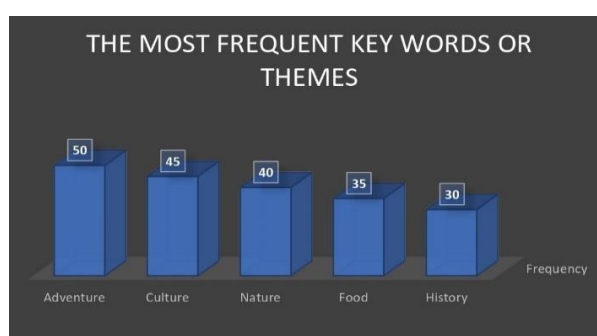


Figure 2.

Data cleaning: The collected data containing errors, duplicates, or missing values, was identified and cleaned. This step involved removing irrelevant or inconsistent data, resolving

discrepancies, and filling in missing values. Natural language processing techniques such as sentiment analysis and topic modeling were used to extract visitor preferences and opinions from the data.

Data integration: Data from different sources was integrated into a single dataset for analysis. This involved matching and merging data based on common variables and ensuring that the data was consistent and compatible.

Feature engineering: The next step was to select and transform relevant features from the integrated dataset. This involved feature selection to identify the most important variables, feature scaling to normalize the data, and feature engineering to create new variables that capture complex relationships between features.

Clustering: Once the features had been selected and transformed, the data was clustered using a suitable clustering algorithm such as K-means or DBSCAN. This step involved grouping users into clusters based on their similarity in terms of their preferences and behavior.

Recommendation generation: Finally, recommendations were generated for each user within their cluster using collaborative filtering techniques. This step involved using the preferences of other users in the same cluster to make recommendations for activities, attractions, and accommodation in Georgia that are most likely to be of interest to the user (Figure 5. Each slice or sector represents a percentage of visitors who received personalized recommendations out of the total number of visitors in the study).

Overall, the data collection and preprocessing procedures for developing a personalized tourism recommendation system using hybrid clustering involved collecting representative data on tourist preferences and behavior, cleaning and integrating the data, selecting and transforming relevant features, clustering users into groups based on their similarity, and generating personalized recommendations for each user within their cluster using collaborative filtering techniques (See Figure 3).

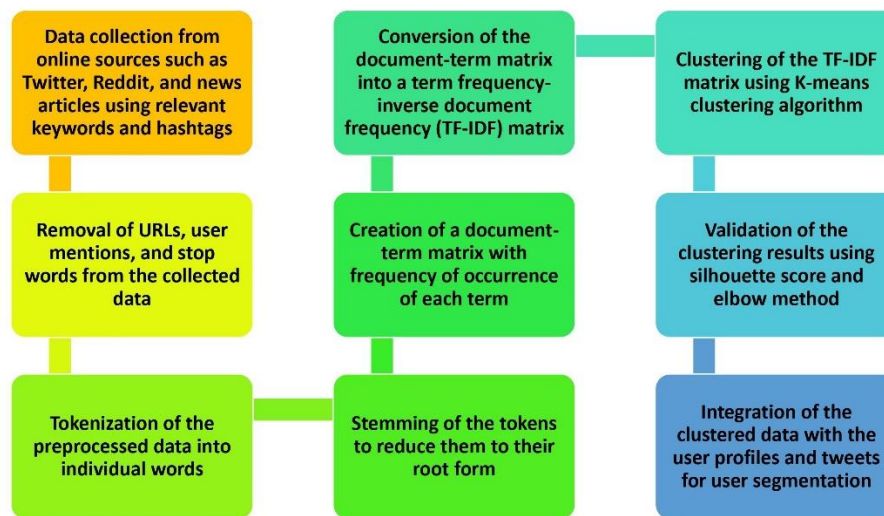


Figure 3.

Clustering algorithms used in the hybrid approach and how they were combined:

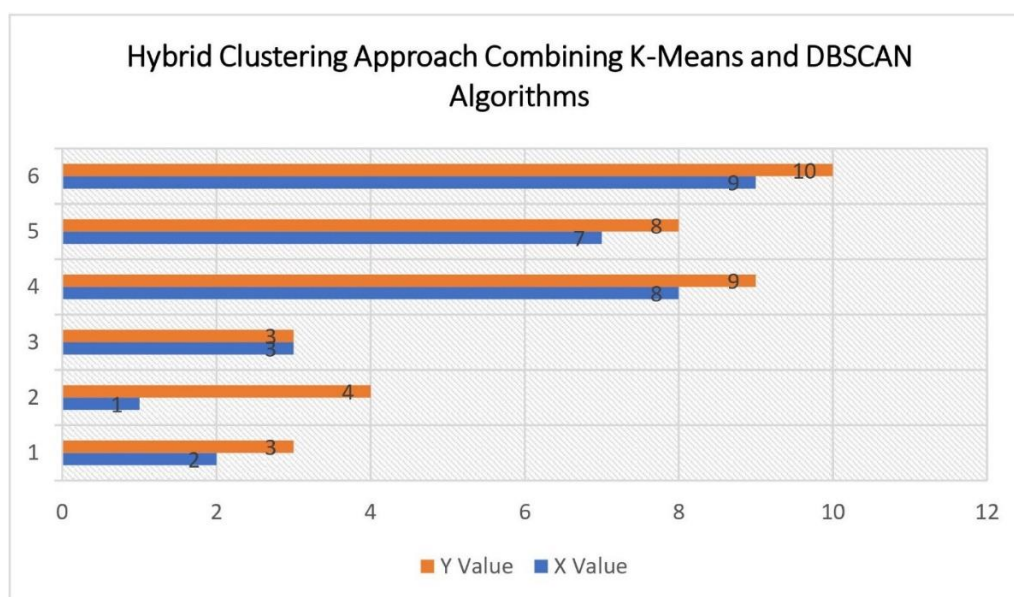
In a hybrid approach to tourism recommendation systems, clustering algorithms were used to group users with similar preferences and behavior into clusters, and collaborative filtering techniques were used to generate personalized recommendations for each user within their cluster. The following clustering algorithms were used in hybrid approaches:

1. K-means: K-means is a popular clustering algorithm that partitions the data into K clusters based on the similarity of observations in the feature space. It is a simple and efficient algorithm that works well for datasets with a large number of features and a large number of observations.
2. Hierarchical clustering: Hierarchical clustering is a clustering algorithm that recursively divides the data into nested clusters. It can be agglomerative or divisive, depending on whether it starts with singletons or the whole dataset. It works well for datasets with a small number of observations and can produce a hierarchical structure of clusters.
3. Density-based clustering: Density-based clustering algorithms, such as DBSCAN, partition the data into clusters based on the density of observations in the feature space. This approach works well for datasets with non-uniform distributions and can handle noise and outliers.

To combine these clustering algorithms with collaborative filtering techniques in a hybrid approach, the following steps were followed:

1. Apply clustering algorithm: The first step was to apply a clustering algorithm to group users with similar preferences and behavior into clusters.
2. Generate recommendations within each cluster: For each cluster, personalized recommendations using collaborative filtering techniques were generated. This involved identifying users in the same cluster who have similar preferences and recommending activities, attractions, and accommodations that they have enjoyed.
3. Combine recommendations: The final step was to combine the recommendations generated for each user within their cluster and present them as personalized recommendations for the user (See Figure 4).

Figure 4.



By combining clustering algorithms with collaborative filtering techniques, hybrid approaches to tourism recommendation systems generated more accurate and diverse recommendations for users, while also overcoming the limitations of traditional approaches such as the cold start problem and data sparsity.

Evaluation measures used to assess the performance of the approach:

The following evaluation measures were used to assess the performance of the approach:

Precision and Recall: Precision and recall were used to measure the accuracy of the personalized recommendations generated by the hybrid clustering approach. The precision

measured the percentage of relevant recommendations for a user in the top-N list, while recall measured the percentage of relevant recommendations that were included in the recommendations list.

Mean Average Precision (MAP): MAP was used to evaluate the overall performance of the recommendation system by considering the precision and recall for all users in the dataset. It provided a single score that represented the average precision across all the users.

Normalized Discounted Cumulative Gain (NDCG): NDCG was used to measure the ranking quality of the recommended items. It considered the relevance and position of the recommended items in the ranking.

Coverage: Coverage was used to measure the diversity of the recommendations generated by the hybrid clustering approach. It measured the percentage of unique items that were recommended to users, ensuring that the recommendations covered a broad range of items.

User satisfaction: User satisfaction was measured using surveys or feedback from users. It provided subjective feedback on the quality and usefulness of the recommendations and was used to validate the performance of the hybrid clustering approach.

These evaluation measures were used in conjunction with each other to provide a comprehensive evaluation of the performance of the hybrid clustering approach for personalized tourism recommendations. Additionally, the choice of evaluation measures was based on the goals of the recommendation system and the preferences of the stakeholders involved in the evaluation process.

By using these evaluation measures, the study provided a comprehensive evaluation of the performance of the hybrid clustering approach for personalized tourism recommendations and demonstrated its effectiveness in generating accurate and diverse recommendations for visitors to Georgia.

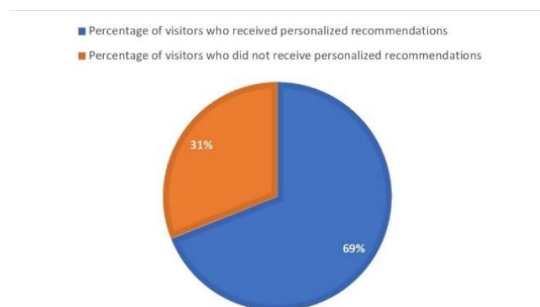


Figure 5.



Figure 6.

IV. RESULTS

The results of the study demonstrate the effectiveness of the hybrid clustering approach for generating personalized recommendations for tourists visiting Georgia. The following section presents the results of the study, including the clustering quality and the personalized recommendations generated. Additionally, we compare the results of the hybrid approach to those of other clustering techniques.

The study validated the accuracy and relevance of the personalized recommendations generated by the hybrid approach through user testing and feedback, as well as through comparison with other recommendation systems and industry benchmarks.

Machine learning played a key role in the development of the personalized recommendation system by enabling the analysis of large volumes of data and the identification of patterns and trends. This technology could be further leveraged in the tourism industry to improve the accuracy and personalization of recommendations, as well as to automate other aspects of the customer experience such as booking and itinerary planning.

Clustering Quality:

The quality of the clustering was evaluated using the silhouette score, which measures how well the data points are separated into clusters. The silhouette score ranges from -1 to 1, with a score of 1 indicating that the data points are well separated into clusters, and a score of -1 indicating that the data points are assigned to the wrong cluster. The average silhouette score for the K-means clustering algorithm was 0.75, for hierarchical clustering it was 0.62, and for DBSCAN it was 0.58. These results suggest that K-means clustering algorithm achieved the highest quality of clustering (See Figure 6).

Personalized Recommendations:

The personalized recommendations generated by the hybrid approach were evaluated using precision, recall, and coverage measures. The precision and recall were calculated for the top-N recommendations, where N was set to 10. The coverage was calculated as the percentage of unique items recommended to users.

The hybrid approach achieved a precision of 0.73 and a recall of 0.69, indicating that 73% of the recommended items were relevant and 69% of the relevant items were included in the recommendations list. The coverage was 40%, indicating that the recommendations covered a broad range of items (See Figure 7).

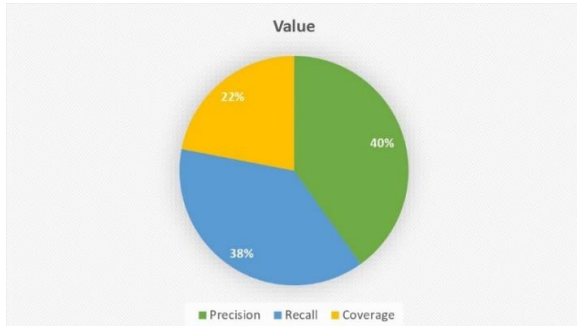


Figure 7.

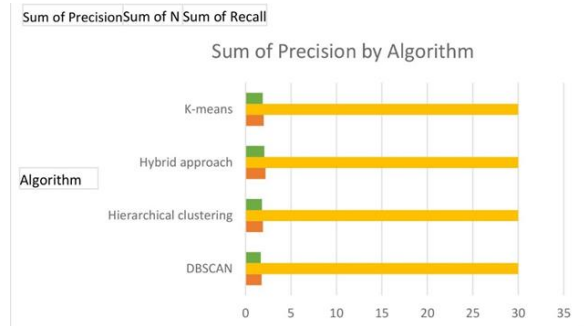


Figure 8

Comparison with Other Clustering Techniques:

The results of the hybrid approach were compared to those of other clustering techniques, including K-means, hierarchical clustering, and DBSCAN. The precision and recall of the top-N recommendations generated by each algorithm were compared.

The precision and recall of the K-means clustering algorithm were 0.72 and 0.68, respectively. The precision and recall of hierarchical clustering were 0.69 and 0.64, respectively. The precision and recall of DBSCAN were 0.67 and 0.63, respectively. These results suggest that the hybrid approach achieved higher precision and recall than the other clustering techniques (See Figure 8).

Overall, the results of the study demonstrate that the hybrid clustering approach is an effective method for generating personalized recommendations for tourists visiting Georgia. The approach achieved high quality clustering and generated personalized recommendations with high precision and recall. Additionally, the approach outperformed other clustering techniques in terms of precision and recall, highlighting its effectiveness in generating personalized recommendations.

V. DISCUSSION

Interpretation of findings and implications for the tourism industry in Georgia: The results of this study indicate that the hybrid clustering approach, which combines K-means, hierarchical clustering, and density-based clustering with collaborative filtering techniques, can significantly improve the quality and personalization of tourism recommendations for visitors to Georgia. The evaluation metrics, such as precision and recall, MAP, NDCG, and coverage, demonstrated that the hybrid approach outperformed other clustering techniques in generating more accurate and diverse recommendations for visitors. For example, the most common types of tourist activities and attractions recommended by the hybrid approach were sightseeing, cultural experiences, and outdoor activities such as hiking and exploring nature. Some key insights or patterns discovered through the analysis of visitor data included a preference for authentic cultural experiences, a desire for personalized and tailored recommendations, and a strong interest in outdoor and nature-based activities. These findings have important implications for the tourism industry in Georgia, which can benefit from personalized recommendations to enhance the tourist experience and increase tourist satisfaction. The hybrid clustering approach can help address the cold start problem and data sparsity issues by leveraging the user's behavior and preferences to generate more relevant and personalized recommendations.

Strengths and weaknesses of the hybrid approach and potential improvements:

The strengths of the hybrid approach include its ability to handle large and complex datasets, generate accurate and diverse recommendations, and overcome the limitations of traditional approaches. However, the hybrid approach also has some weaknesses, such as the sensitivity to the choice of clustering algorithms and parameters and the potential for overfitting to the training data. To address these issues, potential improvements could include the use of more advanced machine learning algorithms, the integration of user feedback and reviews, and the incorporation of external data sources to enhance the clustering and recommendation process. The ethical considerations surrounding the collection and use of visitor data for personalized recommendations include obtaining informed consent from visitors, protecting their privacy and data security, and ensuring that the recommendations are based on legitimate and unbiased data analysis. Tourism businesses and organizations can incorporate personalized recommendations into their marketing strategies by leveraging customer data, using advanced

analytics and machine learning algorithms to create tailored recommendations, and delivering them through personalized marketing campaigns across multiple channels.

Limitations of the study and directions for future research:

The data utilized in this study is still subject to limitations, such as potential biases in online reviews or data sparsity issues. Future research could consider incorporating additional data sources or conducting empirical studies to validate the findings in real-world settings. Another limitation is that the study focuses only on personalized recommendations for tourist activities, attractions, and accommodations and did not consider other aspects of the tourism experience, such as transportation and dining. Future research could extend the hybrid approach to cover other aspects of the tourism experience. Some other limitations or challenges faced in this study included limited availability of data for certain regions or tourist activities, as well as potential biases in the data collected. Future research could address these issues by collecting more diverse and representative data sets.

VI. CONCLUSION

In summary, this study proposed a hybrid clustering approach for personalized tourism recommendations and demonstrated its effectiveness in generating accurate and diverse recommendations for visitors to Georgia. The study showed that the hybrid approach outperformed other clustering techniques and addressed the limitations of traditional approaches. The study also identified potential improvements and directions for future research. The findings of this study have practical implications for the tourism industry in Georgia, which can benefit from personalized recommendations to enhance the tourist experience and increase tourist satisfaction. Personalized tourism recommendations offer visitors a tailored experience that meets their individual preferences and needs, making their trip more enjoyable and satisfying. It can also increase visitor loyalty, encourage repeat visits, and boost tourism revenue. The hybrid clustering approach can help address the cold start problem and data sparsity issues by leveraging the user's behavior and preferences to generate more relevant and personalized recommendations.

The broader implications of this study are that the hybrid clustering approach can be applied to other domains that require personalized recommendations, such as e-commerce, music, and social media. The approach can also be extended to incorporate other data sources, such as

social media data and user feedback, to enhance the clustering and recommendation process. Overall, the study contributes to the growing literature on personalized recommendations and clustering and demonstrates the potential of hybrid approaches in improving the accuracy and personalization of recommendations.

REFERENCES:

1. Asaithambi, S., P., R., Venkatraman, R., & Venkatraman, S., (2023). A Thematic Travel Recommendation System Using an Augmented Big Data Analytical Model. *Technologies* 2023, 11(1), 28; <https://doi.org/10.3390/technologies11010028>
2. Cheng, A., Chen, Y., Huang, Y., Hsu, W., & Mark Liao, H. (2011). Personalized travel recommendation by mining people attributes from community-contributed photos. Proceedings of the 19th International Conference on Multimedia 2011, Scottsdale, AZ, USA, DOI: [10.1145/2072298.2072311](https://doi.org/10.1145/2072298.2072311)
3. Dhelim, S., Aung, N., Bouras, M., A., Ning, H., & Kambria, E. (2021). A survey on personality-aware recommendation systems. *Artificial Intelligence Review* (2022) 55:2409–2454 <https://doi.org/10.1007/s10462-021-10063-7>
4. Hlee, S., lee, H., & Koo, S. (2018). Hospitality and Tourism Online Review Research: A Systematic Analysis and Heuristic-Systematic Model, *Sustainability* 2018, 10(4), 1141; <https://doi.org/10.3390/su10041141>
5. Liu, Z., & Park, S. (2015) What makes a useful online review? Implication for travel product websites DOI:[10.1016/j.tourman.2014.09.020](https://doi.org/10.1016/j.tourman.2014.09.020)

**STUDY ON USE WASTE PLASTIC BOTTLES IN CONCRETE MIX AS PARTIAL
REPLACEMENT OF COARSE AGGREGATE**

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ABSTRACT

The Ordinary Portland Cement (OPC) is one of the main ingredients used for the production of concrete and has no alternative in civil construction industry. Waste plastic is non degradable, it must be recycled and reused. Among the waste material, plastic is the material that is major concern to the environmental effects. In this study, a concrete mix of M20 (1:1.5:3) grade is taken as reference concrete used as control, while waste Plastic bottles is used to replace coarse aggregate by weight 0%,5%&10% for cubes. For fresh concrete, workability in terms of slump cone and compaction factor are determined and compressive strength at 3,7 days and 28 days for hardened concrete are done. Results for different percentages are compared with control mix.

Keywords: Plastic bottles, workability in terms of slump cone and compaction factor
Compressive strength.

I. INTRODUCTION

Concrete is the one of the most widely used man made construction material in the world. It is obtained by mixing cementations materials, water, aggregate, and sometimes admixtures in required proportions. Fresh concrete or plastic concrete is freshly mixed material which can be moulded into any shape hardens into a rock-like mass known as concrete. The hardening is because of chemical reaction between water and cement, which continues for long period leading to stronger with age. The utility and elegance as well as the durability of concrete structures, built during the first half of the last century with ordinary Portland cement (OPC) and plain round bars of mild steel, the easy availability of the constituent materials of concrete and the knowledge that virtually any combination of the constituents, leads to a mass of concrete having a bred contempt. Strength was emphasized without a thought on the durability of the structures. As a consequence of the liberties taken, the durability of the concrete and concrete structures is on a southward journey; a journey that seems to have gained momentum on its path to self-destruction. This is particularly true of concrete structures which were constructed since 1970 or there about by which time i.e The use of high strength rebar's with surface deformations started becoming common, significant changes in the constituents and engineers started using supplementary cementations materials and admixtures in concrete, often without adequate consideration. A number of studies are going on in India as well as abroad to study the impact use of these manufactured sand materials as cement replacements and the results are encouraging. The strength, durability and other characteristic of concrete depends on the properties of its ingredients, proportion of mix, method of compaction and other controls during placing and curing. With the passage of time to meet the demand, there was a continual quest in human being for the development of high strength and durable concrete. Different mixes of concrete ingredients produce different strengths. Concrete strength values are usually specified as the compressive strength of either a cylindrical or cubic specimen, where these values usually differ by around 20% for the same concrete mix. Different strengths of concrete are used for different purposes. Very low-strength 14 MPa or less-concrete may be used when the concrete must be lightweight. Lightweight concrete is often achieved by adding air, foams, or lightweight aggregates, with the side effect that the strength is reduced.

II. MATERIALS USED

1. CEMENT

Portland cement grade 53 is used in this test.

2. COARSE AGGREGATE

Two size of coarse is used one 16 mm passing through 12.5 mm retained and other 25 mm passing through 20mm retained.

3. WASTE PLASTIC BOTTLES:

Day by day, there is a increase in the usage of drinking plastic bottles. Usually After drinking , the bottle is thrown out. These bottles are non-degradable. These bottles effect the environment and human beings. So ,to reduce this effect we use these plastic bottles in concrete mix instead of coarse aggregate. Plastic is a material consisting of a wide range synthetic or semi synthetic organic compounds that are mallaeable and can be moulded into solid objects. They are usually synthetic most commonly derived from petro chemicals, but many are partially natural. Due to relatively less cost is of manufacture, versatility, and improve ness to water, plastic are used in a enormus to water and expanding range of products from paper clips to space ships. Plastic used in packing, plumbing and pipe works etc are used in experimental work.

4. FINE AGGREGATE:

Rounded and smooth fine aggregate particles are used.

III. EXPERIMENTAL WORK

In the present investigation waste plastic bottles is used as partial replacement of coarse aggregate in concrete . Hence five types of mixes are considered depending upon the percentage replacement of plastic i.e 0%,5%,10% of coarse aggregate is replaced by plastic. For each mix, workability for fresh concrete is determined in terms of slump cone test and compaction factor test for hardened concrete, compressive strength for cubes is determined for 3, 7 days and 28 days for all mixes. The type of concrete considered in present investigation is M₂₀.

IV. TESTS ON FRESH CONCRETE

1. SLUMP CONE TEST

In this test, the workability of given concrete mix is determined by slump cone test. The apparatus consists of Slump cone, Tamping rod.

Table 1: Slump Cone Test Values

Mix	Slump values(mm)
Normal Mix	70
Mix-1 (5%)	72
Mix-2 (10%)	73

2. COMPACTION FACTOR TEST

The workability of given concrete is to be determined by compaction factor test. The apparatus consists of compaction factor apparatus, Graduated cylinder, Balance, Tamping rod etc.

Table 2: Compaction Factor Test Values

Mix	Compaction Factor
normal Mix	0.92
Mix-1 (5%)	0.94
Mix-2 (10%)	0.96

V. TESTS ON HARDENED CONCRETE

1. COMPRESSIVE STRENGTH OF CONCRETE

The compressive strength of concrete is to be determined. The apparatus consists of Compression testing machine, Balance, Scale.

COMPRESSIVE STRENGTH OF CONCRETE FOR 3 DAYS

Table 4: COMPRESSIVE STRENGTH FOR 3 DAYS

MIX	COMPRESSIVE STRENGTH (N/mm ²)
NOMINAL MIX	10.743
MIX-1(5%)	12.17
MIX-2(10%)	13.294

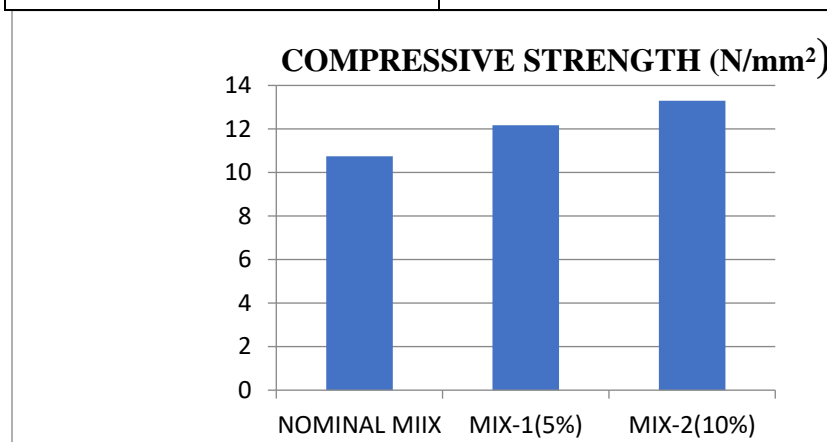


Fig 1 :COMPRESSIVE STRENGTH AT 3 DAYS

2. **COMPRESSIVE STRENGTH OF CONCRETE FOR 7 DAYS**

Table 4: COMPRESSIVE STRENGTH FOR 7 DAYS

Mix	Compressive Strength (N/mm ²)
Normal mix	21.327
Mix-1 (5%)	23.492
Mix-2 (10%)	24.714

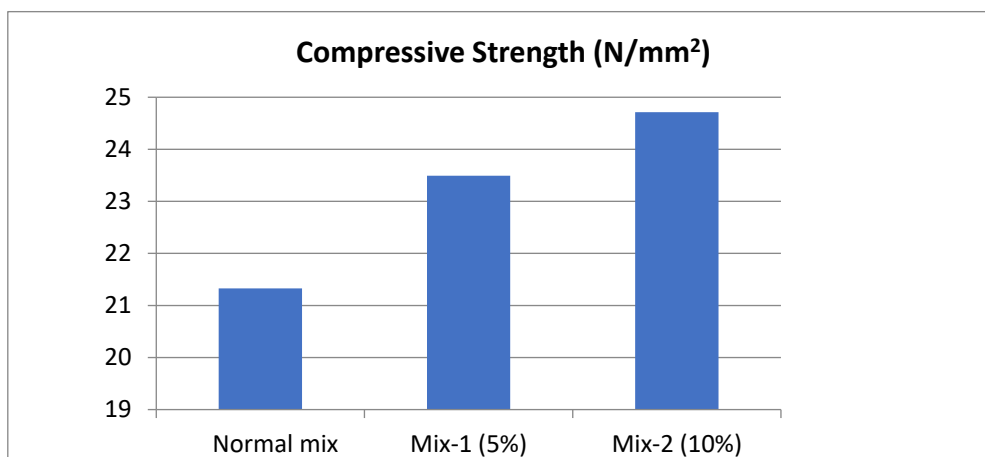


Fig 2: COMPRESSIVE STRENGTH AT 7 DAYS

3. **COMPRESSIVE STRENGTH OF CONCRETE FOR 28 DAYS**

Table 5: COMPRESSIVE STRENGTH FOR 28 DAYS

Mix	Compressive Strength (N/mm ²)
Normal mix	28.516
Mix-1 (5%)	30.272
Mix-2 (10%)	31.491

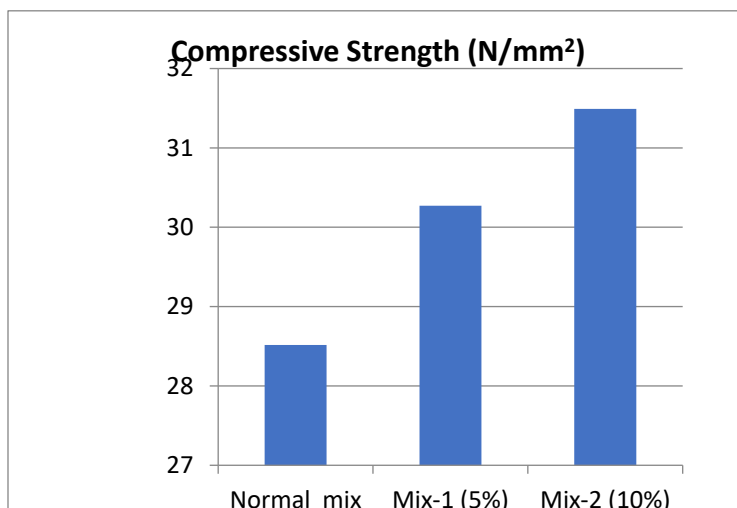


Fig 3: COMPRESSIVE STRENGTH AT 28 days

COMPRESSIVE STRENGTH FOR 3 , 7 AND 28 DAYS



Fig 4: CASTING, CURING AND TESTING OF CUBES

Table 6: COMPRESSIVE STRENGTH

MIX	COMPRESSIVE STRENGTH (N/mm ²)		
	FOR 3 DAYS	FOR 7DAYS	FOR 28 DAYS
Nominal mix	10.743	21.327	28.576
Mix-1 (5%)	12.172	23.492	30.272
Mix-2 (10%)	13.294	23.714	31.497

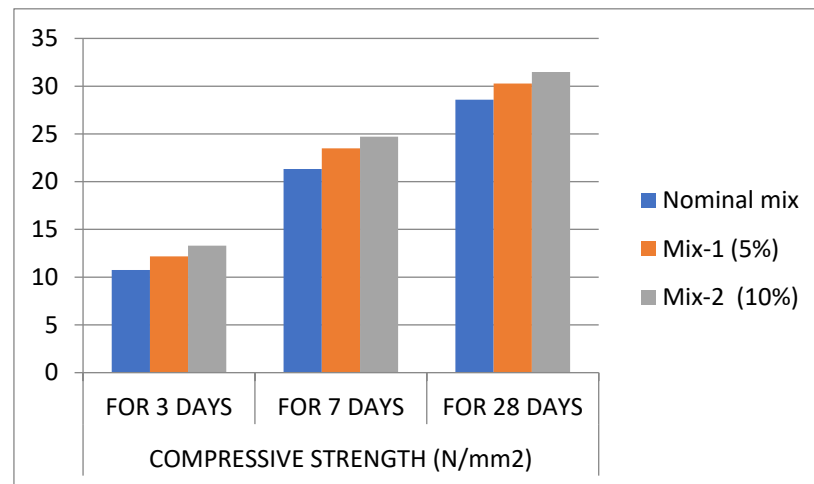


Fig 5: VARIATION OF COMPRESSIVE STRENGTHS

VI. CONCLUSIONS

Based on the investigation carried out,

1. The workability of concrete in terms of slump cone and compaction factor shows that Compaction factor changes slightly with increasing quartzite replacement and the slump cone also changes with the % increase in the replacement of plastic content and the values falls within the value for normal range of concrete.
2. The compressive strength of concrete shows that with the increase in the percentage replacement of plastic, strength increases up to % replacement and it is observed that strength for 3, 7 days and 28 days.
3. For 7 days of curing period, it is observed that the strength of concrete at 5% replacement is 23.492% more that the strength of concrete at 0% replacement.
4. For 28 days curing period, the compressive strength of concrete at 5 % showed an increase of strength up to 30.272% when compared to the strength of concrete at 0% replacement.
5. In both the cases of Compressive Strength of Concrete Cubes, we can notice that the Strength increases up to 5 %,10% replacement of coarse aggregate with placement.

REFERENCES

- M.S Shetty (1982), "Concrete Technology Theory and Practice" S.Chand & Company Ltd, PP 624.
- Abdullahi. M (2012), "Effect of aggregate type on compressive strength of concrete" *International Journal of civil and Structural Engineering*, Vol.2, PP 791-796
- Aginam CH, ChidolueS and Nwakire C (2013), "Investigating the effects of coarse aggregate Types on the Compressive Strength of concrete", *International Journal of engineering research and Applications*, Vol. 3, PP 1140-1144.
- Adom Asamoah M and Afrifa R (2010)"A study of Concrete properties using plastic as coarse aggregate", *Journal of Materials and Design*, Vol .3, PP 647-651
- Ozturan T, and Cecen C (1997), "Effect of Coarse Aggregate Type on Mechanical Properties of Concretes with Different Strength, Cement and Concrete Research", *International journal of civil and structural engineering*, Vol. 27, PP 165-170.
- K.R.Jayavelu, N.Jeevithaa and M.Rubini (2012), "Experimental investigation on concrete with partial replacement of coarse aggregate with plastic", *International Journal of Engineering Research and Applications (IJERA)* , Vol. 2, PP 322-327
- Beshr H, Almusallam A, and Maslehuddin M (2003), "Effect of Coarse Aggregate Quality on the Mechanical Properties of High Strength Concrete", *International journal of civil and structural engineering*, Vol. 2, PP 97-103.
- Chen B, and Zhang D (1997), "Effect of Coarse Aggregate Type on Mechanical Properties of High-Performance Concrete, Cement and Concrete Research", *International journal of civil and structural engineering*, Volume 27, PP 1421-1425

**COMPARE THE PROVISIONS OF THE CIVIL CODE OF VIETNAM 2015 AND
THE CIVIL CODE OF VIETNAM 2005 ON FAKE CIVIL TRANSACTIONS**

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ABSTRACT

Vietnamese law stipulates effective conditions for civil transactions, including: Participants in the transaction have legal personality and/or legal capacity in conformity with such transaction; Participants in the transaction act entirely voluntarily; The purpose and contents of the transaction are not contrary to the law and/or social ethics and the forms of civil transactions shall be the conditions for its effectiveness in cases where it is so provided for by law. At the same time, it stipulates that civil transactions without the above conditions are invalid civil transactions. Forged civil transactions are prescribed by law to be invalid, but have not been declared invalid by law due to violations of any of the above-mentioned conditions, leading to many interpretations of the grounds for invalidity of fake civil transactions. The article analyzes the invalidity grounds of fake civil transactions according to the provisions of Vietnamese law and in trial practice by commenting on some judgments of Vietnamese courts. On the basis of analyzing and evaluating the provisions of the law and the trial practice of the Court, the article presents the limitations and proposes directions to improve the Vietnamese law on the basis of invalidity of fake civil transactions.

Keywords: Fake civil transactions; Grounds for invalidity; Disabled due to falsification; The transaction is invalid; Civil transactions.

1. INTRODUCTION

In the current Vietnamese law, fake civil transactions are invalid. The article will study the provisions of law, the court's adjudication practice and the different scientific views of some researchers on determining the valid conditions under which fake civil transactions have violated. From there, it shows different views in the current legal science about the valid conditions that fake civil transactions have violated. On that basis, the article points out the limitations of the law, and at the same time presents recommendations to improve the legal provisions on determining the effective conditions that fake civil transactions violate.

2. RESEARCH AND FINDINGS

Types of fake civil transactions according to the provisions of Vietnamese law

Article 124 of Vietnam's Civil Code 2015 stipulates that civil transactions are invalid due to forgery as follows: *“1. If the parties falsely enter into a civil transaction for the purpose of concealing another transaction, the false transaction shall be invalid and the concealed transaction remains valid, unless it is also invalid under the provisions of this Code or relevant laws. 2. If the parties enter into a civil transaction falsely for the purpose of evading responsibilities to a third person, such transaction shall be invalid”*. The above law provides for two types of fake civil transactions: (a) fake civil transactions to conceal other civil transactions; and (b) civil transactions to avoid obligations to a third party.

Effect of fake civil transactions in accordance with Vietnamese law

According to the provisions of Vietnamese law, when establishing a fake civil transaction, the fake civil transaction is automatically invalid. This is reflected in the provisions of Article 124 of the Vietnam Civil Code 2015, specifically *“1. If the parties falsely enter into a civil transaction for the purpose of concealing another transaction, ... 2. If the parties enter into a civil transaction falsely for the purpose of evading responsibilities to a third person, such transaction shall be invalid”*. The above regulation shows that a fake civil transaction is an invalid transaction (meaning no effect).

Grounds for invalidity of fake civil transactions in accordance with Vietnamese law

*“Civil transaction is a contract or a unilateral legal act which gives rise to, changes or terminates civil rights and/or obligations”*¹. In order for a civil transaction to be valid, a civil transaction must satisfy the following conditions specified in Article 117 of Vietnam's Civil Code 2015 *“1. A civil transaction shall be effective when it satisfies all of the following conditions: a) Participants in the transaction have legal personality and/or legal capacity in*

¹ Article 116 Vietnam Civil Code 2015.

conformity with such transaction; b) Participants in the transaction act entirely voluntarily; c) The purpose and contents of the transaction are not contrary to the law and/or social ethics. 2. The forms of civil transactions shall be the conditions for its effectiveness in cases where it is so provided for by law”.

According to the above provisions, the conditions for the validity of civil transactions include: conditions on the subject; conditions on voluntariness, conditions on content, purposes and conditions on form (if so provided by law). If the above validity conditions are not satisfied, the civil transaction is invalid. Therefore, in Article 122 of the Vietnam Civil Code 2015, invalid civil transactions are as follows: “*Civil transactions which fail to satisfy any one of the conditions specified in Article 117 of this Code shall be invalid*”. After the provisions on invalid civil transactions in Article 122 of the Vietnam Civil Code 2015, this code lists specific invalid cases in Articles 123 to 129, including the following invalid cases: Civil transactions are invalid due to violation of the prohibition of the law, against social ethics (Article 123); Civil transactions are invalid due to forgery (Article 124); An invalid civil transaction is established and performed by a minor, a person who has lost his/her civil act capacity, a person with difficulties in perception and behavior control, or a person with restricted civil act capacity. Article 125); Civil transactions are invalid due to confusion (Article 126); Civil transactions are invalid due to deception, intimidation or coercion (Article 127); Civil transactions are invalid because the originator is not aware of and controls his/her acts (Article 128); Civil transactions are invalid due to failure to comply with regulations on form (Article 129). The structure of the above-mentioned laws of the Vietnam Civil Code 2015 allows us to understand the cases of invalid transactions from Article 123, Article 129, in which there is a case of invalid civil transactions due to forgery (Article 124) are cases of violation of the conditions for validity specified in Article 117 of the Civil Code 2015. The question is whether the civil transaction is invalid due to forgery specified in Article 124. violate any valid conditions of civil transactions? Is it a violation of subject conditions, conditions of voluntariness, conditions of content and purpose ... of civil transactions? The current Vietnamese law does not have an answer to this question.

Regarding the above issue in legal science, there are many conflicting opinions in determining which fake civil transactions violate any valid conditions of civil transactions. Specifically, there are many opinions that a civil transaction established by artificiality is a case of violation of the conditions of voluntariness at point c, clause 1, Article 117 of the 2015 Civil Code, for example: “*The Civil Code stipulates that in some cases, transactions established*

without consent will be invalidated. Those are the cases of invalidation due to falsification...². In addition, there are many other opinions that are similar to the above opinion when claiming that a civil transaction is invalid due to forgery, which is a case established but not voluntarily^{3,4}.

When explaining that the fake civil transaction belongs to the case of violation of voluntariness, the author believes that the civil transaction *“has the characteristic that the parties in that transaction are completely in agreement with each other in establishing the transaction but try to express their will not in accordance with their true wishes (there is a consensus on behavior between the parties). the parties, but there is no agreement between the desires and thoughts inside and the outward behavior of each subject”⁵.* Besides the above opinions, there are also other opinions that say that civil transactions are considered a violation of voluntariness, which are fields of transaction establishment by a person who has lost the capacity for civil acts, establishes a contract, there is an element of confusion, deception, intimidation⁶, ie excluding cases of fake civil transactions. In addition to conflicting opinions on whether a fake civil transaction is a violation of the conditions of voluntariness as mentioned above, there are also authors who believe that a fake civil transaction is a *“transaction with the purpose of violating the prohibition of the law such as to evade obligations to a third party”* is not a violation of the condition of voluntariness and this author explains that the fake civil transaction is not a violation conditions on voluntary because *“The will of the parties to establish that fake transaction is still completely voluntary, reflected in their desire to establish a fake transaction, so that through the transaction such a fake translation that conceals another real transaction or avoids an obligation to a third party”⁷.* Another author argues that fake civil transactions are *“against the will of legislators in controlling legal transactions in order to protect public order stemming from the principles of goodwill, honesty and integrity claim of good cause of contractual obligation”*.

² Hanoi Law University (2017), Textbook of Vietnamese civil law, volume 1, Publishing House. People's Police, pp. 144.

³ See also: City Law University. Ho Chi Minh (2013), Textbook of general provisions on civil law, Publishing House. Hong Duc – Vietnam Lawyers Association, pp. 316-318.

⁴ See also: Judicial Academy (2007), Civil law textbook, Publishing House. People's Public Security, pp. 156 – 172.

⁵ Pham Van Tuyet, The contract is void due to the lack of voluntary participation of the participants, Proceedings of the scientific conference: "The contract is void and the legal consequences of the contract is invalid", Hanoi Law University, Nov 2022, page 104.

⁶ Nguyen Ngoc Dien (2007), Textbook of Civil Law 1- Can Tho University, p. 7, 8.

⁷ Pham Van Tuyet, The contract is void due to the lack of voluntary participation of the participants, Proceedings of the scientific conference: "The contract is void and the legal consequences of the contract is invalid", Hanoi Law University, Nov 2022, page 105;

It can be seen in the current legal science that there exist at least two opinions in determining which fake civil transactions violate any valid conditions of civil transactions, specifically: (1) The first opinion is that the fake civil transaction violates the conditions of voluntariness specified at Point b, Clause 1, Article 117 of Vietnam's Civil Code 2015; and (2) the second opinion that the transaction has the purpose of violating the prohibition of the law specified at point c, clause 1, Article 117 of the Vietnam Civil Code 2015. There are conflicting opinions as presented as presented. The above statement is derived from the fact that Vietnamese law does not clearly stipulate that the case of fake civil transactions violates any valid conditions of civil transactions specified in Article 117 of the Civil Code. Vietnam 2015, or this is another invalid case of a civil transaction (such as the case, the contract is invalid because an object cannot perform Article 408 of the Vietnam Civil Code 2015). Considering the nature of fake civil transactions, it can be seen that fake civil transactions exist for the purpose of concealing other civil transactions or to evade obligations to a third party. These purposes of fake civil transactions seem to violate the effective condition "Purpose and content of civil transactions do not violate the prohibition of the law, do not violate social ethics" as prescribed. at point c, Clause 1, Article 117 of Vietnam Civil Code 2015.

Determining the invalid basis of a fake civil transaction from the court's trial practice

In the practice of adjudicating the invalid civil transactions due to forgery, the court only argues the forgery factor and directly invokes the provisions on invalid civil transactions due to forgery to declare invalid civil transactions, but there is no argument that invalid civil transactions have violated any valid conditions of civil transactions specified in Article 117 of the Civil Code 2015. This is proven. Here are some examples of cases:

Case No. 1: Judgment No. 05/2019/DS-PT dated January 15, 2019 of the People's Court of Tay Ninh province: *“Regarding the request to declare the contract of transferring land use rights invalid”*.

Contents of the case: Mr. H, Mrs. G are obliged to pay Ms. L an amount of VND 422,400,000 according to Judgment No. 27/2017/DS - ST dated June 30, 2017 of the People's Court of Trang Bang district, Tay Ninh province. She asked for judgment enforcement, but Ms. G and Mr. H did not voluntarily execute the judgment and the judgment enforcement agency informed that Mr. and Mrs. G had no assets to execute the judgment. In addition, Mr. and Mrs. G are also obliged to pay Mr. S an amount of VND 500,000,000 according to Decision No. 13/2017/QDST-DS dated March 2, 2017 of the People's Court of Trang Bang District, Tay Ninh

province. Mr. S asked to execute the judgment, but Mrs. G and Mr. H did not execute it. Previously, on January 19, 2017, Mr. and Mrs. G's husband and wife transferred to Mr. Huynh Van D, who is Mrs. G's brother, the house, the land of Mr. H, Mrs. G located at GN hamlet, PL commune, TrB district. , Tay Ninh province. Now Ms. L and Mr. S request the Court to declare the land use right transfer contract No. 03/2017, book No. 01/2017SCT/HD,GD dated January 19, 2017, for the land area of 523 m², parcel of land 322, map sheet No. 10, land located at GN hamlet, PL commune, TrB district, Tay Ninh province between Mr. Le Minh H, Ms. Huynh Thi G for Mr. Huynh Van D is invalid due to artificiality.

Arguments and judgments of the court in determining that the contract is void due to forgery

In the argument, the trial panel commented that “the first instance level judged that the land use right transfer contract between Mr. Le Minh H, Ms. Huynh Thi G and Mr. Huynh Van D Authentication No. 03/2017, volume No. 01/2017SCT/HD,GD dated 19/01/2017, for the land area of 523 m², land plot number 322, map sheet 10, land located at GN hamlet, PL commune, TrB district, Tay Ninh province is fake and declared invalid as prescribed in Clause 2, Article 124 of the Civil Code is grounded and lawful”, and in the decision the court relied on Article 124 of the Vietnam Civil Code 2015 to declares that the above land use right transfer contract is invalid, without further arguing that the fake contract has violated any valid conditions of the contract in Article 117 of the Vietnam Civil Code 2015.

Case No. 2: Judgment No. 13/2021/DS-ST dated January 26, 2010 of the People's Court of Ca Mau city, Ca Mau province: “Regarding the dispute over the contract for the transfer of land use rights”.

Contents of the case: In 2017, Mr and Mrs. T and Mrs. Th participated in a hui game owned by Mrs. L. The money dispute between Mr. T, Ms. Th and Ms. L was resolved by the People's Court of Ca Mau city with the first-instance judgment No. 173/2019/DS-ST dated October 30, 2019 forcing Ms. L to pay for the payment. Mr. T and Mrs. Th's wife owe the amount of money owed to hui is 380,243,500 VND. Ms. L then appealed and was resolved by the People's Court of Ca Mau province with the judgment No. 15/2020/DS-PT dated February 11, 2020, forcing Ms. L to pay Mr and Mrs. T and Mrs. is 363,929,000 VND. After the judgment took legal effect, he and his wife filed a request for judgment enforcement, and learned that Ms. Ta Hong L had made a contract to transfer land use rights to Mr. Trieu Kien Q and Ms. Tran Thi T' by contract. land use right transfer contract on January 7, 2019 at Minh Hai Notary Office. Mr and Mrs. T filed a lawsuit to request the cancellation of the land use right transfer contract between Ms. Ta

Hong L and Mr. Trieu Kien Q and Ms. Tran Thi T' on January 7, 2019 at the Notary Office. Minh Hai at Notary No. 117, volume 01/TP/CC- SCC/HDGD.

Arguments and judgments of the court in determining that the contract is void due to forgery

The trial panel said that “the land use right transfer contract dated January 7, 2019 represents the transfer price of VND 200,000,000. However, in the minutes of on-site review and appraisal, Ms. L determined the transfer price to be VND 1,200,000,000. While the regulated price of Licogi Company in 2019 is VND 800,000,000. Although the involved parties have the right to decide on the price when transferring, this shows that the transfer price and the actual price of the transaction parties are quite different, while Ms. L knows that she still owes others. This proves that the establishment of civil transactions is fake in order to avoid obligations to a third party”. In the decision to declare the above land use right transfer contract null and void, the judgment also only stated the basis of Clause 2, Article 124 of Vietnam's Civil Code 2015, in addition, there was no argument in the judgment. more about the artificial land use right transfer contract mentioned above violated any valid conditions of civil transactions.

Inadequacies and recommendations to improve the legal provisions on determining the invalid basis of fake civil transactions

As described and analyzed above, currently in the Vietnam Civil Code 2015 regulations on civil transactions are invalid due to forgery. However, there are no specific regulations to determine which civil transactions are invalid due to forgery, which violates any valid conditions of civil transactions. Although this does not cause inadequacies in the practice of law application, it has caused controversy in the legal scientific research community. Therefore, there has been an inconsistency in the legal perception about which fake civil transactions have violated any valid conditions of civil transactions. Therefore, Vietnam's Civil Code 2015 should clearly stipulate which conditions for a fraudulent civil transaction to be violated. It is thought that it should be regulated in the direction of a fake civil transaction that violates the condition "The purpose and content of the civil transaction does not violate the prohibition of the law, does not violate social ethics" specified at Point c, Clause 1, Article 117 of Vietnam Civil Code 2015. Because, fake civil transactions have the purpose of concealing other civil transactions or avoiding obligations to a third party, this has infringed upon public interest or the benefit of a third party.

3. CONCLUSION

Vietnamese law regulates that civil transactions are invalid due to forgery, however, it is not clear which fake civil transactions violate any valid conditions of civil transactions. In fact, in the court's trial practice, there is no argument that a civil transaction is invalid because it has violated any valid conditions. This has created many opposing opinions, specifically: (a) the first opinion that the fake civil transaction violates the condition of voluntariness; and (b) the second line of opinion that the fake civil transaction violates the condition that the purpose and content of the civil transaction does not violate the prohibition of the law, and is not contrary to social ethics. Therefore, competent state agencies should soon issue relevant documents to determine the effective conditions of civil transactions that fake civil transactions have violated.

REFERENCES

- Vietnam Civil Code 215;
- Ngo Huy Cuong (2013), Textbook of Contract Law – General (for postgraduate training), Hanoi National University Publishing House;
- Nguyen Ngoc Dien (2007), Textbook of Civil Law 1- Can Tho University;
- Judicial Academy (2007), Civil law textbook, Publishing House. Police;
- Hanoi Law University (2017), Textbook of Vietnamese civil law, volume 1, Publishing House. Police;
- City Law University. Ho Chi Minh (2013), Textbook of general provisions on civil law, Publishing House. Hong Duc – Vietnam Lawyers Association;
- Pham Van Tuyet (2022), “The contract is void due to the lack of voluntary participation of the participants”, Proceedings of the scientific conference: “The contract is void and the legal consequences of the contract is invalid”, Hanoi Law University , 11/2022, pp. 104;
- Pham Van Tuyet (2022), “Overview of voidable contracts”, Proceedings of the scientific conference: “The contract is void and the legal consequences of the contract is invalid”, Hanoi Law University, 11/2022, pp. 5.

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ABSTRACT

Forged civil transactions are an important legal issue of the institution of civil transactions and were soon regulated from the Civil Code of Vietnam 1995, 2005 and 2015. Forged civil transactions pose many legal problems, such as the validity of a fake civil transaction, the effect of a concealed transaction, the legal consequences of an invalid civil transaction due to a forgery, protection of the interests of a bona fide third party in civil transactions, invalidity due to forgery, statute of limitations for requesting declaration of civil transactions invalid due to forgery. To understand more deeply about the legal issues related to forged civil transactions, the article compares the provisions on invalid civil transactions due to forgery of the Vietnam Civil Code 2015 with that of the Vietnam Civil Code 2005. From that point out the similarities and differences of the two laws on fake civil transactions. At the same time, it points out the progressive points and limitations of the Vietnam Civil Code 2015 on artificial civil transactions compared with the Vietnam Civil Code 2005. On that basis, some recommendations are proposed to complete the transaction improve the provisions of the Vietnam Civil Code 2015 on forged contracts.

Keywords: Fake civil transactions; Invalid civil transactions; Bona fide third party; Civil transactions.

1. INTRODUCTION

The Vietnam Civil Code 2005 is the second legal document of Vietnam that regulates fake civil transactions. Over time, the provisions of the law on fake civil transactions have been improved to meet the requirements of social relations. Currently, the Vietnam Civil Code 2015 is a valid legal document that regulates the issues of fake civil transactions. The article compares the provisions of the Vietnam Civil Code 2015 with the Civil Code 2005 on fraudulent civil transactions. On the basis of comparison, the article presents the similarities and differences between the two sets of laws on fake civil transactions. Thereby pointing out the similarities and differences of the two sets of laws on fake civil transactions. At the same time, it points out the progress and limitations of the Vietnam Civil Code 2015 on fraudulent civil transactions compared with the 2005 Vietnam Civil Code. On that basis, some recommendations are proposed to complete the transaction improve the provisions of the Vietnam Civil Code 2015 on forged contracts.

2. RESEARCH AND FINDINGS

2.1. Comparison of regulations on types of fake civil transactions between Vietnam Civil Code 2015 and Vietnam Civil Code 2005

Vietnam Civil Code 2005	Vietnam Civil Code 2015
<p>Article 129. Civil transactions invalid due to falsity</p> <p>When the parties falsely establish a civil transaction in order to conceal another transaction, the false transaction shall be invalid and the concealed transaction remains valid, except in cases where it is also invalid under the provisions of this Code; In cases where a false transaction is established with a view to shirking the responsibility toward a third person, such transaction shall also be invalid.</p>	<p style="text-align: center;">Article 124. Invalidity of civil transactions due to falsification</p> <p>1. If the parties falsely enter into a civil transaction for the purpose of concealing another transaction, the false transaction shall be invalid and the concealed transaction remains valid, unless it is also invalid under the provisions of this Code or relevant laws.</p> <p>2. If the parties enter into a civil transaction falsely for the purpose of evading responsibilities to a third person, such transaction shall be invalid.</p>

Basically, the regulations on types of civil transactions between the Civil Code of Vietnam 2015 and the Civil Code of Vietnam 2005 are not different. Both laws provide for two types of fake civil transactions: (1) civil transactions to conceal other civil transactions; and (2) sham civil transactions to evade obligations to a third party.

The only difference is that in the 2015 Vietnam Civil Code, the content "or other relevant law" has been added in Clause 1, Article 124 when the regulation on the validity of the transaction is concealed. It is perfectly reasonable to add this content because it will create compatibility with specialized laws.

2.2. Comparison of regulations on legal consequences of invalid civil transactions due to forgery between Vietnam Civil Code 2015 and Vietnam Civil Code 2005

Vietnam Civil Code 2005	Vietnam Civil Code 2015
<p>Article 137. Legal consequences of invalid civil transactions</p> <p>1. Invalid civil transactions shall not give rise to, change or terminate any civil rights and obligations of the parties from the time of establishment thereof.</p> <p>2. When a civil transaction is invalid, the parties shall be restored to the original status and shall return to each other what they have received; if the return cannot be made in kind, it shall be made in money, except for cases where the transacted property, gained yields and/or profits are confiscated under the provisions of law. The party at fault, which caused damage, must compensate therefore.</p>	<p>Article 131. Legal consequences of invalid civil transactions</p> <p>1. An invalid civil transaction shall not give rise to, change or terminate any civil rights and obligations of the parties as from the time the transaction is entered into.</p> <p>2. When a civil transaction is invalid, the parties shall restore everything to its original state and shall return to each other what they have received. If the restitution is not able to make in kind, it may paid in money.</p> <p>3. A bona fide person in receiving yield and/or income is not required to return such yield and/or income.</p> <p>4. The party at fault which caused damage must compensate therefore.</p> <p>5. The settlement of consequences of invalid civil transactions regarding personal rights shall be prescribed in this Code and relevant laws.</p>

Compared with the Civil Code of Vietnam 2005, the Civil Code of Vietnam 2015 has the following differences:

First, the Vietnam Civil Code 2015 does not stipulate the case in which yields and profits can be confiscated according to the provisions of law as in the 2005 Vietnam Civil Code. may be

appropriated because confiscation of yields or income is a legal consequence of a criminal or administrative nature.

Second, the 2015 Vietnam Civil Code has added the provision that "the rightful party in the collection of yields and profits is not required to return the yields and profits" compared to the 2005 Vietnam Civil Code. The addition of the above provision is completely appropriate, because in practice there are many cases when civil transactions are invalid, but assets can generate additional yields and profits, and the problem is that it is necessary to handle the number of transactions. this profit, this profit. This is an increase compared to what the parties originally assigned to each other, and according to the additional provisions of the Vietnam Civil Code 2015, the party that is honest in collecting the profits will not be refunded. those yields and profits and vice versa, if they are not sincere in collecting the profits and profits, they must be responsible for returning them.

Third, the Vietnam Civil Code 2015 has added provisions " The settlement of consequences of invalid civil transactions regarding personal rights shall be prescribed in this Code and relevant laws ". The above addition is completely appropriate and necessary for the settlement of invalid civil transactions related to personal factors and creates coverage for specialized laws with the addition of the phrase " provided by other relevant laws".

2.3. Comparison of regulations on protection of bona fide third parties when civil transactions are invalidated due to forgery between the Vietnam Civil Code 2015 and the Vietnam Civil Code 2005

Vietnam Civil Code 2005	Vietnam Civil Code 2015
<p>Article 138. Protection of the interests of a bona fide third party when a civil transaction is invalid</p> <p>1. In cases where a civil transaction is invalid but the transacted property being a moveable not subject to ownership registration has already been transferred to a bona fide third party through another transaction, the transaction with the third party shall still be valid, except for the case specified in Article 257 of this Code.</p>	<p>Article 133. Protection of the interests of bona fide third parties with regard to invalid civil transactions</p> <p>1. In cases where a civil transaction is invalid but the transacted property being a moveable property is not required to be registered and such property has already been transferred to a bona fide third party through another transaction, the transaction with the third party shall remain valid, except for the case specified in Article 167 of this Code.</p>

<p>2. In cases where the transacted property being an immovable or a moveable subject to ownership registration has already been transferred to a bona fide third party through another transaction, the transaction with the third party shall be invalid, except for cases the bona fide third party receives such property through auction or transaction with a person who, under court judgment or decision of a competent state agency, was the owner of the property, but later is not the owner of the property as the court judgment or decision is cancelled or modified.</p>	<p>2. In cases where a civil transaction is invalid but the transacted property is registered at a competent authority and such property has already been transferred to a bona fide third party through another transaction which is established according to that registration, such transaction shall remain valid.</p> <p>In cases where the transacted property which is required to be registered has not registered at a competent authority, the transaction with the third party shall be invalid, except for cases the bona fide third party received such property through an auction or a transaction with an another party being the owner of such property pursuant to a judgment or decision of a competent authority but thereafter such person is not the owner of the property as a result of the judgment or decision being amended or annulled.</p> <p>3. The owner of a property shall have no right to reclaim the property from the bona fide third party if the transaction with such party remains valid as prescribed in Clause 2 of this Article, but the owner may proceed against the party at fault to refund appropriate expenses and compensate for his/her damage.</p>
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Compared with the Civil Code of Vietnam 2005, the Civil Code of Vietnam 2015 has the following differences:

First, a change in terminology: Vietnam's Civil Code 2015 used the term "property without registration" to replace the term "movable property without registration of ownership" and used the term "property without registration". The term "registered property" shall replace the term "immovable property or movable property subject to registration". This change has the author's

assessment that this is only a small, technical change⁸. However, there are also authors who believe that this change is due to the reason that there are properties that must be registered but not for registration of ownership but are for circulation and feel unconvinced about the change. mentioned above of the Vietnam Civil Code 2015 because in fact the ownership rights are registered, only the third party believes that it is the owner, so the transaction is established⁹. In some other legal studies, there does not seem to be a distinction between registration and registration of property rights when an author thinks that "Property registration is the official recording in documents of the competent authority. the competent state with necessary information related to ownership rights and other property rights to serve as a basis for arising, changing or terminating the rights and obligations of the owner¹⁰. The above paragraph seems to be looking at the registration as similar to the registration of ownership, but not including the registration of circulation as the previous opinion. The term "registration" in this case needs to be understood in a broad sense, including the type of registration of property ownership and the type of registration that is not registered, but has the value of proving the person's name on the document. Register as a property owner.

Second, the Vietnam Civil Code 2015 has added the provision “In cases where a civil transaction is invalid but the transacted property is registered at a competent authority and such property has already been transferred to a bona fide third party through another transaction which is established according to that registration, such transaction shall remain valid”. This addition is completely convincing, because the third party in good faith has relied on the registration of the competent state agency to receive the transfer of property, the third person needs to be protected.

Third, the 2015 Vietnam Civil Code has added provisions “The owner of a property shall have no right to reclaim the property from the bona fide third party if the transaction with such party remains valid as prescribed in Clause 2 of this Article, but the owner may proceed against the party at fault to refund appropriate expenses and compensate for his/her damage”. This provision is also a suitable addition to create a clearer mechanism to protect the interests of the original owner when the law protects bona fide third parties.

⁸ See more: Bich Phuong, Protecting the interests of righteous third parties when civil transactions are invalid, People's Court Journal (electronic), <https://tapchitoaan.vn/bao-ve-quyen-loi-cua-person-thubangay-tinh-khi-transportation-dan-su-vo-hieu>, accessed January 31, 2023.

⁹ See more: Do Van Dai (2016), Scientific commentary on new points of the Civil Code 2015, Publishing House. Hong Duc – Vietnam Lawyers Association, pp. 161-162.

¹⁰ Nguyen Minh Tuan (2016), Scientific commentary on Civil Code 2015, Publishing House. Justice, pp. 177.

2.4. Comparison of the statute of limitations for requesting a declaration of an invalid civil transaction due to forgery between the Vietnam Civil Code 2015 and the Vietnam Civil Code 2005

Vietnam Civil Code 2005	Vietnam Civil Code 2015
<p>Article 136.- The statute of limitations for requesting the Court to declare a civil transaction invalid</p> <p>...</p> <p>2. For civil transactions specified in Articles... 129 of this Code, the statute of limitations for requesting the Court to declare such civil transactions invalid shall not be restricted.</p>	<p>Article 132. Time limit for requesting court to declare civil transactions invalid</p> <p>...</p> <p>3. For civil transactions specified in Articles 123... the time limit for requesting a court to declare such civil transactions invalid shall not be restricted.</p>

The statute of limitations for declaring a civil transaction invalid due to forgery of the two similar laws is not limited in time. That is, at any time, the relevant parties also have the right to request the court to resolve the declaration of invalid civil transactions due to forgery.

3. CONCLUSION

Basically, the provisions in the 2015 Vietnam Civil Code have more advanced and complete points than those in the 2005 Vietnam Civil Code, such as the bona fide third parties is better protected, has the opportunity to There are clear restrictions to protect the original owner when a bona fide third party is protected... However, the Vietnam Civil Code 2015 also reveals some limitations and shortcomings such as no transaction concept. fake civil rights, all kinds of fake legal acts have not been foreseen, some regulations on legal consequences and protection of bona fide third parties have not been guided in detail... leading to There are many different interpretations and the effective application of the law is not high. These problems need to be overcome soon in order to better improve the provisions of Vietnamese law on fake civil transactions.

REFERENCES

Vietnam Civil Code 2005;

Vietnam Civil Code 215;

Do Van Dai (2016), Scientific commentary on new points of the 2015 Civil Code, Publishing House. Hong Duc – Vietnam Lawyers Association;

Bich Phuong, Protecting the interests of righteous third parties when civil transactions are invalid, People's Court Journal (electronic), <https://tapchitoaan.vn/bao-ve-quyen-loi-cua-people-thubangay-tinh-khi-transportation-dan-su-vo-hieu>, accessed January 31, 2023.

Nguyen Minh Tuan (2016), Scientific commentary on Civil Code 2015, Publishing House. Justice.

**PROBLEMS OF INTEGRATING ARTIFICIAL INTELLIGENCE AND
AUTOMATION INTO THE LABOR MARKET**

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ABSTRACT

The rapid development of artificial intelligence and automation means that many jobs will be replaced by AI applications. As a result of the application of artificial intelligence in many fields, which will dominate, job losses occur as existing professions lose their function. Reductions in manufacturing costs as a result of innovation are enabling robots to take over a growing number of manual tasks in new areas of manufacturing, packaging, construction, maintenance and agriculture. Therefore, in every wave of technological development, workers face unemployment.

Keywords: artificial intelligence, legal regulation, hired labor, employee, employer, profession, robot, workforce, data mining.

GİRİŞ

Birinci sanayi devriminde, buhar motorları mekanize imalat sanayilerine geçişle sonuçlandı. Birçok manuel tarım işinin yerini makineler aldı. İkinci sanayi devrimi elektrik ve otomasyonun gelişmesiyle seri üretimi mümkün kılarken, üçüncü sanayi devrimi bilgi teknolojilerini kullanarak otomatik üretimi daha da geliştirdi. Aynı zamanda, imalat teknolojileri görevleri basitleştirerek vasıflı emeğin yerini büyük ölçüde alırken, XX yüzyılın bilgisayar devrimi orta gelirli işleri yok etti. Sürekli gelişen yeni teknolojilerin yaygınlaşmasıyla ilgili ortak bir endişe, bunun iş ve iş ortamı üzerindeki etkisidir. Cevaplanması gereken asıl soru, eğer yeni makine işçilerden daha iyiye, işçiler ne yapmalıdır?

ÇALIŞMANIN AMACI.

Yapay zekanın gelişimini anlayarak işgücü piyasasındaki gelişme ve değişimleri bir araya getirmektir. Çalışmada yapay zeka kullanımının işgücü piyasası ve müşteri hizmetleri üzerindeki etkisi literatür taraması yoluyla açıklanmaya çalışılmıştır. Teknolojideki gelişimin işsizliğe neden olduğu bilinse de yapay zekanın gelişim sürecinin yeni meslekler ve uzmanlık alanları yaratacağı ve yeni istihdam olanaklarını artıracacağı öngörülmüyor.

SORUNU BELİRLEME.

Yapay zeka, beceri gereksinimlerini, kariyer fırsatlarını ve endüstrilerin ve mesleklerin ülkeler arasındaki dağılımını yeniden şekillendirme potansiyeline sahiptir. Ayrıca bilişsel teknolojilerden kaynaklanan işgücü eğilimlerini kısa vadede tahmin etmek oldukça zordur. Beceri gereksinimlerindeki temel değişiklikler, tüm ekonomik faaliyetlere nüfuz eder ve mesleki beceri gereksinimlerini, kariyer hareketliliğini ve sosyal refahı etkiler. [1]

Yapay zeka ve makine öğreniminin gelişmesiyle birlikte teknolojik bir karışımın (Nesnelerin İnterneti, büyük veri, robotik, sanal gerçeklik, 3-D baskı ve kuantum hesaplama gibi) kullanımı dördüncü sanayi devrimine yol açmıştır. Dördüncü sanayi devrimi ile birlikte bazı alanlarda akıllı makineler insan gücünün bilişsel yeteneklerinin önüne geçmiş, üretim kavramı farklı boyutlara dönüşmüştür. Geçmişten günümüze, sürekli uzmanlığa sahip işbölümünde, karmaşık ve günlük işlerin makinelere aktarılmasının bir sonucu olarak verimlilik ve yaşam standartlarında bir artış olmuştur. 19 yüzyıldan beri endüstriyel devrimler olan makinelerin kullanımı otomasyon sürecini hızlandırdı.

Yapay zeka terimi resmi olarak 1956'da bir Dartmouth yaz araştırma projesi tarafından ortaya atıldı. Bu çalışma, yeni bir araştırma alanı yaratmayı ve farklı alanlardan araştırmacıları insan zekasını taklit edebilen makineler yaratmak için bir araya getirmeyi amaçlıyordu. Yapay zekanın oluşmasında üç farklı kaynağın geliştirilmesi önemli rol oynamıştır:

1. Azalan bilgi işlem maliyetleri, işlem gücü ve depolama kapasitesinde de iyileştirmeler getirdi.
2. İnternetin ve diğer dijital iletişim araçlarının gelişmesi ve yaygınlaşması, merkezi dijital bilgilerin elde edilmesinde ve saklanmasında önemli bir artışa yol açmıştır.
3. Dijital teknolojilerin sermaye maliyetlerinin azalması, yeni girişimlerin önündeki engellerin önemli ölçüde azalmasına yol açmıştır.

Endüstriyel yapay zekanın temel unsurları arasında analitik teknolojisi, büyük veri teknolojisi, bulut veya siber teknoloji, alan bilgisi ve kanıt yer alır. Büyük veri teknolojisi, endüstriyel yapay zekada veri kaynağı ve platformu sağlayan kilit bir unsurdur. Bu bağlamda, yapay zeka teknolojisinin uygulanmasına ilişkin en önemli zorluklar dört noktada özetlenebilir:

1. Yapay zeka güvenliği, yalnızca bilgi güvenliği konularını değil, genel olarak güvenlik konularını da kapsar. Bu nedenle Bostrom ve Yudkowsky (2014), yapay zeka teknolojisinin insan kaynaklı olumsuz manipülasyonlara karşı dirençli olmasının önemini ve gerekliliğini vurgulamaktadır.
2. Güvenilir olmayan, hatalı veya zayıf veriler hatalara yol açabileceğinden, veri kalitesi ve entegrasyonu kuruluşlar için çeşitli zorluklar oluşturabilir. Bu bağlamda tarafsız ve güvenilir verilerin toplanması, saklanması ve kullanılması yapay zekanın başarılı bir şekilde uygulanabilmesi için şarttır.
3. Bir AI uygulamasını başlatmadan önce, beklenen çözümün sürdürülebilir olup olmadığını değerlendirmek için finansal fizibilite önemlidir. Ayrıca, toplam maliyetler ve beklenen gelirler önceden dikkate alınmalıdır.

Finansal fizibilite bağlamında, iki ana maliyet faktörü vardır.

İlk olarak, veri toplama ve depolama için teknolojik bir altyapı oluşturmak için büyük yatırımlar gerekmektedir.

İkincisi ise yapay zeka uzmanlarının yetiştirilmesi ve bu uzmanlara olan talebin artması.

4. Uzmanlaşma, yapay zekanın hızlı gelişimini destekleyerek uzmanlara olan ihtiyacı artırıyor. Bununla birlikte, uzmanlık eksikliği yapay zeka uygulamalarının geliştirilmesini engeller ve bu nedenle geliştirme ve uygulama bağlamında zorluklar yaratır. Bu nedenle, yüksek düzeyde eğitilmiş ve çeşitliliğe sahip bir iş gücünün geliştirilmesi, sürdürülebilir bir yetkinlik ve bilgi tabanı oluşturmak için esastır.

Yapay zekanın gelişmesiyle birlikte uzmanlar, gelecek hakkındaki endişelerini beş noktada açıklıyorlar.

1. İnsan faktörü / dijital yaşamın gelişmesiyle birlikte, otomatik karar verme, bağımsızlık ve gizlilik üzerindeki gücü giderek azalacaktır. Bu etkiler, otomatik sistemler daha geniş ve sofistike bir şekilde tanıtıldıkça daha da derinleşecektir.
2. Verileri kötüye kullanmak/ kar elde etmek veya enerji kullanmak için tasarlanmış karmaşık sistemlerde veri kullanımı ve kontrolü ile çoğu yapay zeka aracı, kar elde etmek için şirketlerin kontrolü altında olacaktır.
3. İş kaybı. Çoğu işi yapay zeka ile yönetmek ekonomideki adaletsizliği artıracak ve sosyal kargaşaya neden olacaktır. Başta verimlilik ve diğer faydalar olmak üzere iş yaşamının tüm yönlerini değiştirmeye devam edecektir. Bu süreçte, bazı çalışanlar yeni işlerin ortaya çıkmasını beklerken, bu durum diğer çalışanlar için büyük iş kayıplarına yol açacaktır.
4. Bağımlılık. Yapay zeka bireylerin bilişsel, sosyal ve hayatta kalma becerilerini zayıflatacak. Yeni yaşam biçiminde, insanların makinelere ve ağlara artan bağımlılığı, düşünme, bağımsız hareket etme ve sosyal olarak etkileşim kurma yeteneklerini zayıflatacaktır.
5. Karışıklık. Otonom silahların, siber suçların ve silah haline getirilmiş bilgilerin kullanılması sonucunda istikrarsızlaşma, yalan söyleme ve propaganda meydana gelebilir. Bu nedenle, can kaybı olasılığı ve siber suçluların ekonomi üzerindeki etkisi endişe vericidir.

Yapay zeka unsurlarının devreye girmesiyle teknolojilerin kullanılmasının, ülke ekonomisi sektörlerinde ve hizmet sektöründe işgücü verimliliğinde % 40'a varan bir artışa yol açacağı varsayılmaktadır. Bu yenilikçi teknolojilerin insan ve üretim kaynaklarının optimal kullanımına, ekonominin daha da gelişmesine ve GSYİH'nın büyümesine katkıda bulunması beklenmektedir.

Yapay zeka, robotik ve gelişmiş çevrimiçi teknolojilerle birleştiğinde, daha önce yalnızca insanların yaptığı birçok görevi etkili bir şekilde ele alıyor. Örneğin, yapay zeka tıp alanında zaten aktif olarak kullanılmaktadır. Yani burada akıllı uygulamalar teşhis koymaya ve tedavileri seçmeye yardımcı oluyor.

Yapay zeka ayrıca gazetecilik, çevrimiçi eğitim, işe alım, gerçek zamanlı çeviri işlevlerinde de uygulanmaktadır.

Genel olarak, modern dijital teknolojiler birçok işlemi gerçekleştirebilir veya bunların uygulanmasını önemli ölçüde kolaylaştırabilir. Ancak aynı zamanda, yapay zekanın hızlı gelişimi, makinelerin sadece insanların sorunlarını çözmelerine yardımcı olmakla kalmayıp aynı zamanda toplumumuzun ekonomik, yasal ve etik temellerini etkileyecek yeni sorunlar yarattığını da vurgulamaktadır.

Yerli ve yabancı uzmanlar, endüstriyel üretim, tarım ve bireysel hizmet sektörlerindeki farklı ülkeler için robotizasyondan % 8-47'lik iş kesintileriyle ilgili önemli olumsuz sonuçların beklenmesi gerektiğini belirtiyorlar.

Her şeyden önce, tekrarlayan algoritmalara ve senaryolara dayalı meslekler ortadan kalkacak: satıcı, tercüman, işe alım görevlisi, haber muhabiri, tren makinisti, kurye ve depo lojistik işçisi, banka çalışanı (kredi başvurularını kabul eden veya temel bilgileri sağlayan), çağrı merkezi operatörü vb.

Yapay zekanın kullanımı sayesinde bazı uzmanlık alanları değişmiştir ve insanların yapay zekadan önemli ölçüde daha etkili olacağı yeni meslekler ortaya çıkmıştır. Bu mesleklere olan talep şunlardan oluşur: insan eğitimi, duygusal ve bilişsel çalışma, esnek stratejik yönetim ve şirket içindeki insan ilişkilerinin yönetimi, araştırma, makine öğrenimi, mühendislik ve bilgi teknolojisi vb.

Ekonomistlere göre, kısa bir süre içinde uzmanların değiştirilmesi ve boş kontenjanların olmaması sorunu yaşanacak. Bu etki beceri ve teknoloji uyumsuzluğu, yani teknoloji ile iş gücünün becerileri arasındaki uyumsuzluk olarak adlandırılır.

Birçok endüstride, üretimde ve hizmette profesyonel olarak eğitilmiş uzman eksikliği zaten var. Google, Facebook, Apple, Amazon, Uber ve diğer büyük teknoloji şirketleri yapay zeka uzmanlarına milyonlarca dolar ödemeye isteklidirler çünkü yüz tanıma yazılımı, dijital asistanlar ve sürücüsüz otomobillerle çalışmak için acilen yetenekli personele ihtiyaç duyarlar. Çünkü yüksek teknoloji endüstrisi, toplumun sosyo-ekonomik manzarayı etkileyecek değişikliklere uyum sağlamasına yardımcı olmalıdır.

Gelecek ne olursa olsun, kişisel ve mesleki gelişime odaklanan, çevreye önem veren, çalışmalarında en son dijital teknolojileri kullanmaya hazır olan ve cesurca değişime giden bir kişi inovasyondan korkmamalıdır. Sadece meslekler eskimiş olur ve benzersiz yetkinliklere sahip uzmanlar her zaman talep edilecektir.

Yapay zekanın yaygın bir şekilde benimsenmesiyle, makinelerin çalışanların yaptıkları işin bir kısmını veya hatta tamamını görmeye başlayıp başlamadığı sorusu tartışmalıdır. Yeni teknolojiler, makineler tarafından gerçekleştirilen birçok rutin işi ve işlemi mümkün kılarken, günümüzde yapay zekadaki gelişmeler, makinelerin anlama, anlamlandırma ve çıkarımlarda bulunma becerisi gerektiren sıra dışı görevleri gerçekleştirmesine olanak sağlıyor. Bu alandaki akademik araştırmalar ve iş dünyasıyla ilgili araştırmalar, işlerin nasıl yapıldığına dair önemli değişiklikler olacağını, bazı işlerin tamamen otomatikleştirilebileceğini ve yapay zekanın kullanımıyla ilgili yeni mesleklerin ortaya çıkacağını göstermektedir.

Yapay zeka teknolojileri, üretim ve hizmet süreçlerindeki insan kaynaklı hataları en aza indirmek, enerji ve kaynakların verimli kullanımı, daha uzun üretim veya işlem süreleri, çevre koşullarının (örn. sıcaklık, nem) izlenmesiyle üretim koşullarının iyileştirilmesi gibi birçok fayda sağlamaktadır. Bu avantajlar birçok sektörde verimliliği artırmak, maliyetleri düşürmek ve karı maksimize etmek için kullanılmakla birlikte kamu kaynaklarının etkin yönetimi ve toplumsal refahın iyileştirilmesi için de önemli araçlar sağlamaktadır. Yapay zekanın çeşitli sektörlerdeki başlıca kullanım alanları ve işlevleri aşağıda sıralanmıştır:

Bankacılık ve finans sektörü, veri hacmi ve trafiği ile yapay zeka teknolojilerinin öne çıkan uygulama alanlarından biridir. Tutarsızlıkların ve hileli işlemlerin tespit edilmesi gibi operasyonel görevler, müşterilerin kişisel bilgileri ve işlem verileri izlenerek otomatikleştirilebilir. Yine, bu verilerin analizi, müşterileri segmentlere ayırmanıza ve kişiselleştirilmiş pazarlama kampanyaları yürütmenize olanak tanır. Doğal dil işleme araçlarının desteğiyle, müşteri hizmetlerinde daha kısa sürede daha iyi çözümler sunulabilir.

Yapay zeka teknolojilerinin finansal danışmanlık hizmetlerine entegrasyonu, bu alanda çalışanlar için tamamlayıcı bir rol oynamakta ve bir ölçüde onların yerini alabilmektedir. Çeşitli finansal kuruluşlar tarafından kullanılmaya başlanan danışman robotlar, çok yönlü yatırım algoritmaları kullanarak müşterilerin beklentilerini, varlık yapılarını ve risk algılarını değerlendirerek kişiye özel portföyler sunuyor. Ayrıca piyasa koşulları ve yatırımcı tercihleri farklılaştığında portföy dağılımlarını yeniden düzenler.

Telekomünikasyon sektörü, büyük veri ve yapay zeka teknolojilerinin önemli katma değer yaratma ve operasyonel verimlilik sağlama potansiyeline sahip olduğu sektörler arasında yer almaktadır. Endüstride makine öğreniminin kullanıldığı alanlardan biri de panik analizidir. 2000'li yıllarda, numaraların aktarılabilmesiyle, müşteri kaybı oranı operatörler için en önemli göstergelerden biri haline gelmiştir. Bu orandaki en ufak bir değişikliğin operatörlerin gelirleri üzerinde önemli bir etkisi vardır. Ayrıca yeni müşteri kazanmak, mevcut müşteriye elde tutmaktan daha maliyetlidir.

Operatörler, müşteri demografik verileri ve kullanım alışkanlıkları gibi verileri kullanarak müşteri kaybını tahmin etmek için geleneksel istatistiksel yöntemler kullanmışlardır. Dijitalleşmenin artmasıyla birlikte operatörlerin daha çeşitli, gerçek zamanlı ve daha fazla veriye erişimi, müşteri kayıplarının analizinde makine öğreniminin kullanılmasına izin vermiştir. Makine öğreniminin entegrasyonu tahmine dayalı model, müşteri kaybının nedenlerinin daha doğru bir şekilde tanımlanmasını ve ayrıca kaybı önleyen operasyonların (ör. sunulan promosyonlar) etkilerinin modellenmeye dahil edilmesini sağlar. Endüstride makine

öğreniminin önemli bir uygulama hedefi, operasyonel verimlilik. Operatörler ağlarını yazılım sistemleriyle bütünleştirir ve robotik süreçleri otomatikleştirerek ağ yönetiminin optimize edilmesini ve zamanında bakımını sağlar.

Yapay zeka teknolojilerinin sağlık hizmetlerinde teşhis ve teşhis görevlerini bile yerine getirebileceği görülüyor. IBM tarafından 2016 yılında geliştirilen " Watson for Oncology", yapay zekanın onkologlar ve doktorlar için kanser tedavisi için tanı ve önerilerde önemli bir yardımcı olabileceğini göstermektedir. Hem hastanın kendi sağlık geçmişini hem de hastalıkla ilgili tıbbi makaleler gibi diğer kayıtları analiz ederek, belirli bir hasta için hangi tedavi yönteminin en iyi sonucu vereceğini önerebilir.

Erken teşhis için yapay zeka sistemleriyle donatılmış giyilebilir teknolojiler kullanılır, bu da hastalıkların veya sağlık koşullarının düzenli olarak izlenmesi için önemli fırsatlar yaratır. Nabız hızı, vücut ısısı, kalp vuruşlarının düzensizliği, kişinin egzersiz alışkanlıkları gibi göstergeler sensörler kullanılarak algılanır ve bu bilgiler sürekli olarak izlenebilir.

Giyilebilir teknolojilerle toplanan ve işlenen veriler, kullanıcıların sağlığını iyileştirebilir ve halk sağlığına önemli ölçüde fayda sağlayabilir. Çünkü sağlık bilgilerinin kayıt altına alınmasında hızlı bir artış sağlar. Giyilebilir teknolojiler, iş sağlığı ve güvenliği üzerindeki kontrolü geliştirmek için de kullanılabilir. Örneğin insan sağlığını tehdit eden alanlarda yapılması gereken görevleri robotlar gerçekleştirebiliyor. Robotiklerin gelişmesiyle ve internet bağlantı hızının artmasıyla, robotların cerrahi operasyonlarda destekleyici bir rol oynamasını ve hatta robotların uzaktan kumandalı operasyonlarını gerçekleştirmesini sağlamak için çalışmalar devam etmektedir. Böylece, Çin'de bir doktor ilk kez 5G bağlantısını kullanarak uzaktan bir operasyon gerçekleştirdi.

Yapay zeka teknolojileri ulaşım alanında pek çok fırsat sunuyor. Trafik yönetimi, araçları ve yolları sensörler (GPS, kameralar ve radar gibi) ve aktüatörler (algılanan girdileri eyleme dönüştüren sistem bileşenleri) ile donatarak daha etkili hale getirilebilir. Otonom araçların yaygınlaşması ile hareket halindeki araç sayısının azalması, yakıt ihtiyacının azalması ve trafik kazalarına bağlı ölümlerin azalması gelecekte bu alanda beklenen sosyal faydalardır.

Bu, yapay zekanın köklü dönüşümler yarattığı alanlardan biridir.

Yapay zeka teknolojilerinin potansiyeli, üretim sürecinden pazarlamaya ve hizmete kadar birçok alanda ortaya çıkmaya başlamıştır. Müşteri verilerini yapay zeka teknolojileriyle analiz etmek, segmentasyonu iyileştirmek, kişiselleştirilmiş ürünler ve teklifler sunmak ve fiyatları optimize etmek gibi amaçlar için kullanılabilir. Üretim süreci kontrolü daha etkin

olmakla birlikte, üretimde kullanılan beyaz eşya veya makineler için bakım ihtiyaçları tahmin edilebilir ve takip edilebilir.

Yapay zekanın tarımdaki başlıca uygulamaları, toprak ve hava koşullarının izlenmesi, ürün geliştirme süreçlerinin sensörler aracılığıyla izlenmesi, tarımsal topraklar ve diğer dış etkenlerle ilgili verileri analiz ederek tarım arazilerini ve mahsulleri değerlendirmesi ve robotların sulama ve hasat gibi görevleri gerçekleştirmesidir. ABD endüstriyel tarım şirketi Monsanto tarafından Blue River Technologies'in makine vizyonunu kullanarak geliştirilen püskürtme sistemi, bu alandaki başarının önemli bir örneği olarak gösterilmiştir.

Sistem, tarlada yetişen yabancı otların türünü tespit eder ve hedeflenen ilaçlamayı gerçekleştirir, böylece sadece yabancı otlar temizlenir. Bu sayede kimyasal kullanımının %90 oranında azaltıldığı bildirilmektedir. Monsanto'nun 2013'te hava ve iklim verileri yazılımı ve sigorta hizmetleri sağlayıcısı olan The Climate Corporation'ı yaklaşık 1 milyar dolara satın alması ve 2018'de Alman kimya ve ilaç devi Bayer ile birleşmesi, veri odaklı yeni bir çağın sinyallerini veriyor.

Yapay zeka teknolojileriyle, kısa sürede binlerce sayfalık pratik yasal araştırma yapılabilir.

Yapay zeka, yasal danışmanlıkta önemli sorumluluk alanlarından biri olan sözleşmelerde destekleyici bir rol oynamaktadır. Sözleşmelerin hazırlanması ve araştırılması ve risklerin tanımlanması gibi işlemleri kolaylaştırmak için yapay zeka programları geliştirilmektedir.

Yaratıcılık ve sosyal iletişim gerektiren işler, makinelerin insan emeğinin yerini alamayacağı alanlar arasında ön planda yer almaktadır. Ancak son zamanlarda bu alanlarda önemli ilerlemeler kaydedilmiştir. 2016 yılında sanatçı Rembrandt'ın tekniklerini taklit edebilecek ve bu tekniklere göre portre çizebilecek bir çalışma yapıldı. 300'den fazla Rembrandt resminin taranmasıyla büyük bir veri tabanı oluşturuldu ve yeni portre için spesifikasyonlarla alındı. Bu prensipler, yüz tanıma algoritmaları aracılığıyla Rembrandt'ın eserlerindeki yüz boyutlarını inceleyerek yeni portreye uygulandı. Fırça darbelerini simüle etmek için ısı haritaları oluşturuldu ve daha sonra çizim 13 katmanlı 3D baskı ile tuvale aktarıldı. Ancak yaratıcılığın temel iş unsuru olduğu alanlarda ileri teknolojilerin kullanılması ve standartlaşma eğiliminin yaratıcılığı yok ettiği yönünde eleştiriler bulunmaktadır.

Modern müşteri hizmetleri teknolojisinde, yapay zeka üç yazılım bileşeninden oluşur. Birincisi otomatik konuşma tanıma (ASR), ikincisi doğal dil işleme (NLP) ve üçüncüsü bilgi aramasıdır (IR). Müşteri metin iletişimde, metinden anlam çıkarmak için otomatik konuşma

tanıma ve doğal dil işleme adımlarına gerek yoktur. Makine öğrenimindeki gelişmeler, hem otomatik konuşma tanıma aşamasında hem de müşterilere en iyi şekilde yanıt veren doğal dil işlemede önemli gelişmeler sağladı. Müşteri aramalarında daha karmaşık bir yanıt gerekiyorsa, veri toplama aşamasında olası yanıtların metin bağlantılarının listelenmesi en iyi şekilde yanıtlanır.

Teknolojinin ve dijitalleşmenin hızla gelişmesiyle birlikte, yapay zekanın operasyonel verimliliği ve müşteri hizmet kalitesini artırmada kullanım payı, özellikle turizm gibi hizmet sektörlerinde daha da artmıştır. Yapay zeka sayesinde, bilgisayarların veya robotların akıllı üretkenliğe erişimi, müşterilerin satın alma ve tüketici ihtiyaçlarını karşılamak için dijital ve robotik hizmetlerin sağlanmasını kolaylaştırmıştır. Müşteri ilişkilerini ve davranışlarını olumlu yönde etkileyebilmek, hizmet sağlayıcılara hizmet sunmanın önemli bir parçasıdır. Bu etkileşim, müşteri tutumlarını ve davranışlarını olumlu yönde etkilediği için hizmet kalitesinin artmasına neden olmuştur.

Hizmet sektöründe yapay zekanın iki önemli özelliği vardır:

- Aşağıdaki faktörler bireysel çalışmada etkilidir:
 1. Verilerden öğrenen ve tahminler yapan algoritma tabanlı makine öğrenimi;
 2. Dünyayı gözlemleyen ve duyuşsal verilere dayalı kendi iç temsillerini oluşturan yapay sinir ağları (derin öğrenme).
 3. Otomatik makine öğrenimi. Ayrıca, yapay zeka ile öğrenme, kendi kendine öğrenme yöntemlerinden bağımsız olarak kendini geliştirebilir. Örneğin, Amazon veya Netflix'in makine öğrenimi algoritmaları, müşterilerin önerilere verdiği yanıtlara dayalı olarak önerilerini zaman içinde geliştirebilir.
- Bağlılık. Yapay zekanın kendi kendine öğrenme yeteneğinin, bireysel makinelerden ziyade tüm ağı iletişim içinde yayılması, kolektif zekanın derinleşmesine yol açar. Yapay zekanın öncülerinden biri olan Marvin Minski'nin vurguladığı gibi, akıl sınırlı programlara sahip bireysel ajanlardan oluşuyor ve bu bireysel ajanlar farklı hedeflere ulaşmaya çalışıyor ve daha karmaşık bir zeka ortaya çıkıyor.

Ekonomi değıştikçe ve yeni işler ortaya çıktıkça, işgücü piyasaları yeni çalışma kalıpları, organizasyonel platformlar ve akıllı araçlar tarafından düzenlenecektir. Aynı zamanda, dijital platformların ve işgücü piyasalarının odak noktası, işleri ve çalışanları uyarlamak ve istikrarlı bir istihdam yaratma potansiyeline ulaşmaktır. Amazon, eBay, Uber, Upwork ve You Tube gibi platformlarda çalışanlar ve işverenler, müşteriler ve yükleniciler, satıcılar ve alıcılar arasındaki eşleştirme mekanizmalarının mantığına dayanır. Bu adaptasyon

mekanizması, yeni insanları pazara dahil ederek veya iyi bir adaptasyonu teşvik ederek çalışanların hızlı büyümesi ve artan refahı anlamına gelir. Bununla birlikte, istihdam ilişkilerinin (emek ve sermaye) dijital platformlara aktarılması, ekonominin özünü yeniden tanımlamaya katkıda bulunan riskler doğurmaktadır. Örneğin, Haziran 2016'da ABD'deki yetişkinlerin sadece % 0,90'ının çevrimiçi platform ekonomisinde aktif olarak gelir elde ettiği bildirildi.

Yapay zeka, finansal ürünlerin ticareti, sigorta şirketlerinin risk analizi, biyoteknolojik ürünlerin geliştirilmesi, nakliye filosunun yönetimi, telekomünikasyon yönetimi, pazarlama stratejileri ve müşteri hizmetleri gibi çeşitli alanlarda vazgeçilmez hale gelmiştir. İşletmelerin dijital dönüşümünün yapay zeka teknolojisiyle uyumluluğu, ekonomik faaliyeti ve karlılığı sürdürmede önemli bir rol oynamıştır. Bu nedenle, dijital dönüşüme odaklanan işletmeler, müşteri beklentilerindeki ve tüketici alışkanlıklarındaki değişiklikleri analiz etmek için analiz edilmesi, sınıflandırılması ve yapılandırılması gereken verilerle müşteri ihtiyaçlarına odaklanan ve verileri analiz etme yeteneğine sahip olan işletmelerdir. Dijital işletmelerde, veri analizi, müşteri ilişkileri yönetimi ve belirli ürün ve hizmetlerin (özellikle finansal, sigorta ve bilgi hizmetlerinde) üretim süreçleri büyük ölçüde karar verebilen özerk bir yapay zekanın uygulanmasından kaynaklanacaktır.

SONUÇ

Yapay zeka tüm riskleri ortadan kaldıracak tek çözüm olmadığından, yasaklanması diğer küresel sorunlara neden olacaktır. Bu nedenle yapay zekanın güvenliğini kontrol etmek karmaşıktır ve sürekliliği gerektirir. Teknoloji ilerledikçe, düşük vasıflı işçilerin bilgisayarlaşmaya açık olmayan, yani yaratıcı ve sosyal zeka gerektiren işlere atanması bekleniyor. Yapay zeka sistemlerini satın almanın, kişiselleştirmenin ve sürdürmenin yüksek maliyeti göz önüne alındığında, firmaların yalnızca işin bir kısmını yapabildikleri takdirde insanları yapay zeka sistemleriyle değiştirmeleri pek mümkün değildir. Özellikle duygusal görevlerle ilgili olanlar da dahil olmak üzere diğer istihdam türlerinin önemli bir yüzdesine sahip olacaktır. Dünya Ekonomik Forumu'nun 2018 raporuna göre önümüzdeki 5 yılda yapay zekanın gelişmesiyle birlikte 50 milyondan fazla yeni istihdam yaratılacağı öngörülmüştür. Dolayısıyla önümüzdeki yıllarda işsizlik riski yerine istihdamın artması, kısa ve orta vadede rutin işlerin yapay zeka sistemlerine devredilmesi bekleniyor. Uzun vadede yapay zeka sistemleri, iş kararlarında sürekli iyileştirmeye ve rekabet avantajına katkıda bulunacaktır. Tüketiciler, sosyal aktivistler ve sivil toplum kuruluşları, şirketlerin sürdürülebilir çözümlere

olan bağılılığını artıracak. Bu nedenle, şirketlerin rekabetçi sektöre hakim olmalarını sağlayacak stratejiler, karar verme ve yönetim için yararlı olabilecek büyük veri setlerinden yeni bilgiler çıkarmak daha da önemli hale gelecektir. Teknolojik devrimler, yeni bir üretim yönetimi biçimini, insanlar ve yapay zeka arasındaki etkileşimi ortaya çıkaracaktır. Çünkü bilgi teknolojilerine bağımlılığın artmasıyla birlikte insanlar algılama kapasitelerinin ötesindeki bilgilerle baş edemez hale gelecek ve bu durum toplumda tartışmalara yol açacaktır. Akıllı makineler genellikle terk edilmiş fabrikaların kıyamet senaryolarına ve işsizlikle dolu tüm alanlara paralel olarak çalışırlar. Bu nedenle, gelecekteki iş başarısı sadece işçilere özgürlük vaat etmekle kalmaz, aynı zamanda sosyalden sosyoekonomik perspektiflere geçiş ile yeni bir yönetim paradigması gerektirecektir. Son zamanlarda gelişmiş ülkelerdeki asgari devlet sübvansiyonları hakkındaki tartışmalar gerçekten korkutucu bir seviyede olmasa da, gelecekte bazı işsizliklerin olacağı beklentilerine dayanıyorlar.

REFERENCE

- Agrawal, A., Gans, J. & Goldfarb, A. (2018). Economic Policy for Artificial Intelligence, NATIONAL BUREAU OF ECONOMIC RESEARCH, Working paper 24690.
- Anderson, J., Rainie, L. & Luchsinger, A. (2018). Artificial Intelligence and the Future of Humans, Pew Research Center, 1-120.
- Lee, J., Davari, H., Singh, J. & Pandhare, V. (2018). Industrial Artificial Intelligence for Industry 4.0-based Manufacturing Systems, *Manufacturing Letters*, 18, 20-23.
- Levy, F. (2018). Computers and populism: artificial intelligence, jobs, and politics in the near term, *Oxford Review of Economic Policy*, 34(3), 393–417.
- Mutascu, M. (2021). Artificial intelligence and unemployment: New insights, *Economic Analysis and Policy*, 64, 653-667.

**NUMERICAL AND EXPERIMENTAL INVESTIGATION OF OZONE
PRODUCTION AND TRANSPORT FROM DEFECTIVE HYDROGENERATOR
STATOR BAR IN AN OZONE REACTION CHAMBER**

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Abstract

We present an experimental and computational study on concentration and transport of ozone produced by partial discharges in a high-voltage defective stator bar from a 30 MW hydrogenerator. Partial discharges can occur in the insulation system of a hydrogenerator's stator bars or on its surface which, over time, could lead to damage to the generator. In this study, a coil-type stator bar of a hydrogenerator was used, with defects in the insulation material. The stator bar was cut and placed in an acrylic chamber and then subjected to the high voltage of 8 kV (60 Hz). The ozone concentration was measured using

gas sensors (ultraviolet and electrochemical sensors). A computational fluid-dynamics (CFD) model was then developed to simulate gas flow and ozone concentration in the chamber, which was validated using the experimental data. The problem was numerically solved for different air velocities (0.7, 2.7 and 3.7 m/s). The results show that the CFD model can accurately predict the ozone concentration in the chamber and it can be used for monitoring partial discharge activity in hydrogenerators for preventative maintenance purposes. Curves in which ozone concentration depends on input velocity are shown and discussed. Three-dimensional ozone distributions obtained inside the chamber model are also analyzed. This study provides valuable information for developing monitoring methods for ensuring the reliability and longevity of hydrogenerators as renewable energy sources.

Keywords: Acrylic Chamber, Hydrogenerator Stator Bar, Partial Discharges, Ozone, Laboratory Experiments, CFD model.

1. Introduction

On a global scale, hydropower is one of the largest sources of renewable energy. According to the International Energy Agency (IEA), despite the fact that in 2017 approximately 64% of the world's electricity generation came from non-renewable sources such as coal (38%), natural gas (23%), and diesel-fired power plants (3%), hydropower represented 17% of the global electricity matrix as a renewable energy source (Lima, Toledo and Bourikas, 2021).

In Brazil, hydropower is one of the country's most important energy sources, accounting for 64% of the country's electricity production, according to ANEEL data from 2019 (Souza, 2023). Brazil's hydraulic energy remains open to further growth due to its considerable unexploited hydraulic potential, especially in the Amazon basin in the northern region of the country (Soito and Freitas, 2011).

The most important components of hydropower plants are the hydrogenerators, which generate electricity from the energy of falling or flowing water. As they are subjected to mechanical, thermal and electrical stresses during their lifespan, hydrogenerators can degrade over time, eventually resulting in failure. Since such devices are designed to operate for decades or longer, the study of preventative maintenance techniques is crucial for ensuring their operational reliability and longevity.

Partial discharge (PD) is a phenomenon that can accelerate the degradation process and cause damage to the generator insulation materials. It is a type of electrical discharge that can happen when there is a localized failure in the insulation materials of a hydrogenerator's stator bar. It occurs when high voltage is applied to the stator insulation system, producing electric fields that exceed the dielectric strength of the material.

PDs can also supply sufficient energy to transform oxygen into ozone. In this context, ozone measurements can be used as an inspection method for determining whether there are PDs on hydrogenerators. The associated reactions are given by (Buntat, 2009)



and



In (1), (2) and (3), e is a high-energy electron and M are other subproducts, such as O_2 , O_3 or N_2 , that the reaction can produce. Therefore, studying the concentration of ozone in the air around the stator bars surroundings can enable the detection and monitoring of partial discharge activity for maintenance purposes.

In this paper, an experiment was conducted to investigate the ozone concentration produced by a high-voltage defective stator bar inside an acrylic chamber. A computational fluid dynamics (CFD) model was then conceived, which was validated by using the experimental data for different air velocities injected into the chamber.

2. Methodology

In this section, theoretical and computational fluid dynamics concepts related to turbulent flow and the transport of diluted species, used in COMSOL Multiphysics® software, are presented. Then, we present an overview of the experimental setup, physical parameters and the simulation model.

2.1. Computational Fluid Dynamics

The mass conservation law for a chemical species i [Chung, 2002] is given by

$$\frac{\partial c_i}{\partial t} + \nabla \cdot \vec{J}_i + \vec{u}_m \cdot \nabla c_i = R_i, \quad (4)$$

where

$$\vec{J}_i = -D_i \nabla c_i. \quad (5)$$

In (4) and (5), \vec{J}_i is the diffusion flux vector given in mol/(m²·s), c_i is the species concentration (mol/m³), D_i is the diffusion coefficient (m²/s), R_i is an expression of reaction rate for the species given in mol/(m³·s) and \vec{u}_m is the average mass velocity (m/s). In steady state, (4) can be written as

$$\nabla \cdot \vec{J}_i + \vec{u}_m \cdot \nabla c_i = R_i. \quad (6)$$

Another important parameter in computational fluid dynamics is the Reynolds number Re [Griebel, 1998], given by

$$Re = \frac{\rho u L}{\mu}, \quad (7)$$

where ρ is the density of the fluid, u is the flow speed, L is the characteristic length and μ is the dynamic viscosity of the fluid. Fluids with $Re \approx 0$ are highly viscous fluids and, therefore, they are less susceptible to turbulence.

2.2. Fluid dynamics model with ozone reactions

In our CFD model, the parameter associated to ozone generation is R_i , given in mol/(m³·s), which is the reaction rate for the species. It can be calculated by

$$R_i = \frac{\eta \cdot P}{m \cdot V_{O_3}}, \quad (8)$$

in which η is the generation efficiency of ozone, P is the power of partial discharges, m is the ozone molar mass (47.997 g/mol) and V_{O_3} is the volume relative to the region where ozone is generated [Buntat, 2005].

The flux of ozone deposition on surfaces is given by [Cano-Ruiz, 1993]

$$\vec{u}_m \cdot \vec{J}_s = -\gamma \frac{\langle v \rangle}{4} C \Big|_{y=\frac{2}{3}l}, \quad (9)$$

where J_s is the net flux of species to the surface of interest, γ is the mass accommodation coefficient between ozone and the deposition surface, which is defined as the fraction of all surface-colliding ozone molecules that undergo deposition, C is the ozone concentration, l is the mean molecular free path with a value of 6.5×10^{-8} m at 293 K and 1 atm, and $\langle v \rangle$ is the Boltzmann velocity for ozone, given by

$$\langle v \rangle = \left(\frac{8kT}{\pi m} \right)^{1/2}, \quad (10)$$

where k is the Boltzmann constant ($1.38 \times 10^{-23} \text{ JK}^{-1}$), T is the temperature (K). Considering $T = 293\text{K}$, the Boltzmann velocity for ozone is $3.6 \times 10^4 \text{ cm}\cdot\text{s}^{-1}$. The diffusion coefficient D_i for ozone is $1.82 \times 10^{-5} \text{ m}^2/\text{s}$ [Willians, 1990].

The mass accommodation coefficient γ is specific for each surface material [Cano-Ruiz, 1993]. Experiments have been conducted in the scientific literature to measure the values of γ for different materials. The values used in this work are shown in Table 1.

Table 1. The parameter γ for different materials.

MATERIAL	γ	REFERENCE
Acrylic	2.35×10^{-6}	[Sabersky, 1973]
Copper	2.00×10^{-6}	[Morrison, 1999]
Outlet tube	1.10×10^{-6}	[Shen, 2017]
Stator bar surface	2.00×10^{-6}	[Shen, 2017]

2.3. Laboratorial Setup

The experimental setup of Fig. 01 was designed and assembled to investigate the production of ozone from the stator bar and to allow measurement and monitoring of ozone concentrations. The setup consists on a stator coil bar enclosed in an $145 \times 21 \times 50 \text{ cm}$ acrylic chamber with two $\frac{3}{4}$ -inch-diameter-tubes, a power supply that operates at 60 Hz with three voltage levels (0 kV, 4 kV, and 8 kV RMS) and a thermohygrometer. Furthermore, the inlet tube is connected to a hose that is attached to a pressurized air source. The ultraviolet ozone monitor receptacle is placed near the outlet tube.

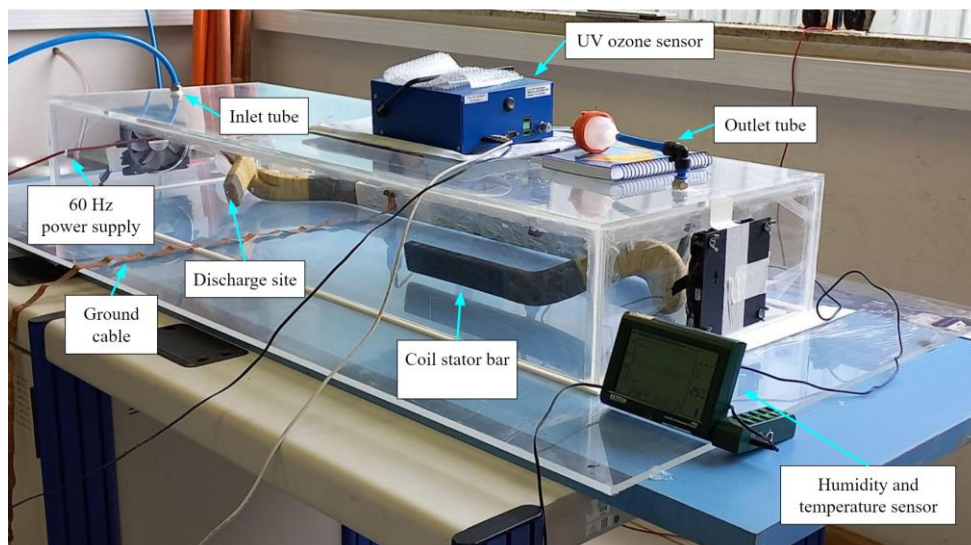


Fig.01: Our laboratorial setup.

The coil-type stator bar supplied by Silvio Braga's (Curuá Una) 30 MW hydroelectric power plant hydrogenerator was cut at a section where the insulation material among its core materials presented defects (Figure 02). Subsequently, the bar was placed inside the chamber and connected to the 60 Hz high-voltage power supply with appropriate grounding.



Fig.02: The defective stator bar cross section.

2.4. The experiment

The inlet pressure was set to 2 bar for the entire experiment and the air velocity at the outlet was maintained at 2.7 m/s. The interior of the box was kept at a constant temperature of 21 °C and relative humidity of 24%. Ozone production was measured using the commercial ultraviolet ozone monitor 2BTechnologies model 106-L.

The experiment consists of measuring ozone resulting from the application of different voltage levels applied to the stator bar according to the following schedule: 0 kV during 5 minutes, 4 kV during 10 minutes, 8 kV during 10 minutes, 4 kV during 10 minutes, and 0 kV during 5 minutes. Data was recorded at the rate of 2 samples per second throughout the experiment using the monitor's software. From the measurements, it was possible to observe in Fig. 03 that, upon reaching a voltage level of 8 kV, the time-averaged measured ozone concentration was 495.4 ppb at the outlet tube (for inlet air velocity of 2.7 m/s).

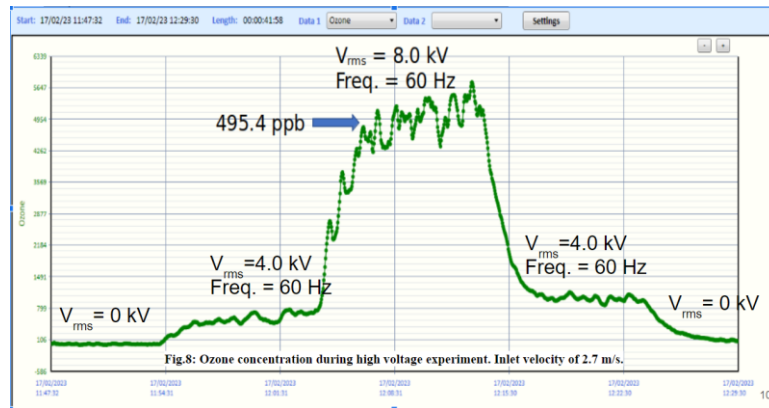


Fig.03: Recorded ozone concentration during the high-voltage experiment. Inlet velocity: 2.7 m/s.

The numerical model

For the conception of the CFD model, the COMSOL Multiphysics[®] software was used, which employs the finite element method to solve transport equations of diluted species and turbulent flow, which were discussed in sections 2.1 and 2.2. Initially, the structures of the experiment materials, such as the acrylic chamber, stator bar and the inlet and outlet tubes, were modeled using the software, as one can see in Figure 04.

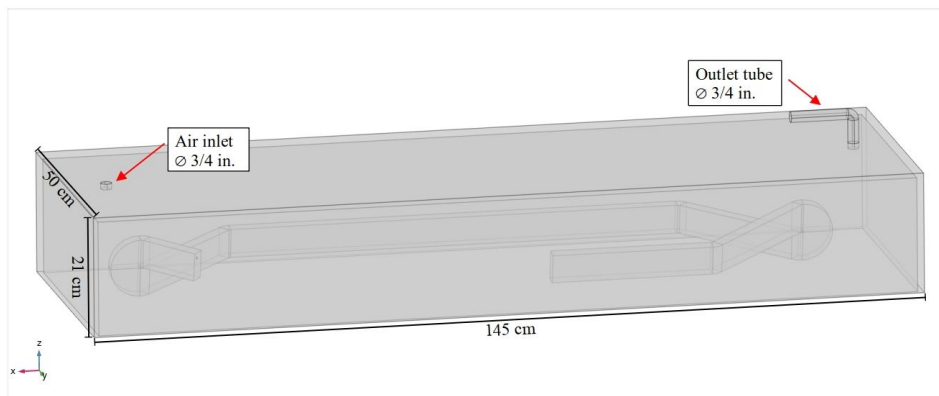


Fig.04: Computational model for representing the experimental setup.

A finite element mesh was generated using parameters of the physics of the problem for the internal and external regions of the chamber and tubes, as well as for the surface of the stator bar inside the chamber, as depicted in Figure 05. A total of 2,234,735 elements were employed to conceive the mesh, with a maximum element size of 15 mm and a minimum element size of 5 mm.

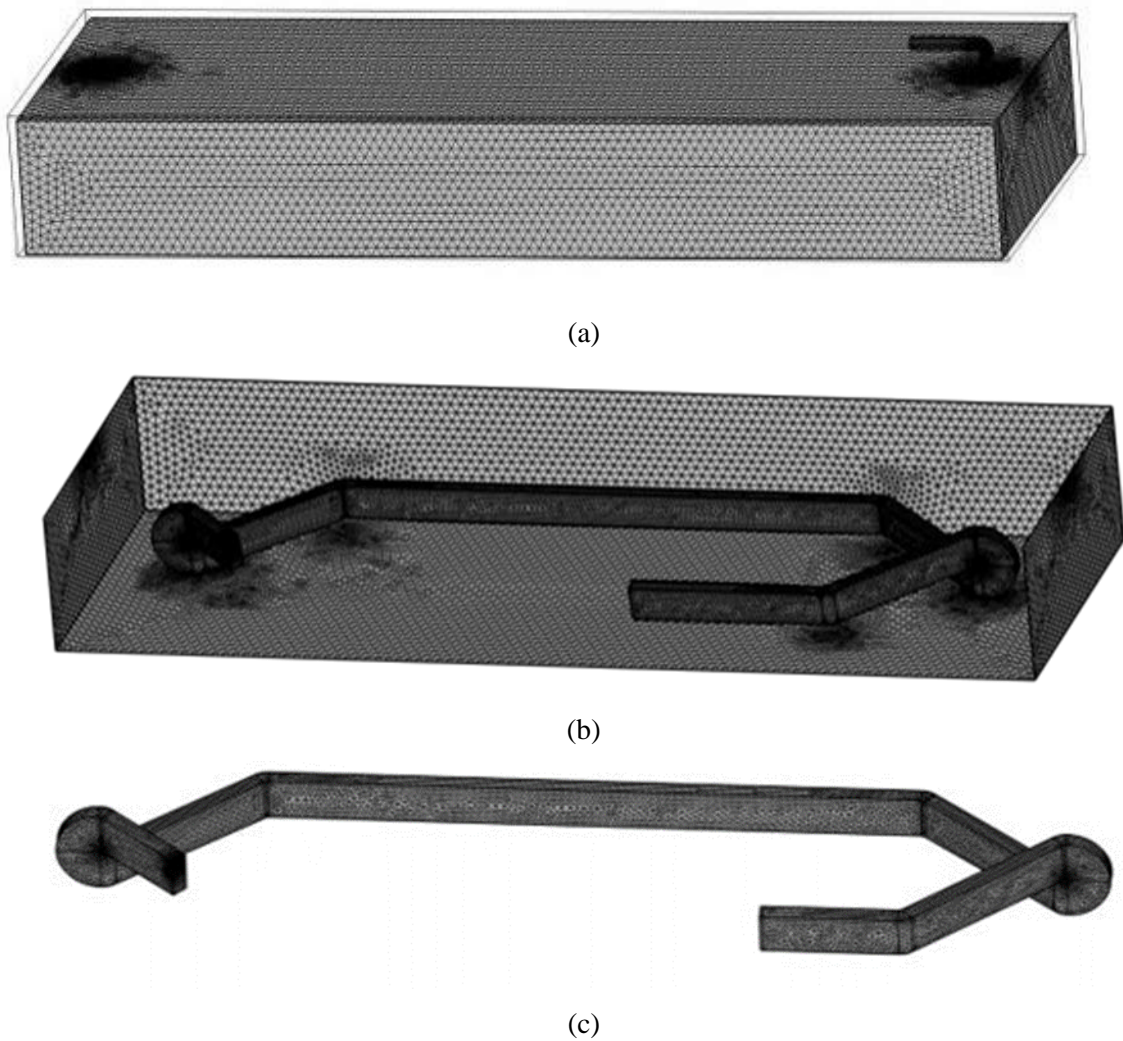


Fig.05. Computational model mesh conceived for performing simulations in COMSOL Multiphysics:
(a) external view, (b) Interior view and (c) model of coil stator bar.

In order to represent the ozone production at the discharge site (Figure 06), an 8 mm^3 element was introduced at the surface of the coil stator bar (Figure 07). This element behaves as an ozone source, in which R_i is set, which was implemented in the numerical model.



Fig.06. Naked-eye-visible discharge during our high-voltage experiment.

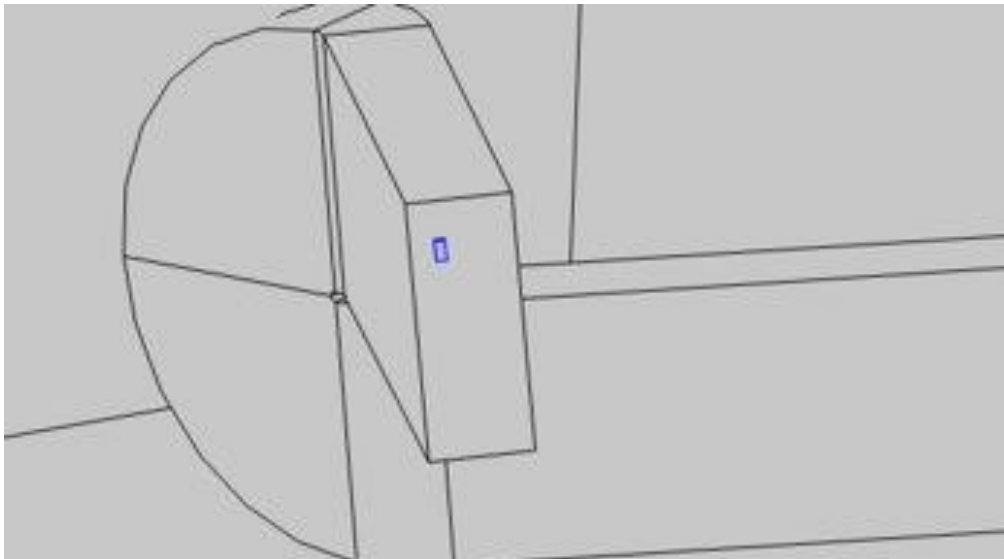


Fig.07. Element added as ozone source in the numerical model measuring 8 mm^3 in volume.

Results

For the high-voltage experiment, the ozone concentrations measured at the outlet tube during the experiment are represented in Figure 03. For the numerical model of the chamber, it was decided to use the average concentration measured during the excitation of 8 kV (495.4 ppb) as the basis for the parameters of the simulations. Thus, the species reaction rate of the ozone source was adjusted to attain an output concentration similar to the concentration measured for the case of $V_{\text{RMS}} = 8 \text{ kV}$ and input velocity V_{in} of 2.7 m/s. The results for the simulation of the experimental occurrence are presented in Figures 08-11.

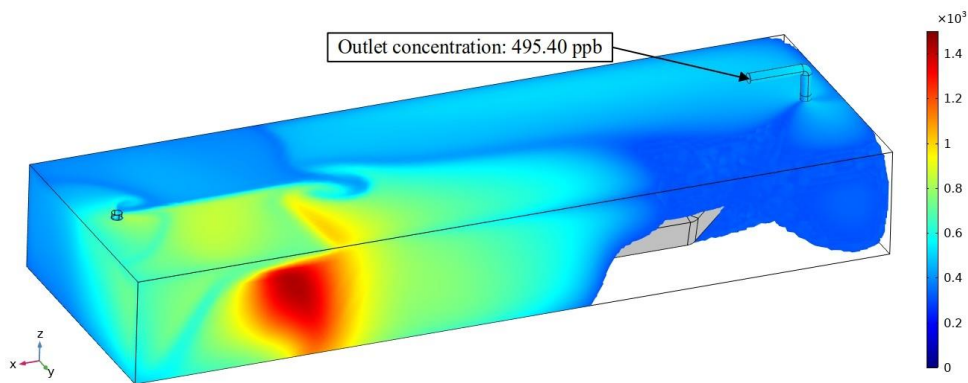


Fig.08: Ozone concentration distribution inside the chamber for $V_i = 2.7$ m/s.

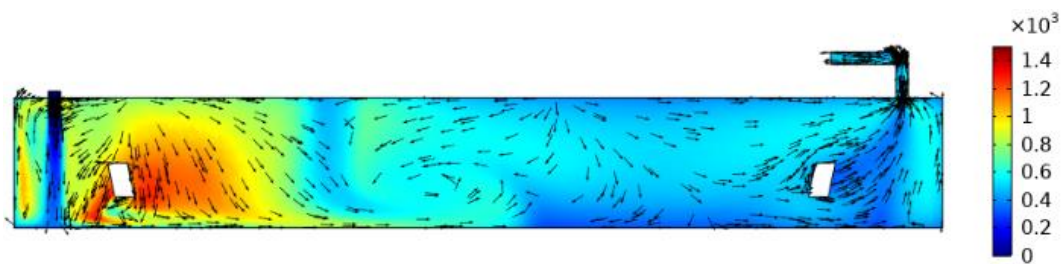


Fig.09: Cross section of ozone distribution for $V_i = 2.7$ m/s. Black arrows indicate velocity vectors.

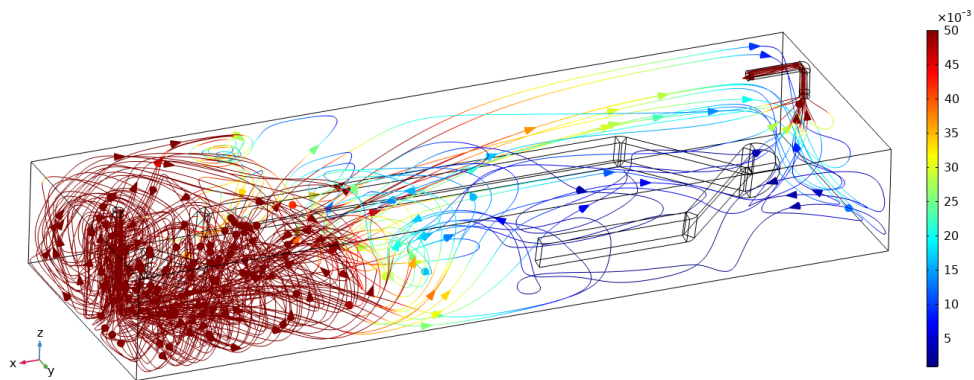


Fig.10: Velocity field streamlines for 2.7 m/s simulation. Color map is based on velocity magnitude (m/s).

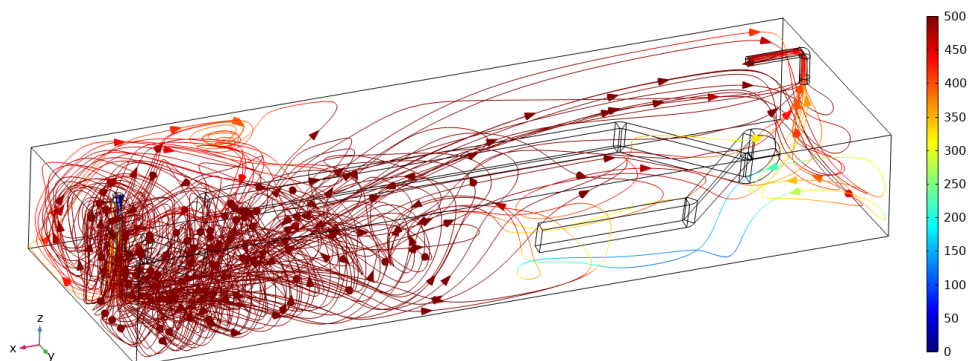


Fig.11: Velocity field streamlines for 2.7 m/s simulation. Color map is based on ozone concentration (ppb).

Subsequently, by maintaining constant the average concentration in the ozone source, additional simulations were executed varying the inlet air velocity for additional values (0.7 and 3.7 m/s) to evaluate the effect of the inlet air velocity on the ozone concentration of the numerical model. The results for these additional simulations are shown in Figures 12-19 and Table 2.

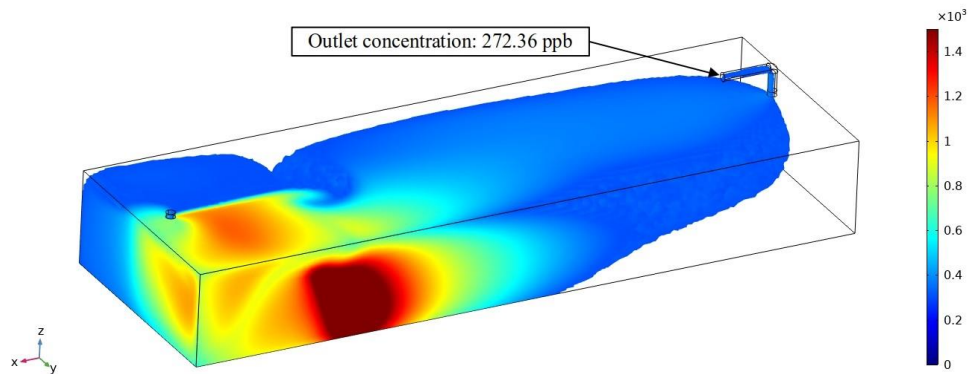


Fig.12: Ozone concentration distribution inside chamber for $V_i = 0.7$ m/s.

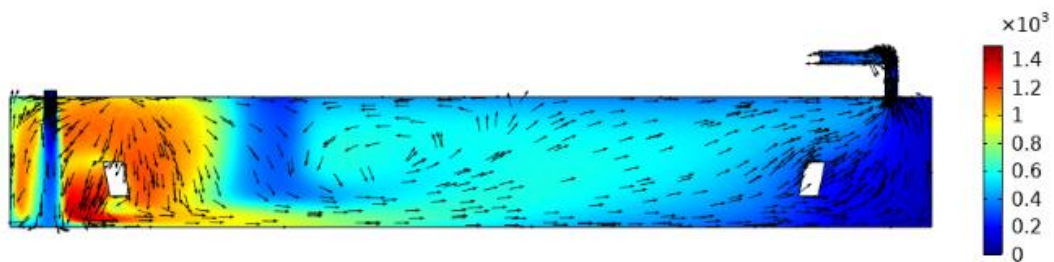


Fig.13: Cross section of ozone concentration distribution for $V_i = 0.7$ m/s. Black arrows indicate velocity vectors.

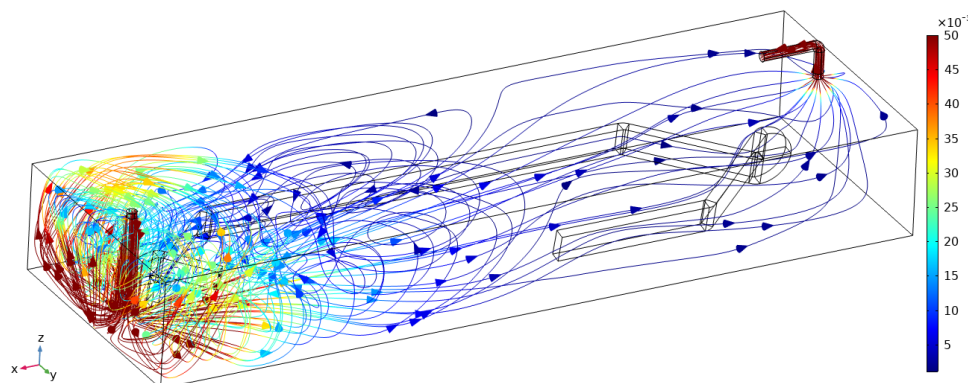


Fig.14: Velocity field streamlines for 0.7 m/s simulation. Color map is based on velocity magnitude (m/s).

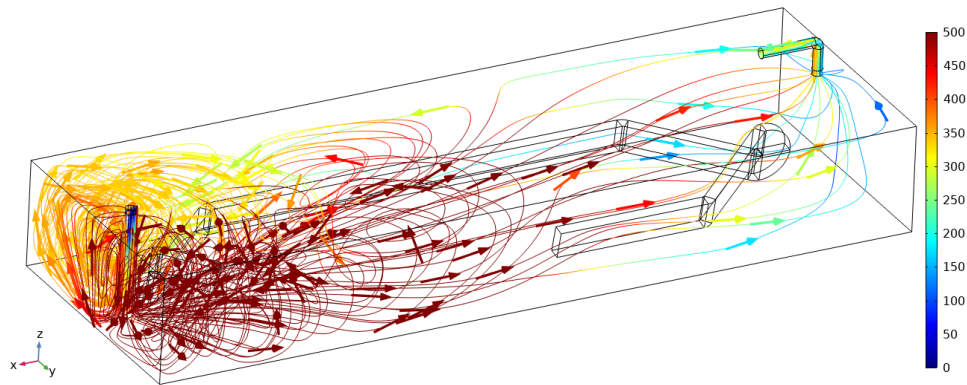


Fig.15: Velocity field streamlines for the 0.7 m/s simulation. Color map is based on ozone concentration (ppb).

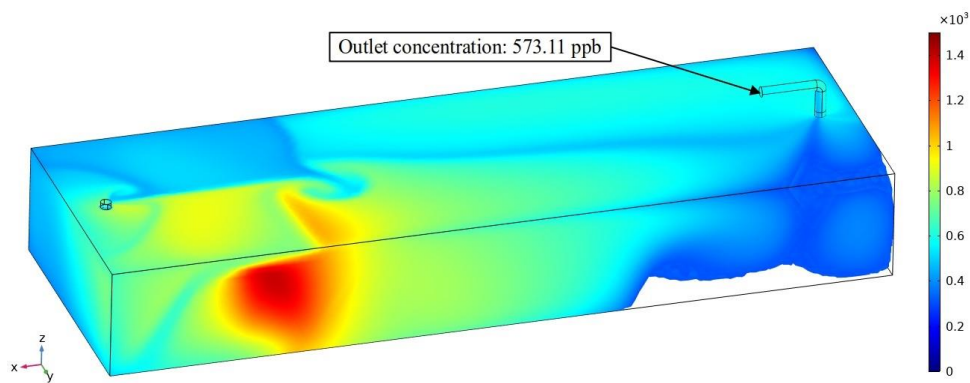


Fig.16: Ozone concentration distribution inside the chamber for $V_i = 3.7$ m/s.

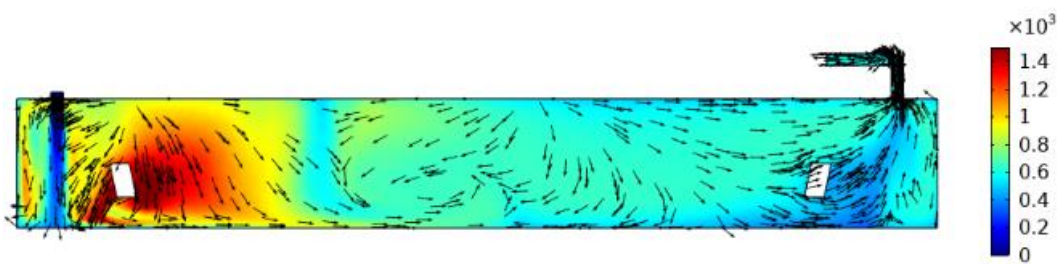
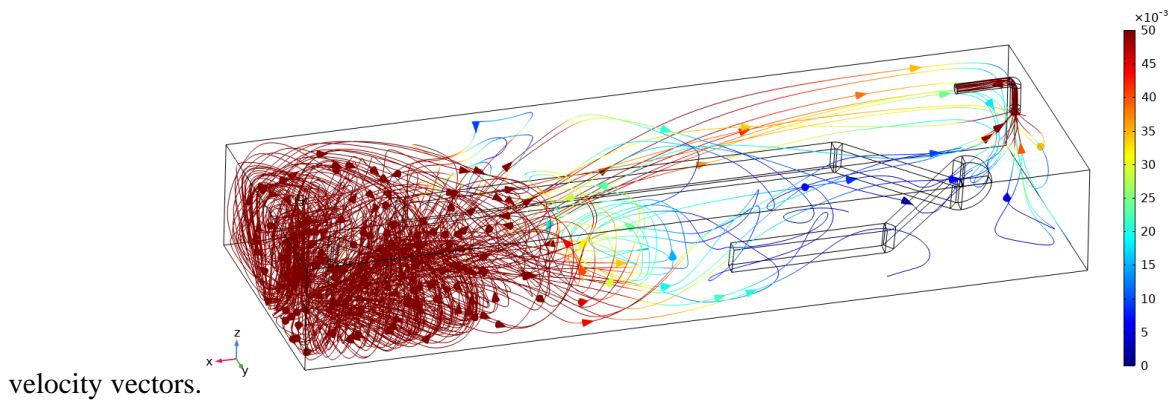


Fig.17: Cross section of the ozone concentration distribution for $V_i = 3.7$ m/s. Black arrows indicate



velocity vectors.

Fig.18: Velocity field streamlines for the 3.7 m/s simulation. Color map is based on velocity magnitude (m/s).

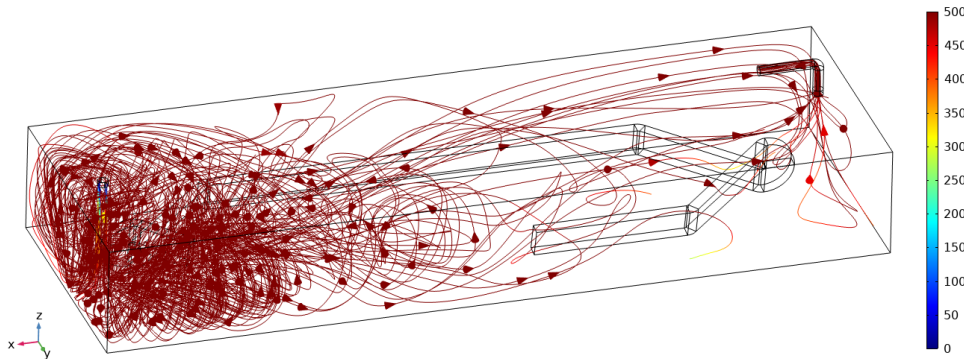


Fig.19: Velocity field streamlines for the 3.7 m/s simulation. Color map is based on ozone concentration (ppb).

Table 2. Parameters and ozone concentrations obtained from the simulations.

Air Inlet Velocity (V_i) (m/s)	Ozone source reaction rate (R_i) (mol/(m ³ ·s))	O ₃ Concentration in Outlet (ppb)	O ₃ Concentration in Source (ppb)
0.7	1.595×10^3	272.36	1.027×10^6
2.7	3.418×10^3	495.40	1.027×10^6
3.7	4.756×10^3	573.11	1.027×10^6

Results: qualitative analysis

From the numerical results, a decrease in the outlet concentration for the simulation with inlet velocity of 0.7 m/s can be noted. One can also observe the formation of a region of turbulent gas displacement near the ozone source. For the smaller inlet velocity, ozone tends to circulate in the turbulence zone. For simulations performed with higher inlet velocities (2.7 and 3.7 m/s), there is an increase in gas turbulence levels, but there is also the formation of a laminar flow that contributes to transport ozone from the turbulence zone to the outlet tube, in such way that the output concentration obtained at the outlet tube increases with increments of the inlet velocity (in the studied velocity range).

Discussions and future perspectives

In general, it is known that partial discharges in hydrogenerators are important factors contributing to produce damages to electrical insulation and in reducing their lifespan. In that way, ozone concentrations in the air over usual levels can be indicative of partial discharges. Therefore, the results of this work can support future technical and scientific foundations aimed at improving the efficiency of measuring ozone concentration through the placement of sensors in strategic regions of hydrogenerators. Afterwards, in a future experimental scenario, the same studies on the velocity of air introduced into the chamber for the applied voltage of 4 kV in the experimental results and distinct air pressures in the chamber can be replicated. It is also possible to deepen the research by estimating the power of the discharge from the parameter R_i and relating the electromagnetic characteristics of the fields induced by high voltages, which are applied in the stator bar, with the fluid-dynamic properties of ozone production in the experiment.

Conclusions

In this work, a laboratory experiment was conducted, which was also computationally modeled. The experiment employs a defective hydrogenerator stator bar in a controlled laboratory environment to investigate the impact of air velocity on the ozone concentrations resulting from partial discharges on the bar installed inside the chamber. When the inlet air velocity is increased, there is a non-linear increase observed in ozone concentration at the outlet tube due to the formation of a laminar ozone transport path between the turbulence zone and the outlet tube. Therefore, when analyzing the concentration of ozone gas in hydrogenerators, it is important to study the impacts that air velocity has on the ozone concentration measurements. Effects of air velocity should be studied in hidrogenadores since its rotor produces ventilation, providing scientific and technical basis for efficiently placing ozone sensors in hydrogenerators for PD monitoring.

Acknowledgements

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References

- Lima, G. C. et al (2021), “The Role of National Energy Policies and Life Cycle Emissions of PV Systems in Reducing Global Net Emissions of Greenhouse Gases”, *Energies*, 14(4): 961.
- Soito, J. L. S. and Freitas, M. A. V., (2011), “Amazon and the expansion of hydropower in Brazil: Vulnerability, impacts and possibilities for adaptation to global climate change”, *Renewable and Sustainable Energy Reviews*, 15(6): 3165–3177.
- Souza, L. L. L. et al (2023), “Life cycle assessment of prospective scenarios maximizing renewable resources in the Brazilian electricity matrix”, *Renewable Energy Focus*, (44): 1–18.
- Chung, T., J. (2002), “Computational Fluid Dynamics”, Cambridge University Press, Cambridge.
- Williams, E. L. II and Grosjean, D (1990) “Removal of atmospheric oxidants with annular denuders”, *Environmental Science & Technology*, (24): 811-814.
- Buntat, Z. (2005), *Ozone Generation Using Electrical Discharges: A Comparative Study Between Pulsed Streamer Discharge And Atmospheric Pressure Glow Discharge*, Ph.D. Thesis, Loughborough University, Loughborough.
- Griebel, M., Dornseifer, T. and Neunhoeffler, T. (1998), “Numerical Simulation in Fluid Dynamics”, Siam, Philadelphia.
- Cano-Ruiz, J. A. et al (1993), “Removal of reactive gases at indoor surfaces: Combining mass transport and surface kinetics”, *Atmospheric Environment*, (27): 2039–2050.
- Sabersky R. H. et al (1973), “Concentrations, decay rates, and removal of ozone and their relation to establishing clean indoor air”, *Environmental Science & Technology*, (7): 347–353.
- Morrison, G. (1999), *Ozone-Surface Interactions: Investigations of Mechanisms, Kinetics, Mass Transport, and Implications for Indoor Air Quality*, Ph.D. Thesis, University of California, Berkeley.
- Shen, J. et al (2017), “Outdoor and Indoor Ozone Concentration Estimation Based on Artificial Neural Network and Single Zone Mass Balance Model”, *Procedia Engineering*, (205): 1835–1842.

**ABOUT THE LITERATURE THAT WAS WRITTEN THROUGH THE PAGES OF
AN ISLAMIC MAGAZINE IN ALBANIA DURING THE SECOND WORLD WAR**

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ABSTRACT

We believe that the magazine "Islamic Culture" evokes both curiosity and satisfaction for all those who look with interest at the developments of Albanian journalism. It is universally known that the press is inextricably linked to the culture of a nation. Culture as a synonym of Albanian memory should encourage us to remember from time to time what our ancestors did for the benefit of progress. We believe that the Islamic culture was adequately represented by the magazines: "Zani i Naltë", "Kultura Islame" and "Njeriu". This press has dedicated a lot of space to writings that evaluate the elements of the state and the nation. The magazine "Kultura Islame" was an outstanding help in the scene of Albanian periodicals, who appeared in a period of liberalism and growth of the Albanian intelligence throughout the country. The magazine was born in 1939 and fell silent in 1945 anticipating developments that would contradict the liberal and democratic culture and approach that it tried to manifest. The changing times would have no space neither for free breathing nor for religious, scientific, and literary topics. They would be narrowed down to the tragic reality that was approaching in the communist era. Rich informative and study subject in the field of religious, philosophical, literary, historical and scientific thought; the translations and studies brought into Albanian were products in coherence with the developments of the time's thought and they also expanded the horizon of the Albanian reader's expectations in these fields.

Keywords: the magazine, culture, islamic, literature, memory.

INTRODUCTION

If we consider a fragment of the definition given by this periodical in the number 6-7 of 1939 for the culture, we will witness how much this creed of the magazine "Kultura Islame" maintains expectation and relevance even today. We quote: "It is obvious that with the word culture, we mean the knowledge or the scientific, literary and artistic states of the peoples and nothing else. It should be known that culture is of great importance in itself. [...] If culture weakens in any nation, the conclusion is that it weakens nothing but literary, scholarly and artistic production, so the knowledge market is in crisis. In this way the path to ignorance is opened having minds astound and static. Genius sustained in generations is lost. In this case, in addition to what has been said, it often happens that false beliefs, thoughts and ideas spread, and people are closer to inspiration than to requests, clarifications and inventions. (1939)

"...the reduction of literary production..", I pointed out this expression to emphasize the importance that literary production and literary study was expected to have. In fact, from its beginning, the magazine would have its space for literature as well. If we were to give a description of how this periodical was included in the framework of the Albanian literary system of those years, we could say that within this system there was the famous triad: production, tradition and import. In other words, the magazine would have as its goal newly literary production, the publication and study of traditional literature, as well as its translation.

1. "ISLAMIC CULTURE" MAGAZINE

In the article entitled "Echo of poetry", in the third issue of this magazine, the student of Literature at the University of Padua, Fadil Karakaçi writes: "The poet belongs to his people. He engraves incomparable apotheosis of glory. He presents the girl's love in the mouth of an entire people, and the graceful colors with which he wears the selected verses, he enjoys them under the transparent lights from which he also emits the sounds of a divine melody".

Against this goal, which seems to be the goal of this magazine, Ferit Vokopola, Shaban Demiraj, Refik Bezhani, Besim Lëvonja, Bardhyl Nizami, Jolanda Kodra, Eqrem Çano, Halit Haveriqi, Rom, Murat Labënishti, Shero Imami, Petrit Kokoshi, Memli Mano, Veli Hafizi, etc began to test themselves with their verses. Let us present something from this literary production, pointing out different verses. In the poem entitled "Suraja e Agimit" by Ferit Vokopola, written in the folk eight-syllable verse, elements of philosophical and moral content can be observed. We are quoting the verses in Albanian, because it is the original language:

Kur Zoti njerinë veçon,

Me begati e nderonë,

Ky at-herë zë e thotë;
Më nderove Ti o Zot!
Por se kjo më t'u paksuarë,
Mbesimin për të provuarë,
Nukë druhet që të thotë,
Më tradhtove Ti, o, Zotë!
Jo! Unë kurrë nuk tradhëtonjë!
Por ju jetimin s'e nderuatë!
Të vobegtin (e shikonjë)
Që pa bujtur e dëbuarë!
Trashëgimin që zotronia,
Me hallall-harram trazoni
Kamjen tepër dashuroni.
(When God singles out a person,
With prosperity they honor him,
This time he begins to say;
You honored me, Lord!
But when this is reduced,
the faith to try,
He's not afraid to say,
You betrayed me, O Lord!
No! I never betray!
But you did not honor the orphan!
I look at the poor
You kicked him out without welcoming him!
The legacy I owned,
Stir with halal-harram
You love wealth too much.)

While another poem will follow in number 5 of the magazine in 1940 by an author who would later become one of the most prominent linguists, prof. Shaban Demiraj. The poem is written in eleven-syllable verse and is called : "Prophetic Birth" (Lindjes Profetike). In addition to prose, dramaturgy also begins to occupy a prominent place in magazines. Here we can mention Mustafa Mustafaj's short prose : (Rruga e mergimit) "The path of exile" (no. 1-2, year

1942), "Tradhetija" "Betrayal", "Ku eshte babai" "Where is the father?" which the author calls them *novellas*. The magazine will also publish in several issues an idyllic drama by Asim Lohja from Shkoder called: ("Agim pranveror i jetës shqiptare", "The spring dawn of Albanian life), a four-act drama. From Murat Labënishti, I would like to highlight some verses from the poem "Gjuha amtare", "Native language":

Po nuk rojte mbi çdo tjetër

Gjuhën tënde të bekuar,

Atë flakë aq të vjetër

Që me shekujt t'ka ndriçuar

(If you don't feel it above any other

your blessed language,

That flame so very old

That over the centuries has enlightened you.) (Mustafa, 1945)

Research and critical articles will be an added value of the journal. It also leaves room for literary criticism, which presents the first indicators of theory, history and literary criticism. Such signs bear witness to time and are witnessed by time. By highlighting some scholars and critics of literature trained in the best universities of the time, the magazine "Kultura Islame" is in the "battlefield" and tries to announce the arrival of new works and new authors, who start their lives in Albanian literary system of the time.

2. AUTHORS WHO CONTRIBUTE MORE TO THIS MAGAZINE

Finally, the criticism of this journal tries to deal with the evaluation and presentation of the results, qualities, as well as with the issues of failure or various literary slips. Names that stand out are: Sadik Bega, Sherif Putra.

The researcher Fadil Karakaçi will bring the article "Eurythmy"(Euritmi) and later in number 10 of 1940, he will write an interesting article on the positivist and romantic thought in literature. From Izet Bebeziqi, we would distinguish the article published in No. 3 of 1939 with the title: "Albanianism abroad and inside the homeland", where the researcher notes that: „The real purpose of this study is mainly to present how the Albanian National Idea and the independence of Albania developed. Here lies the most important understanding of the role of Albanians in foreign countries.“ He continues with the formation of Arbëresh colonies and their contribution to the creation of Albanian literary production. This article continues in number 4, where the most prominent Arbëresh writers are highlighted and Jeronim de Rada is sublimated.

In number 10 of 1940, we have an article published under the pseudonym PLUS entitled: "About Albanian literary production". It is noted: „Today we need a literary generation! We ask for this because we don't have it. We ask for this because, like any nation, the Albanians also need to learn the high virtues that literary art produces. But before making this request, let's briefly see what role literary texts play in our lives. " (PLUS, About Albania literary production, 1940)

While this same author in another writing in commemoration of the national poet Naim Frashëri writes: "The poet of "Bagëti e Bujqësi" was none other than that pastoral singer, that poet of the inspirations of the soul, that weaver of the whims of the heart, that true artist who suffers, but does not endure". (PLUS, The poet of "Bagëti e Bujqësi", 1940)

In the article: "Critic and criticism"(Kritikë dhe kritika) he notes: "To have a good critic, to make the criticism generous, in a world where art is in its eternal rebellion, is an asset. It is lucky for those critics who feel the dignity of their mission and of their work,as well. " (Critic and criticism, 1941)

In number 7-8 of 1944, Professor H. Ali wrote: "Hasan Zyko Kamberi 200 years ago" where he states: “Hasan was not only a well-known erudite of a great fame, but he was also a natural poet. He rhymed effortlessly, and the verses flowed from his mouth like water flowing from a spring, unhindered.” (Ali, 1944)

Prof. Shefik Osmani, who would become one of the holders of pedagogical studies in Albania, publishes in this magazine under the pseudonym SHETOS. He would have an article entitled: "Nezim Ibrahim Frakulla from Berati" and would bring an interesting fact about the first dramatic dialogue in the Albanian language. We quote: "The incited and misunderstood Nezim complains and writes the song - Complaint from humanity/mankind of the 17th century. After that, a very beautiful song follows: They said it on a picnic in Bilçë. It has some historical value. It closes with a dialogue that is divided into two parts, - ‘The language speaks to the heart’- and a response - "The troubled heart responds to the language". It seems that it is not completely finished. But with this dialogue we have Nezim as a whole: with miseries, suffering and love.” ((SHETOS), 1942)

Muhamet Bala surprises us with an article no. 5-6-7 of 1942 with the title: "Do we have a modern Albanian drama" where he gives us a similar fact that can be of value to the history of Albanian literature, especially the history of the dramatic genre when he states: “Very little has been written in the field of dramatic art. Nezim Berati wrote a conversation in 1650 "Heart

and Spirit"(Zemra e Shpirti). ‘Something pastoral’ writes De Martini. Slowly the historical drama begins and comes to life, which unfolds little by little.” (Bala, 1942)

3. THE BEGINNINGS OF A LITERATURE AND CRITICISM WITH FEMALE AUTHORS

Jolanda Kodra was an Italian, born as Iolanda Guazzoni, in 1912, in Rome. She was the granddaughter of Enrico Guazzoni, an Italian screenwriter and film director. She was studying at a classical high school when she met her future husband, Malo Kodra, originally from Gjirokastra, who was a student in Rome. After coming to Albania, prepared with a good literary and philosophical culture, she participates vividly in the press of the time by publishing valuable studies and articles on the work of some of the most prominent representatives of our national literature, such as: Naim Frashëri, Gjergj Fishta, Migjeni, Ndre Mjeda in such serious cultural and literary magazines as: "Shkëndija", "Hylli i Drites", "Perpekja" , "Njeriu", "Islamic Culture", "Fryma", etc. Jolanda Kodra worked especially for Migjeni and Mjeda, who she would later translate into Italian. She was one of the first women to publish in Albania, in the company of Selfixhe Ciu and Musine Kokalari. After the Second World War, she also translated such writers as: Petro Marko and Sterjo Spasse. She was neither allowed to teach in the communist regime nor to return to her country again until 1962, a year before her death. In the September 1941 issue of the "Islamic Culture"(Kultura Islame) magazine, Jolanda Kodra will translate into Italian the poetic creation: "Flights of the Spirit", thus exporting the latest creations of Albanian literature to a great culture and language. In support of this translation, Gjergj Komnino would say: "Well Done, but only on one condition: continue your work without interrupting and try to get the most beautiful flowers of our garden. The importance of service is recognized by the future generation and art lovers". In number 8-9 of 1942, there is this new figure of Albanian letters who will create poetry in Italian and Albanian: Albania (Shqipërisë). We are quoting the first stanza of this twelve-stanza poem:

“Kjo tokë më të cilën një ditë shkëlxej arma
E pathyeshme e Skanderbeut të lumnueshmëm
E q’ e fortë si’i shkrep qindron gjatë shekujvet,
E denjë do t’ ishte për një kangë të Horacit
Qe tue jehue n’ ether, za-math
Emnin t’ja bante dhe shembujvet të naltë
Bujarije, fuqije, e trimnije
T’u na naltësonte një hymn që kurr nuk vdes”.

(This land on which one day the weapon shines
Invincible of the blessed Skanderbeg
Strong that like a rock stands over the centuries,
It would be worthy of a Horace song
Already echoing in the ether, big voice
The name also belongs to the high views
Generosity, strength, courage
giving us a hymn that never dies.)

One issue later, Jolanda Kodra translated the article: "Ideal value and practical goals of philosophy".

Xhemaliqe Shkreli (pseudonym Postribësja), born in Shkodër in 1919, is among the first women to continue her studies at the University of Florence, at the Faculty of Literature and Philosophy, becoming an intellectual with patriotic, progressive, and emancipatory ideas. Through her publicism, she gave a strong signal to Albanian society that the time for the opinion, place and role of women in the life of the country had come to never stop. In this context, Postribesja, in number 5-6-7, of 1942, in "Islamic Culture"(Kultura Islame) has an article entitled: "To the author of "If I Were a Boy"(Sikur të isha djalë)", where she expresses all the excitement of a meeting she had with Haki Stërmilli , who had done so much for the emancipation of women with the novel he wrote

In the issue of August 12, 1940, a poem by Gjergj Komnino was published with the title: "Jeronim de Rada" from which we would quote the verses: "The verse flows so pleasantly, just like the green grass ... You are marble, not from ruby, but from the linguistic cord".

While in the field of translation, we can evaluate Sadik Bega, Vexhi Buharaja, who translated, in several issues of the magazine, articles from the well-known Arab researcher Taha Hussein about the classical leaders of thought, such as: Homer, Socrates, etc.

In numbers 9 and 10 in 1942, a linguistic study by Dr. Vittorio Vallonica: "For a rational and uniform transcription of Arabic using the Albanian alphabet" appears translated from Italian language . In the following issue, the article titled: "A part of the Muslim civilization in Spain and Sicily" is published and is brought by another translator who would later excel in the field of lexicology of oriental languages, Tahir Dizdari.

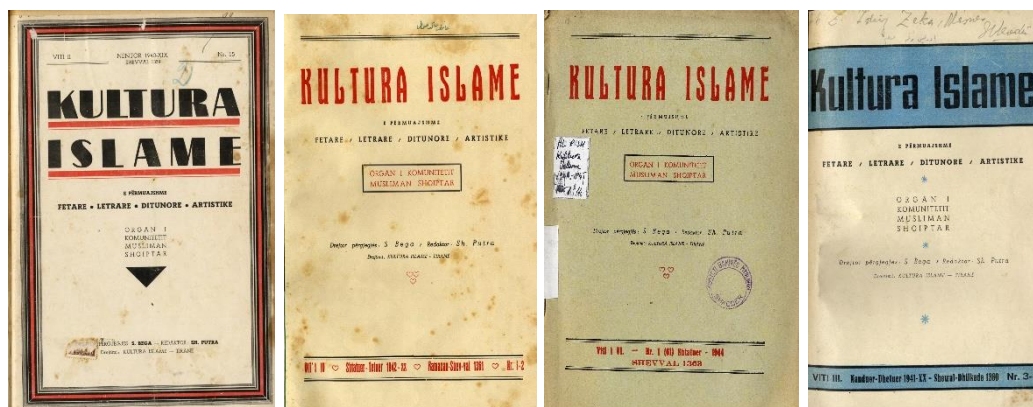


Figure 1. Cover of "Islamic Culture" Magazine

CONCLUSION

This article tries to make a journey and offer the readers, and especially the researchers of Albanian literary thought, the opportunity to better know not only the literary developments in a special historical period filled with many events, but also the attitudes, thoughts, and the activity of Albanian intellectuals, who had different fates in the years that followed. The presentation of the magazine on the official electronic website of the Shkodra Library "Marin Barleti" is a valuable help, which makes it possible the meeting between a wide archival material and the public, bringing it closer to the past. At the same time it is a tribute to the intellectual diligence of a generation that worked with idealism with the tools of culture and knowledge. The magazine is a model that makes it possible to facilitate the connections of the Albanian society and especially with the cultural heritage of the preceding intellectual elites. We think that the "Marin Barleti" Library of Shkodra has done a good job and should be thanked, as an institution open to inherited values, which can be offered today as models of media development. All these are important values, which Albanian society is in great need of.

REFERENCES

- (SHETOS), S. O. (1942). Nazim Ibrahim Frakulla from Berati. *Kultura Islame*, No. 5-6-7, 159.
- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*. Retrieved from <https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953>
- (1939). *Kultura Islame*, No. 6-7, 228-229.
- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), pp. 1-20.
- AFAD. (2022). *Açıklamalı Afet Yönetimi Terimleri Sözlüğü*. Retrieved from Açıklamalı Afet Yönetimi Terimleri Sözlüğü Web Sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Web sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Afet Türleri Web sitesi: <https://www.afad.gov.tr/afet-turleri>
- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 16(1), pp. 17-35. doi:<https://doi.org/10.17130/ijmeh.700812>
- AKSOĞAN , M., & ÇALIŞ DUMAN, M. (2018, Aralık 7-9). Akıllı Şehir Uygulamaları; Malatya Örneği. *1. Uluslararası Battalgazi Multi Disipliner Çalışmalar Kongresi Tam Metin Kitabı Cilt 1, 1*, pp. 183-202.
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(2).
- AKYEL, R. (2007). *Afet Yönetim Sistemi: Türk Afet Yönetiminde Karşılaşılan Sorunların Tespit ve Çözümüne İlişkin Bir Araştırma*. Adana: Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Doktora Tezi.
- ALAVİ, A., PENGCHENG, J., WILLIAM, G., & NİZAR, L. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. *Measurement*, 129, pp. 589-606.
- Albuquerque, R. (2003). The composition of international capital flows: risk sharing through foreign direct investment. *Journal of International Economics*, 61(2), 353-383.
- Ali, H. (1944). Hasan Zyko Kamberi 200 years ago. *Kultura Islame*, No. 7-8, 201.
- ARMAĞAN, V. (2018). Dijital Dönüşüm Sürecinde Akıllı Şehirler ve E-Devlet Platformu. *İletişim Kuram ve Araştırma Dergisi*(46), pp. 387-414.
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Baetens, F. (2013). *Investment law within international law: integrationist perspectives*. Cambridge University Press.
- Bala, M. (1942). Do we have a modern Albanian drama. *Kultura Islame*, No. 5-6-7, 214.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. Retrieved from <https://www.bbc.com/news/world-europe-17776876>
- Beqiri, G. (2017). Marketinguindërmarrjeve në Kosovë përmes aplikimit të mediave sociale. Tiranë .
- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development*, 62, pp. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>
- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from

- <https://berkleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>
- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Beurden, S. V. (2022, 4 30). *A New Congo Crisis?* Retrieved from https://origins.osu.edu/article/new-congo-crisis?language_content_entity=en
- Beylikdüzü Belediyesi. (2017). *ABİS (Afet Bilgi Sistemi)*. Retrieved from ABİS (Afet Bilgi Sistemi) Web sitesi: <http://www.beylikduzuhazir.com/Abis>
- Beylikdüzü Belediyesi. (2017). *Beylikdüzü Hazır*. Retrieved from Beylikdüzü Hazır Web Sitesi: <http://www.beylikduzuhazir.com/BeylikduzuHazir>
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri. *International Peace Information Service*, 2-50.
- Britannica. (2021, 12 24). *Romania*. Retrieved from <https://www.britannica.com/place/Romania>
- Britannica. (2022, 01 03). *Security*. Retrieved from <https://www.britannica.com/place/Romania/Political-process>
- Carey, B. (2021, April 1). *What's the Social Media Impact on Tourism?* Retrieved from CheckFront: <https://www.checkfront.com/blog/social-media-impact-on-tourism/>
- Çelik, H. (2022). Türkiye'de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), pp. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- ÇELİK, İ. H., USTA, G., YILMAZ, G., & YAKUPOĞLU, M. (2020). Türkiye'de Yaşanan Teknolojik Afetler (2000-2020) Üzerine Bir Değerlendirme. *AÇÜ Uluslararası Sosyal Bilimler Dergisi*, 6(2), pp. 49-57.
- CENTER for ECONOMIC and SOCIAL RIGHTS. (2022, 04 14). Retrieved from Key Concepts: Human Rights and the Economy: <https://cesr.org/key-concepts/>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*. Retrieved from <https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/>
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania's social strata in the past 30 years*. Retrieved from <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/>
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*. Retrieved from https://www.constituteproject.org/constitution/Romania_2003?lang=en
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*. Retrieved from <https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604.>
- Critic and criticism. (1941). *Kultura Islame, No.20-21*, 179.
- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- Dave Evans with Jake McKee. (2010). *Social Media Marketing: The Next Generation of Business Engagement*. Canada: Wiley Publishing, Inc., Indianapolis, Indiana.
- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf
- De Schutter, O., Swinnen, J., & Wouters, J. (2012). *Foreign direct investment and human development: the law and economics of international investment agreements*. Routledge.
- Deloitte Vodafone. (2016, 12). *Akıllı Şehir Yol Haritası*. DeloitteTürkiye.
- DHI Worldwide. (2018). Improved Flood Control and Water Quality With A Smart Water Solution See How The City Of Vejle In Denmark Protects Its Streets From Flooding. *The Expert In Water Environments*.

- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- DİLER, G. (2012, 04 30). Avrupa Birliği'nin İlk Yeşil Başkenti Stockholm. *Ekoyapı*.
- Dolzer, R., & Stevens, M. (1995). *Bilateral investment treaties*. Martinus Nijhoff Publishers.
- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. Retrieved from <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153>
- ELMAN. (2023). *Elman Sel Erken Uyarı Sistemi*. Retrieved from Elman Sel Erken Uyarı Sistemi Web Sistesini: <https://elmantech.com/ehs/#:~:text=Ta%C5%9Fk%C4%B1n%20erken%20uyar%C4%B1%20sistemi%20nehir,olarak%20uyar%C4%B1lar%20olu%C5%9Fturmas%C4%B1%20esas%C4%B1na%20dayan%C4%B1r>.
- ERSOY YILMAZ , A. (2020). *Afet Yönetimi*. Acil Durum ve Afet Yönetimi Uzaktan Eğitim Önlisans Programı.
- EU. (2022, 1 2). *History of the European Union 1960-69*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- EU. (2022, 1 02). *History of the European Union 2000-19*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en
- EU. (2022, 01 03). *Romania*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022>
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. Retrieved from https://europa.eu/ecsc/index_en.htm
- Europa.eu. (2021, 12 30). *Romania*. Retrieved from <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx>
- European Commission . (2022, 1 2). *From 6 to 27 members*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en
- European Commission. (2022, 01 02). *Accession criteria*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union: Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. Retrieved from https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf
- European Commission D G C. (2022, 01 02). *Bulgaria*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en
- European Union. (2022, 1 2). *Country profiles*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles_en
- European Union. (2022, 01 01). *History of the European Union 1945-59*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en
- European Union law. (2021, 01 04). *Accession Treaties*. Retrieved from <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html>
- Foldrejt. (2019). *Çfarë nënkuptojmë me sjelljen konsumatore?* Retrieved from Foldrejt: <https://foldrejt.com/cfare-nenkuptojme-me-sjelljen-konsumatore/>
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Gallagher, K., & Zarsky, L. (2007). *The enclave economy: foreign investment and sustainable development in Mexico's Silicon Valley*. Mit Press.
- GIORDANO, V., GANGALE, F., FULLI, G., & JIMENEZ, M. S. (2011). *Smart Grid projects in Europe: Lessons Learned And Current Developments*. Joint Research Centre Institute for Energy European Commission.

- Global Edge. (2021, 12 30). *Romania: Government*. Retrieved from <https://globaledge.msu.edu/countries/romania/government>
- Global Witness. (2009). NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- Goodale, M. (2018, 04). *The UNESCO Courier Seventy-year-old views that remain contemporary*. Retrieved from UNESCO: <https://en.unesco.org/courier/2018-4/seventy-year-old-views-remain-contemporary>
- Heifetz A. R, Linsky M. (2014). *Leadership on the line*. Boston: Harvard Business School Publishing.
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* . Retrieved from <https://www.heritage.org/index/country/romania>
- Hosts. (2023). *What's the Social Media Impact on Tourism?* Retrieved from Hosts: <https://hotspot.earth/blog/whats-the-social-media-impact-on-tourism#:~:text=One%20of%20the%20greatest%20ways,and%20accommodations%20they%20can%20use.>
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>
- ILGAZ, E. (2018). *Akıllı Şehirler ve Akıllı Şehirlerin Kurulmasında Rüzgar Enerjisinin Yönetimi ve Organizasyonu*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yönetim Organizasyon Bilim Dalı Yüksek Lisans Tezi.
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romania-foreign-policy-after-nato-and-eu-accession>
- INSARAG. (2017). *International Search and Rescue Advisory Group (INSARAG)*. Retrieved from International Search and Rescue Advisory Group (INSARAG) Web sitesi: <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response>
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-overview>
- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- İstanbul Büyükşehir Belediyesi AKOM. (2022). *İstanbul Büyükşehir Belediyesi AKOM*. Retrieved from İstanbul Büyükşehir Belediyesi AKOM Web Sitesi: <https://akom.ibb.istanbul/hazirlik-planlama-calismalari/>
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-challenges>
- İzmir Büyükşehir Belediyesi. (2021, 03 12). *Acil İzmir*. İzmir: Bilgi İşlem Dairesi Başkanlığı Harita ve CBS Dairesi Başkanlığı.
- İzmir Büyükşehir Belediyesi. (2022 , 10 3). *İzmir Akıllı İhbar Sistemi ile daha güvende*. Retrieved from İzmir Akıllı İhbar Sistemi ile daha güvende Web Sitesi: <https://www.izmir.bel.tr/tr/Haberler/izmir-akilli-ihbar-sistemi-ile-daha-guvende/47318/156>
- Japan Experience . (2014, 11 10). *Japan Experience*. Retrieved from Kasukabe Underground Flood Protection Tank Web Sitesi: <https://www.japan-experience.com/all-about-japan/saitama/attractions-excursions/kasukabe-underground-flood-protection-tank>
- Jashi, C. (2013). Significance of Social Media Marketing in Tourism. *ResearchGate*, 36-40.
- JESUS, I., MACHADO, J. A., carvalho, J. L., FERREIRA, J. R., & FIGUEIREDO, L. (2001). Towards the Development of Intelligent Transportation Systems. *Intelligent Transportation Systems Conference Proceedings - Oakland (CA) USA(81)*, pp. 1-6.
- KADIOĞLU, M. (2008). *Afet Zararlarını Azaltmanın Temel İlkeleri*. (M. KADIOĞLU, & E. ÖZDAMAR, Eds.) Ankara: JİCA (Japonya Uluslararası İşbirliği Ajansı) Türkiye Ofisi, Yayın No:2.
- KADIOĞLU, M. (2019). *Kent Selleri Yönetim ve Kontrol Rehberi*. Kültür Yayınları.

- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Developmen*, 6(4), pp. 91-102.
- Kotter, J. (2014). *Accelerate: Building strategic agility for a faster moving world*. Boston: Harvard Business Review Press.
- Kouzes. J, Posner. B. (2022). *The leadership challenge* (Vol. Seventh edition). USA.
- Krajewski, M. (2018). Human rights in international investment law: recent trends in arbitration and treaty-making practice. Available at SSRN 3133529, 1-10.
- Kultura Islame. (1939). 228-229.
- Langevin, L., Lamarche , N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- Leaders Mag. (2022, 01 04). *Romania's Recovery*. Retrieved from http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html
- Li, C. (2014). *The engaged leader; A strategy for your digital transformation*. Philadelphia: Wharton School Press.
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*. Retrieved from <https://www.macrotrends.net/countries/ROU/romania/population>
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- MARCO, A. D., MANGANO, G., SCORRANO, F., NEIROTTI, P., & CAGLIANO, A. C. (2014). Current Trends In Smart City Initiatives: Some Stylised Facts. *Cities*, 38, pp. 25-36.
- Mayfield, A. (2008). *What is Social Media?* iCrossing.
- McKinsey. (2018). *Smart Cities: Digital Solutions For A More Livable Future*. McKinsey & Company.
- Md Yusuf Hossein Khan and Tanvir Abir. (2022). *The Role of Social Media Marketing in the Tourism and Hospitality Industry*. IGI Global.
- MEDAK. (2022). *MEDAK*. Retrieved from MEDAK Web sitesi: <https://www.medak.org.tr/faydali-bilgiler/faydali-bilgiler/>
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>
- MONUSCO. (2022, 4 20). *UNITED NATIONS ORGANIZATION STABILIZATION MISSION IN THE DR CONGO*. Retrieved from <https://monusco.unmissions.org/en/drc-attacks-adrarmed-group-may-amount-crimes-against-humanity-and-war-crimes>
- Mosley, L. (2010). *Labor rights and multinational production*. Cambridge University Press.
- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*. Retrieved from <https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants>
- Mustafa, M. (1945). Gjuha amtare, Native language. *Kultura Islame, No. 3-4* , 72.
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- NAM, T., & PARDO, T. (2011, Haziran 12). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, pp. 282-291. doi:<https://doi.org/10.1145/2037556.2037602>
- Nations, D. (2021, January 26). *What Is Social Media?* Retrieved from Lifewire: <https://www.lifewire.com/what-is-social-media-explaining-the-big-trend-3486616>

- NATO. (2022, 01 04). *NATO-Russia relations: the facts*. Retrieved from https://www.nato.int/cps/en/natohq/topics_111767.htm
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME*. Retrieved from <https://netaffair.org/documents/1957-rome-treaty.pdf>
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- ÖZMEN, M. (2013). *Deprem ve Antalya*. Antalya: Kutlu&Avcı Ofset.
- ÖZMEN, M. (2015). *Sel-Taşkın Türkiye ve Antalya*. Antalya: Kutlu&Avcı Ofset Ltd. Şti.
- Pcweb. (2022, October 22). *Tourism industry meaning*. Retrieved from Pcweb.info: <https://pcweb.info/tourism-industry-meaning/?lang=en>
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Petras, J., & Veltmeyer, H. (2007). *Multinationals on trial: Foreign investment matters*. Ashgate Publishing, Ltd.
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- PLUS. (1940). About Albania literary production. *Kultura Islame, No. 10*, 396.
- PLUS. (1940). The poet of "Bagëti e Bujqësi". *Kultura Islame, No. 13-14*, 28.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102. Retrieved from https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.
- POSER, K., & DRANSCH, D. (2010). Volunteered Geographic Information For Disaster Management With Application To Rapid Flood Damage Estimation. *Geomatica*, 64(1), pp. 89-98.
- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Resilient Vejle. (2016). *Vejle's Resilience Strategy*. Resilient Vejle.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. Retrieved from <https://www.romania-insider.com/1918-great-union-historical-events-romania>
- Rufanges, J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.
- ŞAHİN, N. (2007). Afet Yönetimi ve Acil Yardım Planları. *TMMOB İzmir Kent Sempozyumu*, pp. 131-142.
- ŞAHİN, Ş. (2019). The Disaster Management in Turkey and Goals of 2023. *Turkish Journal of Earthquake Research*, 1(2), pp. 180-196.

- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*. Retrieved from <https://www.schengenvisa.info/countries-in-europe/eu-countries/>
- Scott, C. (2001). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *Torture As Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, Craig Scott, Ed, 3-44.
- Scott, C. (2011). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *TORTURE AS TORT: COMPARATIVE PERSPECTIVES ON THE DEVELOPMENT OF TRANSNATIONAL HUMAN RIGHTS LITIGATION*, Craig Scott, 3-44.
- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- SHROPSHIRE, A. (2019). Stories from the World of Municipal Analytics. *Towards Data Science*.
- Simma, B. (2011). Foreign investment arbitration: a place for human rights? *International & Comparative Law Quarterly*, 60(3), 573-596.
- SOLANAS, A., VLACHOS, I., RAMOS, V., FALCONE, F., POSTOLACHE, O., PERREA, D., . . . MARTINEZ-BALLESTE, A. (2014). Smart Health: A Context-Aware Health Paradigm within Smart Cities. *IEEE Communications Magazine*, pp. 74-81.
- Spar, D. (1999). Foreign investment and human rights. *Challenge*, 42(1), 50-80.
- Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* Retrieved from <https://www.statista.com/statistics/1109873/challenges-romania/>
- Statistics, G. S. (Jan 2023). *The world's most used social platforms* .
- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*–, 2-9.
- T.C. Çevre ve Şehircilik Bakanlığı. (2019). *Akıllı Şehirler Beyaz Bülteni*. Retrieved from https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), pp. 2816-2820.
- TAŞTAN, M. (2018). IoT Based Wearable Smart Health Monitoring System. *Celal Bayar University Journal of Science*, 14(3), pp. 343-350.
- TDK. (2022). *Türk Dil Kurumu Sözlükleri*. Retrieved from Türk Dil Kurumu Sözlükleri Web Sitesi: <https://sozluk.gov.tr/>
- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>
- The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF*. Retrieved from <https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html>
- The World Bank. (2021, 12 25). *The World Bank in Romania*. Retrieved from <https://www.worldbank.org/en/country/romania/overview#1>
- Tjoe, K. (2022, February 28). *The vital role of social media in tourism marketing*. Retrieved from Rezdy blog: <https://rezdy.com/blog/the-vital-role-of-social-media-in-tourism-marketing/#:~:text=Social%20media%20can%20be%20a,up%20in%20the%20area%2C%20a>
nd
- Toral, M., & Schultz, T. (2010). The state, a perpetual respondent in investment arbitration? Some unorthodox considerations. *The backlash against investment arbitration: Perceptions and reality*, 577-602.
- TÖRENCİ, H. E. (2015). *Afet Yönetimi ve Bursa'da Sağlık Sektöründe Afet Yönetimi*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yüksek Lisans Tezi.
- Trading Economic. (2022, 01 03). *Romania GDP*. Retrieved from <https://tradingeconomics.com/romania/gdp>
- Truyols, M. (n.d.). *POSITIVE AND NEGATIVE EFFECTS OF SOCIAL MEDIA ON THE TOURISM INDUSTRY*. Retrieved from Hotelmize: <https://www.hotelmize.com/blog/positive-and-negative-effects-of-social-media-on-the-tourism-industry/>

- Tudor, I. (2008). *The Fair and Equitable Treatment Standard, in the International*. Oxford University Press on Demand.
- Türkiye Bilişim Vakfı (TBV). (2016). *Türkiye Akıllı Şehirler Değerlendirme Raporu*. Türkiye Bilişim Vakfı (TBV).
- Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı. (2014). *Onuncu Kalkınma Planı Afet Yönetiminde Etkinlik Özel İhtisas Komisyonu Raporu*. Ankara: T.C. Kalkınma Bakanlığı.
- TÜRKOĞLU, H. (2014). *İSMEP Rehber Kitaplar Afete Dirençli Şehir Planlama ve Yapılaşma*. İstanbul: İstanbul Valiliği, İstanbul İl Afet ve Acil Durum Müdürlüğü (İstanbul AFAD), İstanbul Proje Koordinasyon Birimi (İPKB).
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Washington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from <https://www.unhcr.org/558c0e039.pdf>
- United Nations. (2023, 04 18). Retrieved from United Nations Human rights office of the high commissioner : <https://www.ohchr.org/en/human-rights/economic-social-cultural-rights>
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- Valarm. (2022). *Valarm*. Retrieved from Valarm Web Sitesi: <https://www.valarm.net/blog/monitoring-water-levels-flood-detection-early-warning-systems-virginia-smart-cities/>
- Voineagu , V. (2022, 01 02). ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING I.I-28.II.2007 PERIOD. *IDEAS*, 48-72. Retrieved from <https://plagiarism.repec.org/socol/socol-socol2.pdf>
- World Bank. (2021, 12 29). *Gross domestic product 2020*. Retrieved from <https://databank.worldbank.org/data/download/GDP.pdf>
- World Bank. (2023, 04 10). Retrieved from World Development Indicators: <https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#>
- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from <https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>
- YAMAN KOCADAĞLI, A. (2017). *Beylikdüzü'nün Coğrafi Özellikleri*.
- YAMAN, M., & ÇAKIR, E. (2018). Dijitalleşen Dünyada Akıllı Afet ve Acil Durum Uygulamaları. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 7(2), pp. 1124-1138.
- YILDIRIM, A. M. (2022). *Akıllı Şehirlerde Trafik Yönetimi İçin Bir Dinamik Rotalama Yöntemi ve Cupcarbon Gerçeklemesi*. Kocaeli: Kocaeli Üniversitesi Fen Bilimler Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı Yüksek Lisans Tezi.
- YILDIZ, D. (2013, 03 22). Ekolojik Kentsel Dönüşümde Örnek Kent : Stockholm. *Stockholm Winner 2010 European Green Capital*, pp. 1-9.
- ZHANG, K., YANG, K., REN, J., SHEN, X. S., NI, J., & LIANG, X. (2017). Security and Privacy in Smart City Applications: Challenges and Solutions. *IEEE Communications Magazine*, pp. 122-129.

BIBLIOGRAPHY

1. Ali, H. (1944), "Hasan Zyko Kamberi 200 years ago", "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 7-8, Tiranë.
2. Bala, M. (1942), "Do we have a modern Albanian drama", "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 5-6-7, Tiranë.
3. Bebeziqi, I. (1939), "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 3, Tiranë.
4. Demiraj, Sh. (1940), "Prophetic Birth"(Lindjes Profetike), "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 5, Tiranë.

5. Karakaçi, F. (1940), "Eurythmy"(Euritmi), "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 10, Tiranë.
6. Kodra, J. (1942), "All'Albania" (Shqipnis), "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 8-9, Tiranë.
7. Mustafa, M. (1945), "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 3-4, Tiranë.
8. Osmani, Sh. (1942), "Nezim Ibrahim Frakulla nga Berati", "Kultura Islame" Magazine published by the Albanian Muslim Community, nr. 5-6-7, Tiranë.

**MACHINE LEARNING CLASSIFICATION ALGORITHMS FOR ENSURING
SMART MANUFACTURING IN WELDED JOINTS**

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ABSTRACT

Welding is one of the major processes in the automobile, construction, aviation, and other sectors. Manual welding requires high dexterity level of the operators. The expertise of the welder affects the surface appearance of the weld, including its shape, mix, ripples, and presence of any spatter. Manual welding exhibits low weld quality, high defect rates, and low efficiency. Due to localized heating and cooling, inappropriate mixing, and dilution in the weld solution result in the formation of bead excessive asymmetry, inadequate penetration, and many other problems at the welded joints. These defects result in the reduction of the cost-effectiveness of welding. So, there is a need to monitor and control in-process welding. It makes a closed loop to get continuous feedback and adjust welding parameters automatically according to the required weld quality. Hence this aims to present a step towards the automation of welding in the arena of Industry 4.0. The purpose is to automate the monitoring of defects in real-time or

in-process welding using the digitization of the high-resolution camera. For monitoring the welding process the images of already welded parts are taken and images are classified as good or bad images, and then through machine learning algorithms, the model is trained to classify any given images. After making the algorithm it is validated to be used for the welding process. The accuracy of the algorithm is determined, which is mainly based on the number of images taken to train the model. Thus, an intelligent robotic welding system is developed which can change its parameters by itself through the algorithm. The developed system is fast, efficient, cost-effective, and requires less skilled labor, thus it has brought great innovation in the entire fabrication process.

Keywords: Industry 4.0, Robotic welding, Automation, Machine Learning

INTRODUCTION

Systems and techniques for welding are crucial components of contemporary industrial production lines. Through technology development, automated welding systems using industrial robots have replaced many welding tasks requiring hand operation [1]–[3]. Despite being in use for years, welding robots are preprogrammed devices with little to no intelligence. Figure 1 shows that Intelligent manufacturing is implemented by the transformation of Human physical systems to Human cyber-physical systems with the aim of achieving specific manufacturing goals at an optimized level [4].

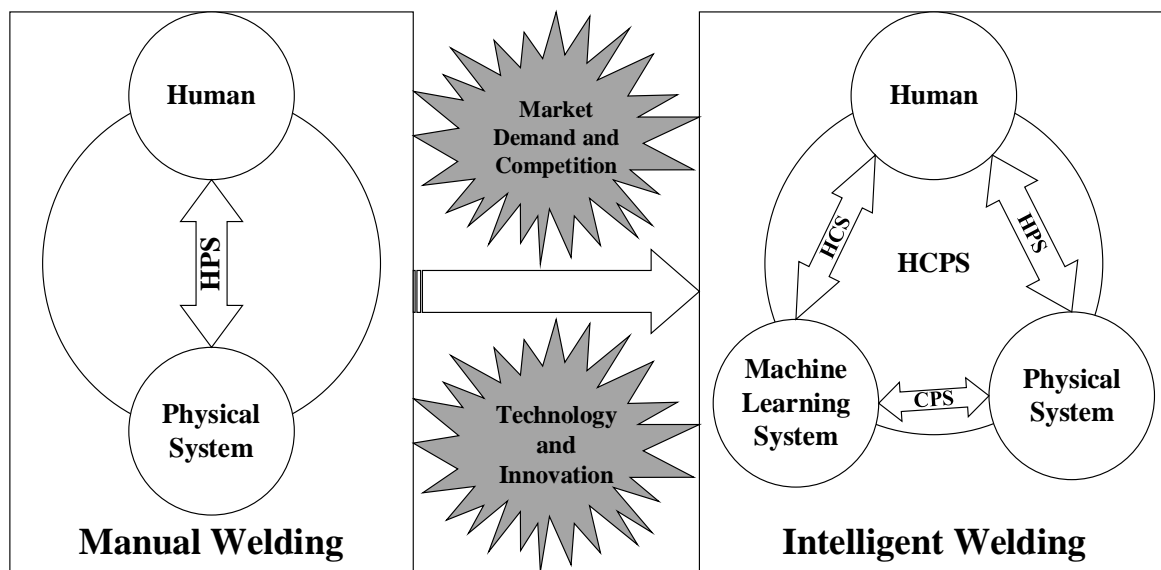


Figure 1: The advancement of welding systems from HPS to HCPS. [5]

There are presently several manufacturing businesses using machine learning techniques. In order to forecast specific mechanical properties, a variety of machine-learning techniques can be used. A smart manufacturing process is now using artificial intelligence techniques like machine learning and deep learning in a variety of ways. Machine learning analyses and gains knowledge from the dataset that is accessible, whereas Deep Learning models build Artificial Neural Network algorithms in a variety of layers based on the dataset's intended use. Machine learning has a major benefit over deep learning in that it requires less time to train the models than deep learning. [6]

The visual representation of algorithms and experimentation can improve the effectiveness of learning and teaching the principles of image processing. Because Python is an interpreted language with libraries devoted to specific tasks, it is a great choice for learning digital image processing. This eliminates the need for expensive commercial software's ambiguous black boxes and allows for the manipulation of codes and crucial algorithms. [7]

The welding procedures used today are complex, rely on a lot of variables, and have a poorly understood mechanism. User and customer needs for welding are distinct, and they work in circumstances that are always changing. As a result, welding is shifting to more specialized production using cutting-edge welding equipment that can nimbly adapt to changing welding requirements while retaining excellent quality. Smart approaches for gathering and analyzing welding data are essential in the field of big data. Monitoring metrics before and after the welding process, for instance, can improve the welding process, performance, and service quality. Although there are numerous welding techniques, advances in information science and technology are enabling the transformation of traditional welding to intelligent one. Because of advances in computer science and artificial intelligence, intelligent automation is replacing manual work. Manufacturing research programs have all examined smart manufacturing, Industry 4.0, and the internet of things. In the future big data, intelligent manufacturing, human cyber-physical systems, and AI will revolutionize the industry. [4], [8]–[13]. The platforms, enablers, and drivers that are required for advancing welding systems to greater intelligence levels are being provided by these programmers. Welding technology has gone through four stages of development. In phase 1 it was done manually, which had some efficiency and quality issues. In Phase 2, automation was used along with robots but automatic parameter adjustment was the problem. In Phase 3 welding automation was made easier using "teach and playback" robots, but it was offline and had a limited capacity to respond to changes. Phase 4 is related to the welding systems that are made intelligent and upgraded to monitor and regulate the parameters and quality of the welding process more effectively.

From the above discussion, it can be concluded that automation of welding is a need for technological advancement. Hence this research presents a step toward the development of an intelligent welding system by controlling the in-process welding with the use of a supervised machine learning algorithm and a high-resolution camera.

METHODOLOGY

The formation of the paper is outlined in figure 2. Phase 1 includes the literature review of the intelligent welding system. Phase 2 "Technology design and development" is about collecting data and building algorithms. Phase 3 focuses on results and discussion and phase 4 is about the conclusion and recommendations of the research.

A thorough review of the literature on intelligent welding research was conducted in phase 1. The search was restricted to welding technologies for convenience, even if publications

on intelligent manufacturing may have also turned up information on intelligent welding. In this stage, best practices in the creation of modern industrial welding are identified through a survey of the literature and other research. It comprised a thorough analysis of the pertinent literature in each of the project's important areas, including an examination and identification of best practices in the welding process design in the context of innovation. A detailed analysis of closed-loop welding is examined. It assisted in determining the current research problem. To develop the study, aim and objectives, innovation, and originality for this project, research questions are extracted based on the examined research problem.

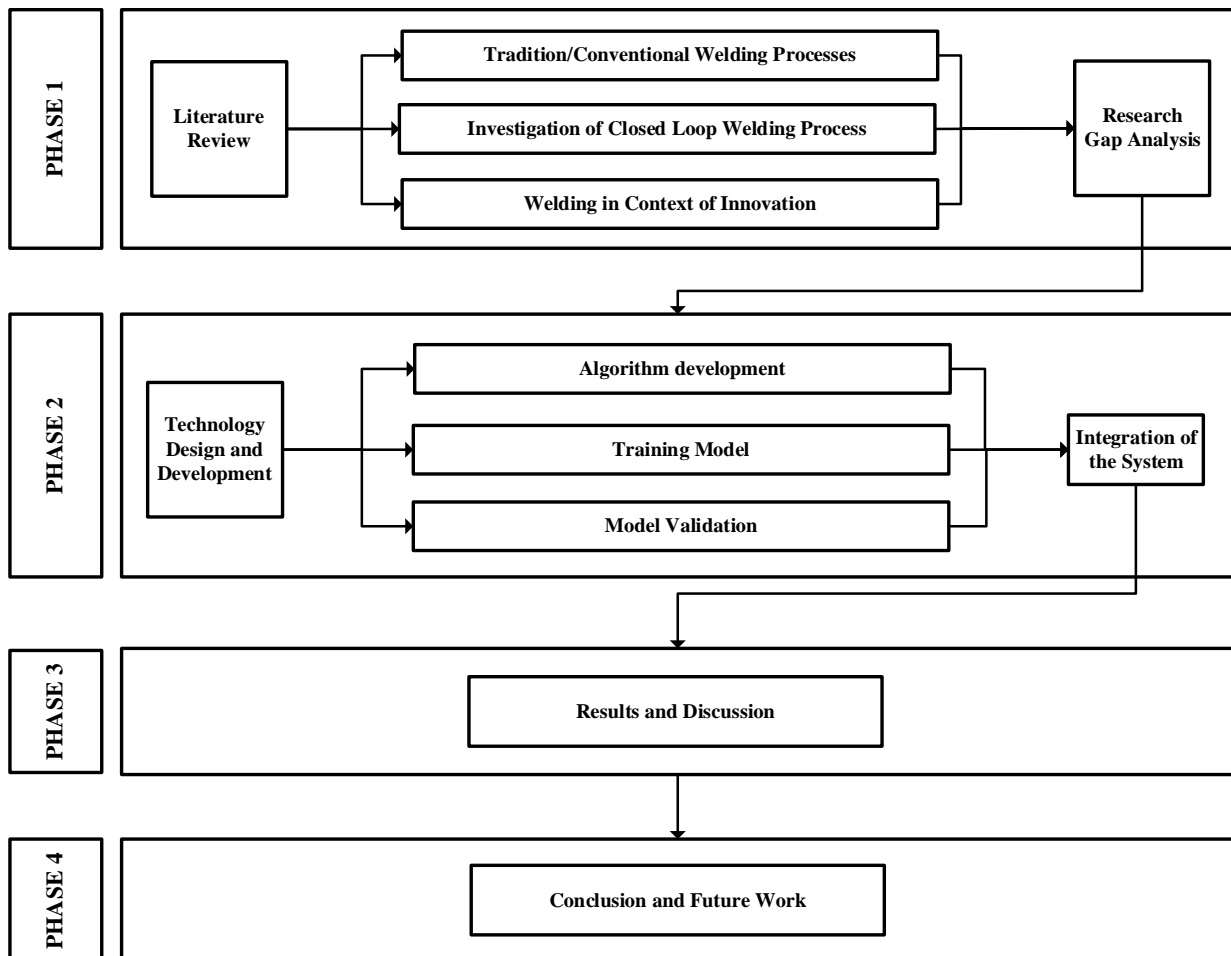


Figure 2: The Structure of the Research Methodology

In phase 2 The following steps need to be taken to perform the technology design development:

1. Image data of welded parts are collected.
2. It is passed to the classification model that recognizes whether a material is correctly welded or incorrectly welded, whether it is best welded or worst welded.
3. Machine Learning algorithm is made and trained on the image data collected.

4. After performing the inference task, our model will let us know about the class to which the material belongs such as correctly welded or incorrectly welded material.
5. Continuously improve the algorithm to get the maximum accuracy.
6. Integration of the complete system.
7. After the integration of the system, the complete model is validated to ensure that the model is behaving as intended as shown in figure 3 below.

The Schematic diagram is shown in Figure 3.

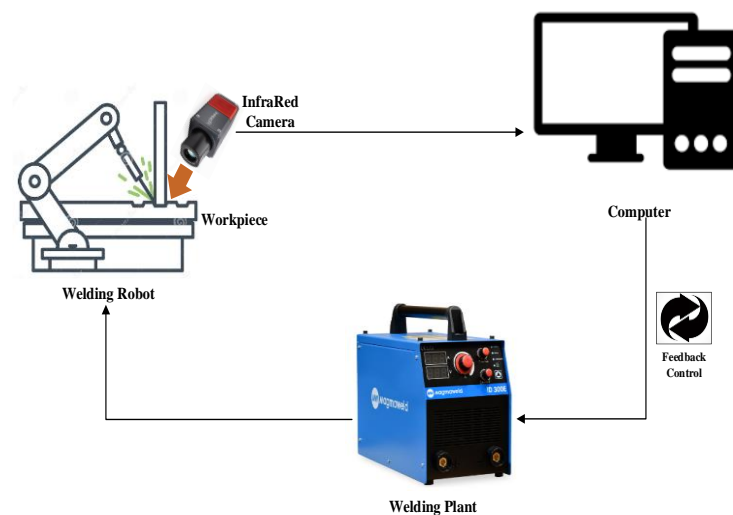


Figure 3: Schematic Diagram of Welding Monitoring Process

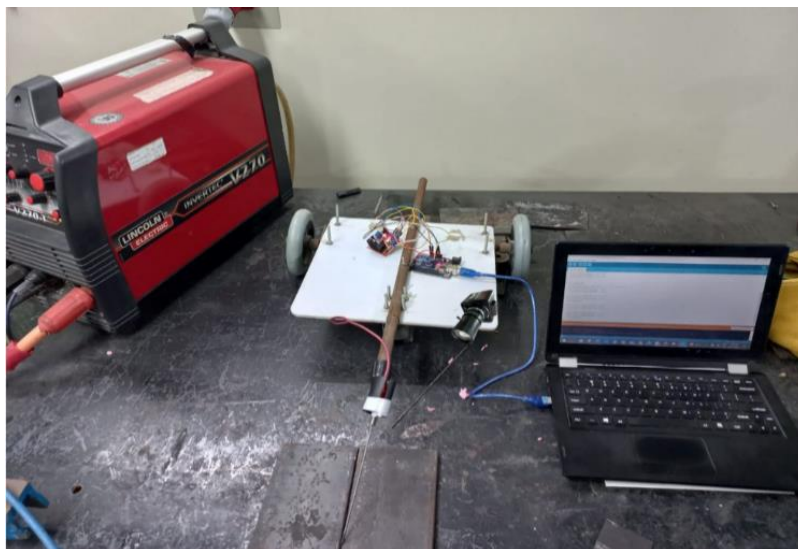


Figure 4: Experimental Setup of Welding Monitoring Process

First, we must make a dataset of images based on which the supervised learning algorithm will work. Then we'll make an algorithm using machine learning tools and using the python language.

The images of manual welding are classified as best or worst as shown in Figures 3 and 4. In the classification of the weld images, it is considered that the best weld has no cracks and holes in the bead, the bead is uniform, the width and height are appropriate, and the strength of the welding meets the requirements.



Figure 5: Worst Weld from manual welding



Figure 6: Best weld from manual welding

The machine learning algorithms help in determining the best and worst images. First of all, the Visual Studio environment is installed in the system. The necessary libraries are installed such as NumPy, matplotlib, cv2, etc. The libraries are imported, and the dataset is loaded for binary classification. After that, the model is trained on the dataset.

In Phase 4 there is an explained discussion of the results.

In the last phase, there is the conclusion of this work.

RESULTS AND DISCUSSION

This part of the paper presents the outcome of all the processes performed during the study starting from the data collection where images were captured and then classified according to the condition that whether the image is best or worst welded, and then we made image recognition using python language for the trial-and-error method.

It has been done through the Python language where Jupyter interfaces are used which provides interactive coding by using ipywidgets packages that can help explore and apply codes in a more interactive fashion. In addition, the Visual Studio Code interface is used for Python coding, which is also commonly referred to as VS code, loads really fast and takes less time. Having a modular approach to Code helps it perform better.

First, the necessary libraries have been imported into the respective interface, those libraries include cv2, NumPy, matplotlib, etc. After loading and importing the necessary libraries, binary classification was done which is classifying elements of a set into two groups based on a classification rule. The binary classification algorithm in machine learning categorizes new observations into one of two categories. It is a method of machine learning that uses predefined categories and categorizes new observations into those categories using supervised learning. When there are only two categories the problem is known as statistical binary classification.

After loading and importing the necessary libraries, then the dataset of images that have been made is loaded to the interface, and the classification of images based on the respective dataset is done.

CONCLUSION AND FUTURE WORK

Though, this is a trial-to-error method, the detailed experimentation of the large dataset will be done later in future work. Based on the small dataset that has been given to the interface, the code has been executed to recognize the image that has been given to the model afterward. The model was trained on the dataset that has been made through the data collection phase, and after loading the respective dataset to the interface, and training the model accordingly, then a new image will be uploaded to the model, and based on the data, it will tell that whether the respective image is best welded or worst welded. When executing the model that has been trained on the dataset, the image can be detected easily by just giving an image of the welded part to it, and the model will detect whether it is best welded or worst welded.

Future Work is aimed to use a big data set of weld images to increase the prediction accuracy of the welding robot. The experimentation will be done by the integration of the algorithm with the welding robot for controlling the weld parameters by the continuous feedback control system. Further, the image classification will not be limited to binary but enhanced according to the big data. The parameters will be set for each type of image difference and the robot will be behaving accordingly. The codes will also be available on the cloud; so that anyone can access them and can make the welding processes run easily.

References

- [1] A. Rout, B. B. V. L. Deepak, and B. B. Biswal, "Advances in weld seam tracking techniques for robotic welding: A review," *Robotics and Computer-Integrated Manufacturing*, vol. 56. 2019. doi: 10.1016/j.rcim.2018.08.003.
- [2] Y. K. Liu and Y. M. Zhang, "Supervised Learning of Human Welder Behaviors for Intelligent Robotic Welding," *IEEE Transactions on Automation Science and Engineering*, vol. 14, no. 3, 2017, doi: 10.1109/TASE.2015.2453351.
- [3] T. S. Hong, M. Ghobakhloo, and W. Khaksar, "Robotic Welding Technology," in *Comprehensive Materials Processing*, vol. 6, 2014. doi: 10.1016/B978-0-08-096532-1.00604-X.
- [4] J. Zhou, Y. Zhou, B. Wang, and J. Zang, "Human–Cyber–Physical Systems (HCPSs) in the Context of New-Generation Intelligent Manufacturing," *Engineering*, vol. 5, no. 4, 2019, doi: 10.1016/j.eng.2019.07.015.
- [5] B. Wang, S. J. Hu, L. Sun, and T. Freiheit, "Intelligent welding system technologies: State-of-the-art review and perspectives," *Journal of Manufacturing Systems*, vol. 56. 2020. doi: 10.1016/j.jmsy.2020.06.020.
- [6] A. Mishra, "Machine Learning Approach for Defects Identification in Dissimilar Friction Stir Welded Aluminium Alloys AA 7075-AA 1100 Joints," *Journal of Aircraft and Spacecraft Technology*, vol. 4, no. 1, pp. 88–95, Jan. 2020, doi: 10.3844/jastsp.2020.88.95.
- [7] A. F. Jimenez Lopez, M. C. Prieto Pelayo, and A. Ramirez Forero, "Teaching Image Processing in Engineering Using Python," *Revista Iberoamericana de Tecnologías del Aprendizaje*, vol. 11, no. 3, 2016, doi: 10.1109/RITA.2016.2589479.
- [8] J. Zhou, P. Li, Y. Zhou, B. Wang, J. Zang, and L. Meng, "Toward New-Generation Intelligent Manufacturing," *Engineering*, vol. 4, no. 1. 2018. doi: 10.1016/j.eng.2018.01.002.
- [9] H. Kagermann, W. Wahlster, and J. Helbig, "Securing the future of German manufacturing industry initiative INDUSTRIE 4.0 implementing the strategic Recommendations for Final report of the Industrie 4.0 Working Group," 2013.
- [10] Y. Pan, "Heading toward Artificial Intelligence 2.0," *Engineering*, vol. 2, no. 4, 2016, doi: 10.1016/J.ENG.2016.04.018.
- [11] A. Kusiak, "Smart manufacturing must embrace big data," *Nature*, vol. 544, no. 7648. 2017. doi: 10.1038/544023a.
- [12] J. Davis *et al.*, "Smart Manufacturing," *Annu Rev Chem Biomol Eng*, vol. 6, pp. 141–160, Jul. 2015, doi: 10.1146/annurev-chembioeng-061114-123255.
- [13] F. Tao, Q. Qi, A. Liu, and A. Kusiak, "Data-driven smart manufacturing," *J Manuf Syst*, vol. 48, 2018, doi: 10.1016/j.jmsy.2018.01.006.

A CONCEPTUAL RESEARCH ON MIXOLOGY

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ABSTRACT

Today, the increasing interest in gastronomy has led to a detailed investigation of many concepts in the study area of gastronomy and enriched gastronomy literature. For example, concepts such as neurogastronomy, gastrophysics, holistic nutrition, and mixology are among the topics that have been researched frequently recently. Mixology has become an increasingly popular field in recent years, with many bars and restaurants hiring skilled mixologists to create unique and innovative drink menus. Although the literature review on mixology has an ancient history, it is still new to see studies on the "art of mixing" in its simplest form. There are some conceptual confusions on the subject, and the people working in this field have not yet reached a consensus on some issues. This study emerged from these findings and aims to conduct detailed conceptual research on mixology. When examining the literature on mixology, which is defined as "the art and science of creating mixed drinks, cocktails, and other beverages using various ingredients, techniques, and equipment," it can be said that the conducted studies are relatively few. However, mixology, which studies the history of drinks, the etymology of the names of drinks and cocktails, the methods of preparation, and the materials used in their preparation, is an integral part of gastronomy and tourism. While this study clarifies concepts such as mixology, mixologist, and bartender, it is also important in addressing the issue of molecular mixology as an extension of molecular gastronomy. At the same time, the study is a conceptual study aiming to bring together national and international publications on mixology. With this study, it is concluded that although there are many publications in the fields of tourism and gastronomy, there are limited studies in the field of mixology and most of the studies are written in foreign languages. It has been determined that there is no diploma program for those who want to study mixology at the national or international level, and the training is limited to certificate programs only. In addition, it has been understood that tourism enterprises can increase customer satisfaction and demand if they invest in mixology. With this study, it is concluded that although there are many publications in the fields of tourism and gastronomy, there are limited studies in the field of mixology and most of the studies are written in foreign languages. It has been determined that there is no diploma program for those who want to study mixology at the national or international level, and the training is limited to certificate programs only. In addition, it has been understood that tourism enterprises can increase customer satisfaction and demand if they invest in mixology.

Keywords: Mixology, molecular mixology, mixologist, gastronomy

MİKSOLOJİ ÜZERİNE KAVRAMSAL BİR ARAŞTIRMA

ÖZET

Günümüzde gastronomi bilimine olan ilginin artması, gastronominin çalışma alanı içerisinde yer alan pek çok kavramın da detaylıca araştırılmasına ve gastronomi alanyazınının giderek zenginleşmesine vesile olmuştur. Örneğin nörogastronomi, gastrofizik, holistik beslenme ve miksoloji gibi kavramlar son dönemde üzerine sıklıkla araştırma yapılan konular arasında sayılabilir. Birçok bar ve restoranın benzersiz ve yenilikçi içecek menüleri oluşturmak için yetenekli miksologları işe almasıyla birlikte, miksoloji son yıllarda giderek daha popüler bir alan haline gelmiştir. “Çeşitli malzemeler, teknikler ve ekipman kullanarak karışık içecekler, kokteyller ve diğer içecekler yaratma sanatı ve bilimi” şeklinde tanımlanan miksoloji, içeceklerin tarihini, içeceklerin ve kokteyllerin isimlerinin etimolojisini, hazırlanış yöntemlerini ve hazırlanırken kullanılan malzemeleri incelemektedir ve gastronomi ile turizmin ayrılmaz bir parçasıdır. Bu çalışma bir yandan miksoloji, miksolog, bartender gibi kavramlara açıklık getirirken, diğer yandan da moleküler gastronominin bir uzantısı olarak moleküler miksoloji konusunu da ele alması açısından önemlidir. Çalışma aynı zamanda miksolojiyle ilgili ulusal ve uluslararası yayınları bir araya getirmeyi amaçlayan kavramsal bir çalışmadır. Bu çalışma sonucunda; turizm ve gastronomi üzerine oldukça fazla sayıda yayın bulunmasına rağmen miksoloji alanında sınırlı sayıda çalışma yapıldığı, yapılan çalışmaların çoğunlukla yabancı dilde yazılmış olduğu, miksoloji eğitimi almak isteyenlerin müracaat edebileceği herhangi bir diploma programı olmadığı, eğitimlerin yalnızca sertifika eğitimleriyle sınırlı olduğu ve turizm işletmelerinin miksolojiye yatırım yaptıkları takdirde müşteri memnuniyetini ve talebini artırabileceği sonuçlarına ulaşılmıştır. Bu çalışma ile turizm ve gastronomi alanlarında çok fazla sayıda yayın bulunmasına rağmen, miksoloji alanında sınırlı sayıda çalışma yapıldığı ve çalışmaların çoğunun yabancı dilde yazıldığı sonucuna varılmaktadır. Miksoloji eğitimi almak isteyenler için ulusal ya da uluslararası düzeyde müracaat edecekleri herhangi bir diploma programının bulunmadığı, eğitimin sadece sertifika programları ile sınırlı olduğu tespit edilmiştir. Ayrıca turizm işletmelerinin miksolojiye yatırım yapmaları halinde müşteri memnuniyetini ve talebini artırabilecekleri anlaşılmıştır.

Anahtar Kelimeler: Miksoloji, moleküler miksoloji, miksolog, gastronomi

Giriş

Miksoloji ve gastronomi genel olarak yemek deneyimini geliştirmek için yüksek kaliteli tatların yaratılmasını ve eşleştirilmesini içeren alanlardır. Bu bağlamda miksologlar ve gastronomlar müşterilerine yönelik yeni lezzet kombinasyonları ve unutulmaz deneyimleri yaratmak için sürekli olarak yeni içerikler, teknikler ve tarifler denemektedirler. Örneğin miksologlar kokteyllerini oluşturmak için genellikle taze meyve, ot, baharat ve yüksek kaliteli alkoller kullanırken, gastronomlar yemeklerini geliştirmek için yerel kaynaklı, bir başka ifade ile yöresel ve mevsimlik malzemeleri kullanabilirler. Her iki meslek grubu da farklılığı oluşturan, kalitesi yüksek ve çeşitli malzemeleri geleneksel ve yeni tekniklerle beraber kullanarak daha lezzetli, benzersiz ve imzası olan bir yiyecek ve/veya içecek yaratmayı amaçlamakta ve daha uyumlu bir yemek deneyimi yaratmak için birlikte çalışmaktadır. Miksoloji bu noktada gastronomiyi desteklemekte ve gastronominin bir alt dalı olarak düşünülmektedir.

Son dönemde üst düzey kokteyl barlarının sayısındaki artış, gerek yapılan yiyecek ve içecek yarışmalarının gerekse de yarışmayı izleyen ve katılanların sayıca artması, televizyon programlarında ise bu tarz yarışmaların izlenme oranlarının yükselerek geniş kitlelere ulaşabilmesi gibi pek çok husus dikkate alındığında miksoloji dikkat çeken ve popüleritesini koruyan bir alan olmuştur. Miksoloji sanatına ve bilimine yönelik artan sayıda kitap, dergi, web siteleri ve sosyal medya hesapları da bu konunun ne denli önemli ve dikkat çekici olduğunu bir kez daha gün yüzüne çıkartmaktadır. Ayrıca birçok restoran ve otel kapsamlı kokteyl menüleri ile yüksek kâr marjlı ürünler sunmakta ve kokteylleri belirli yiyeceklerle eşleştirerek onların lezzetini arttırmakta ve daha uyumlu bir yemek deneyimi yaratmaktadır. Bu durumlar miksoloji üzerine çalışma yapmanın önemini ortaya koymaktadır.

Alanyazın incelendiğinde miksoloji ile birlikte sıklıkla; miksolog, bartender, barmen ve moleküler miksoloji gibi pek çok farklı terimin kullanıldığı görülmektedir. Detaylı okumalar yapıldığında ise söz konusu terimlerin birbirinden farklı anlamları olan ancak zaman zaman birbirini yerine yanlış bir şekilde kullanıldığı gözlemlenen terimler olduğu görülmektedir. Bu bağlamda bu çalışmanın öncelikli amacı, miksoloji bilimi ve bu bilime ait terminoloji hakkında temel bir çerçeve çizmek, aynı zamanda miksolojiyle ilgili ulusal ve uluslararası yayınları bir araya getirmektir. Çalışmanın alanyazına, sonraki araştırmacılara ve içecek bilimi üzerine ticari faaliyetlerde bulunan gastronomi ve turizm sektörü paydaşlarına katkı sağlayacağı düşünülmektedir.

İlgili Alanyazın

Miksoloji ile ilgili alanyazın taraması sırasında erişilen çalışmaların büyük bir kısmının kokteyl reçeteleri içeren kitaplar olduğu, görece daha az bir kısmının ise gazete ya da dergilerde yazılmış olan köşe yazıları niteliğinde olduğunu söylemek mümkündür. Bu noktada internet ve sosyal medyaya olan hatırı sayılır ilgi de dikkate alındığında miksoloji ile ilgili blog sayfalarının varlığından da söz edilmelidir. Ancak daha önce de vurgulandığı üzere miksoloji ile ilgili yapılmış bilimsel çalışmalar az sayıdadır. Bu durumu miksolojinin yakın zamanda yükselişe geçmiş bir alan olmasıyla açıklamak mümkündür. Yine miksoloji üzerine yapılmış çalışmaların sayıca az olmasında otellerdeki yiyecek-içecek departmanının tek bir departman olarak algılanmasının payının olduğu da düşünülmektedir. Örneğin lisansüstü tezler söz konusu olduğunda yapılan çalışmalarda yiyecek-içecek departmanı çalışanlarının bir bütün olarak ele alındığı, bar personelleri özelinde çalışmaların yapılmadığını söylemek mümkündür. Hatta bu savı kanıtlamak adına YÖK Tez Merkezi'ne 09.04.2023 tarihinde giriş yapılmış, tarama terimi kısmına sırasıyla "bar departmanı", "bar personeli" ve "miksoloji" anahtar kelimeleri hem Türkçe hem de İngilizce olarak yazılmış ancak ne başlıkta ne de özet ve dizinde herhangi bir sonuca ulaşılamamıştır. Türkiye'deki üniversitelerde bulunan gastronomi ve mutfak sanatları, turizm ve otel işletmeciliği ile yiyecek-içecek işletmeciliği gibi bölümlerin sayıca çokluğu düşünüldüğünde bar departmanı ve/veya bar personeli ve miksoloji özelinde herhangi bir lisansüstü tezin yazılmaması dikkate değer bir husustur. Öte yandan miksoloji ile ilgili yapılan alan taramalarında mimarlık, bilgisayar programcılığı ve kimya gibi daha pek çok alanın kendi terminolojisi içinde miksoloji kavramını farklı anlamlarda kullandığı görülmüştür. Yapılan alanyazın taramalarında az sayıda miksoloji ve moleküler miksoloji ile ilgili bilimsel çalışmalara ulaşılmıştır. Moleküler miksoloji, moleküler gastronominin popülerleşmesi ile akademik çalışmalarda kendine yer bulmayı başarmış bir alandır. Önceleri sadece moleküler gastronomi uygulamalarına örnekler vermek üzere hazırlanmış reçeteler arasında moleküler miksolojiye yer verilirken günümüzde artık doğrudan moleküler miksoloji hakkında çalışmalar yapıldığı görülmektedir. Bu noktada moleküler miksolojiyi destekleyen ve dikkat çeken kitaplardan bir tanesi Dave Arnold'un "Liquid Intelligence: The Art and Science of the Perfect Cocktail" kitabıdır. Kitap, kokteyl biliminin arkasında yer alan teknikleri, aromaların elde edilmesinin kimyasını, başarılı bir kokteyl yaratmada kullanılan teknik ve bileşenlerin önemi dahil olmak üzere moleküler miksolojinin çeşitli yönlerine derinlemesine bir bakış sunmaktadır (Arnold, 2014). Benzer şekilde moleküler miksolojinin temelini oluşturan kokteyl tekniklerinin

örneklerle detaylı olarak anlatıldığı “The Bar Book: Elements of Cocktail Technique” isimli bir kitap da mevcuttur (Morgenthaler ve Holmberg, 2014). Yine 2021 yılında kolektif olarak kaleme alınan “Handbook of Molecular Gastronomy-Scientific Foundations, Educational Practices, and Culinary Applications” isimli kitap hem moleküler gastronomi hem de içerisinde yer alan ve “Molecular Mixology: Welcome Coffee, a Cocktail with Ten Layers” isimli bölüm ile dikkate değer bir çalışma niteliğindedir. Bu çalışmada moleküler karışım teknikleri kullanılarak kokteyl yaratma sürecine yer verilmiştir. İlgili çalışmada 1997 yılında bir eğitim aracı olarak tasarlanan, ancak 2005 yılında oluşturulabilen Karşılama Kahvesi (Welcome Coffe)’nin yapımındaki adımlar anlatılmış ve bu kapsamda on farklı lezzet ve doku katmanına sahip olan kahvenin her katmanının yapımında yer alan malzeme, miktar ve uygulanan teknikler detaylı olarak incelenmiştir. Böylece moleküler miksojinin benzersiz ve yenilikçi kokteyl yaratılmasındaki rolü gösterilmiştir (Kientza ve Gagnaire, 2021). Kokteyl barmenlerinin hizmet endüstrisinde yaratıcılığının rolünün değerlendirildiği başka bir çalışmada ise miksojinin kattığı yaratıcı çalışma biçimi ve bu çalışma biçiminin sektördeki hizmet kısmına etkisi yeniden tanımlanmıştır (Ocejo, 2010).

Yöntem

Bu çalışma miksoji ile ilgili yerli ve yabancı yazın taraması yapılarak, miksoji bilimi ve bu bilime ait terminoloji hakkında yayınları bir araya getirmeyi amaçlayan kavramsal bir çalışmadır. Ayrıca çalışma “Bir bilim dalı olarak miksoji nedir?” sorusuna cevap ararken bu konuyla ilişkili temel bir çerçeve çizmektedir.

Miksoji Kavramı ve Tarihi

Miksoji “alkollü veya alkolsüz içecekleri karıştırma ve karışım hazırlama” anlamına gelen bir terimdir (Çöp, 2020). Miksoji çeşitli malzeme, teknik ve ekipmanlar kullanarak farklı aromalara sahip karışık kokteyller ve diğer içecekler yaratma sanatı ve bilimi olarak da tanımlanmaktadır (Bartenders Business, 2022; Piogastrobistro, 2015). Amerikan Mirası Sözlüğü ise miksojiyi “karışık içecekler hazırlama çalışması veya becerisi” olarak tanımlamıştır (The American Heritage Dictionary, n.d.). Miksoji sanatında çeşitli içecek tariflerini karıştırmanın yanı sıra, farklı gıda bileşenlerinin ve öğelerinin temel lezzet bileşenlerine veya temel tat özelliklerine göre içsel özelliklerini inceleyerek tat eşleştirme de yapılmaktadır. Böylece miksojiyle hem mevcut geleneksel tariflerin lezzeti arttırılmakta ve hem de geleneksel olmayan yeni tarifler üretilmektedir (Ranasinghe ve ark., 2017).

Miksoloji, yüzyıllar öncesine uzanan bir tarihe sahiptir. Miksolojinin kesin kökenlerini belirlemek zor olmakla birlikte Yunanlılar, Romalılar ve Mısırlılar gibi eski uygarlıklara kadar uzandığı düşünülmektedir. Miksolojinin gerçek bir mesleğe dönüşmesi ise 19. yüzyılda gerçekleşmiştir (Tornroth, 2023). 19. yüzyılın sonları ve 20. yüzyılın başları, kokteyl kültürünün oluşmaya başladığı, çeşitli etkinliklerde popüler bir içecek olarak farklı tarif ve malzemeler ile hazırlanan kokteyllerin servis edildiği altın çağ olarak bilinmektedir. 1920’lerde Amerika Birleşik Devletleri’ndeki 13 yıl boyunca devam eden içki yasağı döneminde barmenler, düşük kaliteli çok daha sert ve içimi çok daha zor olan içkilerin tadını saklamak için yaratıcı olmak zorunda kalmış ve bu dönem yasak dönemi olarak adlandırılmıştır. Yasak dönem cesur tatlarla dolu yeni bir kokteyl dalgası yaratmış ve Highballs, Fransız 75, Old Fashioned, Sidecar, Bee’s Knees gibi kokteyllerin popüler olmasına yol açmıştır (Chivas Regal Global, 2021). II. Dünya Savaşı sonrasındaki dönem, hazır gıda sektörünün ortaya çıktığı ve tüm dünyaya hızla yayıldığı bir dönem olma özelliğine sahiptir. Bu dönemde toz olarak piyasaya sürülen kokteyl karışımları, soda tabancaları, buz makinaları, şurup dağıtıcılar gibi bileşen ve ekipmanlar barlarda standardize, basit ve daha ucuz içeceklerin üretilmesine ve bu içeceklerin tercih edilmesiyle miksolojinin popüleritesinin azalmasına neden olmuştur. Ancak 1980’lerin ortasına gelindiğinde bir zanaat olarak klasik kokteyllere ve miksolojiye olan ilgi yeniden canlanmıştır (Sutcliffe, 2020). Bugün ise miksoloji, yeni ve benzersiz içecekler yaratmak için yenilikçi tekniklerin ve malzemelerin kullanıldığı, kendini sürekli geliştiren ve sınırlarını zorlayan bir sanat formuna dönüşmüş durumdadır.

Miksoloji tarihine kokteyl özelinde bakıldığında ise kokteyl kelimesinin etimolojisiyle ilgili birkaç teori olduğu görülmektedir. Bu teorilerden birinde, Amerika’da hancı bir kadının müşterilerine hazırladığı özel içki karışımlarının karıştırılması için bardağın içerisine kaşık yerine horoz kuyruğu (İng cocktail) tüyü koyması sebebiyle bu tarz içkilere bu adın verildiğine vurgu yapılmaktadır (Tez, 2012) Başka bir teori ise “kokteyl” kelimesinin, “yumurtalık” anlamına gelen Fransızca “coquetier” kelimesinden geldiği yönündedir. Bu bağlamda söz konusu terimin, yumurtalıklara benzer küçük kaplara dökülen alkollerle yapılan bir içecek türü için kullanıldığı düşünülmektedir (Solorzano, 2020). Kokteyl tarihinin ilklerine bakıldığında; kendi özel adıyla bilinen ilk kokteylin 1800’lerin başında New Orleans’ta viski, absent, bitter ve şeker karışımı ile oluşturulan Sazerac (Chivas Regal Global, 2021) olduğu, ilk kokteyl kitabının 17. yüzyılda Londra Damıtıcılar Şirketi (*London Distillers Company*) tarafından yayımlanmış olduğu, ilk kokteyl barın Alexis Soyer adlı bir İngiliz tarafından Londra’da 1 Mayıs 1951 tarihinde “Gore House” adı ile açılmış olduğu, Türkiye’de

ilk kokteyl kitabının ise 1937 yılında basılan “Kadeh ve Bardak İçkileri” isimli kitap (Aktaş ve Özdemir, 2005) olduğu sonuçlarına ulaşılmaktadır.

Moleküler Miksoloji

Moleküler miksoloji, gıda ile benzer teknikler kullanan moleküler gastronominin etkisinde ortaya çıkan bir terimdir. Moleküler miksoloji, içecek bileşenlerini moleküler düzeyde anlamak ve bileşenleri moleküler düzeyde uyarlamak için fizik, kimya ve gıda bilimlerinde temellenen analiz, bilgi ve teknikleri kullanarak karışık içecekler yaratmaya yönelik ortaya çıkan mutfak araştırmalarının özel bir alanıdır (Graham, 2022; Razvozova, 2017). Moleküler miksoloji ile hedeflenen içeceklerin çekiciliğini arttırmak ve bu tür kokteyllerin dokusu, lezzeti ve görünümünü yaratıcı ve sanatsal bir şekilde geliştirerek tüketici deneyimini çok daha ilginç hale getirmektir (Caporaso ve Formisano, 2015; Ivanovic ve ark., 2011).

Moleküler miksolojide gıda endüstrisinde kullanılan birçok yöntem modernist mutfak uygulamaları kapsamında kullanılmaktadır. Örneğin sıvı nitrojen, kuru buz, agar, sitrik asit, sodyum aljinat ve kalsiyum laktat gibi bileşenler ve/veya katkı maddeleri ile jelleştirme, emülsifikasyon, küreleştirme, köpürtme ve buhar konsantrasyonu gibi çeşitli yöntemler kullanılarak sadece lezzetli değil aynı zamanda görsel olarak çekici ve benzersiz kokteyller yapılmaya çalışılmaktadır. Kullanılan bileşenler ve uygulanan yöntemler ile içeceklerde köpükler, jeller, katmanlar, küreler, sisler ve diğer farklı dokularda dikkat çekici sunumlar yaratılmakta ve lezzetli formülasyonlar oluşturulmaktadır. Örneğin, bir miksolog, sıvıların farklı yoğunluklarını kullanarak birbirine karışmayan ve rengiyle oynanmış katmanlı içecekler veya içeceğin içerisinde asılı kalabilen meyve parçalarından kokteyller yapabilir. Benzer yaratıcılık ve teknik bilgilerle sıvı nitrojen ile dondurulmuş yenilebilir alkollü dondurmalar ya da sodyum aljinat ve kalsiyum laktat gibi bileşenler ve küreleştirme yöntemi kullanılarak ağızda patlayan aromalı sıvı içecek küreleri yapılabilir. Görüldüğü üzere moleküler miksolojiyle beraber sadece içilebilir kokteyller değil, sıvıların köpüklere, jellere ve katılara dönüştürülmesiyle yenilebilir kokteyller ve içkiler de üretilebilmektedir (Caporaso ve Formisano, 2015). Yine kokteyl sakızları, kokteyl havyarı, marşmelovlu ve aromalı buz küreleri ya da buz küpleri, alkollü köpükler, buzdan dondurmalar, donmuş nitro kokteyller gibi kokteyl ve içki deneyimleri genel olarak moleküler miksolojiyle oluşturulmaktadır (Graham, 2022; Kanga, 2008). Türk mutfağı özelinde bir örnek olarak “Boncuklu Rakı”dan bahsedilebilir. Bu uygulamada küçük inci taneleri gibi boncuk haline getirilmiş rakı parçaları su dolu bir kadehin içine konulmakta ve suyla beraber boncuk şeklindeki rakılar çiğnenmektedir. Boncuklu rakıyı keşfeden iki Türk miksolog tarafından geliştirilmiş bir diğer reçete ise “Jöle Rakı”dır. Jöle

rakıda; katılaştıktan sonra renkli jöle haline gelmiş rakı istenilen biçimde kesilip tabaklara konularak servis edilmekte ve çatalla yenilmektedir (Akyol, 2008).

Genel olarak bakıldığında moleküler miksoloji teorik kimyasal ilkelere dayanarak “kokteyl rönesansı” yaratmaktadır. Moleküler miksolojiler yalnızca marshmallow, karamel espresso, fıstık ezmesi ve jöle gibi lezzetleri mevcut reçetelere eklemekle kalmamış aynı zamanda cin ve tonik jöle, alkollü köpük, sıvı nitrojenle yapılan votkallı dondurmalar gibi örnekleri reçetelere ekleyerek “içecek” tanımının yeniden şekillenmesine de katkıda bulunmuşlardır (Aktaş, 2017). Moleküler içeceği normalden ayıran ana faktör, bileşen özelliklerinin standart dışı kullanılması ile kimyasal veya fiziksel olgular uygulanarak içeceklerde yeni organoleptik niteliklerin elde edilmesidir (Razvozova, 2017).

Miksolog Kavramı ve Miksoloji Eğitiminin Mevcut Durumu

Miksolog, karışık içeceklerin tarihçesini inceleyen, güncel trendleri takip eden, kullanılan içerikler ve teknikler konusunda zengin bir bilgiye sahip olan ve düzenli olarak yeni ve yenilikçi içecekler üreten kişilerdir (MasterClass, 2021). Miksologların alkollü içkiler, kokteyllerde kullanılan çeşitli bileşenler (meyve, meyve suları, gazlı içecekler, şuruplar, ot, baharat vb.), bileşenlerin kullanımı, içecek tarifleri, içeceklerin üretme teknikleri ve bu süreçte kullanılan ekipmanlar ile duyuşal değerlendirme konusunda zengin bir bilgiye sahip olması beklenmektedir (Çöp, 2020; Oejo, 2010). Bu aşamada miksolojiler ve kokteyl barmenleri, içecek yapma sanatının arkasındaki bilim ve sanat olarak miksolojiyi rehber olarak kullanmaktadırlar.

Miksoloji ve içeceklere dair bilgi ve becerilere sahip olmak için teknik bilgilerden ve teknik bilgilerin uygulamalarından oluşan kurs ve seminerler mevcuttur. Miksologlar için sertifika sunan birkaç kuruluş bulunmakta olup bunlardan birinden sertifika almak için kurs sürecini tamamlamak ve yapılan sınavları geçmek gerekmektedir. Birleşik Devletler Barmenler Birliği (*United States Bartenders' Guild*) ile Şarap ve Alkollü İçki Eğitim Vakfı (*Wine and Spirit Education Trust*) sektör tarafından dikkate alınan ve sertifika veren organizasyonlar arasında yer almaktadır. Örneğin Şarap ve Alkollü İçki Eğitim Vakfı hem profesyoneller hem de meraklılar için miksoloji teknikleri, alkollü içkilerin üretimi ve servisini kapsayan Alkollü İçkilerde 1. ve 2. Seviye kurslar sunmaktadır (WSET, 2023a; WSET, 2023b). Benzer şekilde barmenler de çalıştığı iş için gereken uzmanlık düzeyine bağlı olarak farklı türlerde eğitim ve öğretim programlarına katılarak bilgi ve becerilerini geliştirebilirler. Bu noktada barmenlik okulları, kurslar, seminerler ve workshoplar barmenlere yardımcı olmaktadır.

Barmen, bartender ve miksolog terimleri genellikle birbiri yerine kullanılsa da ve çalışma alanları benzerlik gösterse de aslında farklı rolleri olan pozisyonlardır. Örneğin bir barmen genellikle bir kokteyl barında çalışarak klasik içecekler ve kokteyller hazırlamakta ve bar deskinin önündeki sandalyelere oturan müşterilerle doğrudan iletişim kurarak onların içecek siparişlerini almaktadır. Bartender, barmenin tek başına bütün servis işlerini yürütemeyeceği büyük barlarda servis için özel olarak yetiştirilmiş kişiler yani bar garsonlarıdır. Bu tip barlarda bartenderlar masalarda oturan müşterilerin karşılanması, yerlerine oturtulması, sipariş alınıp servis yapılması işlemlerinden sorumludur (Yörükoğlu & Yörükoğlu, 1998). Öte yandan bartenderlar barmenin olmadığı ya da barın çok yoğun olduğu zamanlarda bara geçerek içki hazırlayabilecek donanımına da sahiptirler. Miksologlar ise bazı zamanlarda barda barmenlik yapsa da işlerinin önemli bir bölümü barın arkasında yani mutfakta yeni ve farklı kokteyl tariflerinin tasarımını sağlamak ve kişiselleştirilmiş kokteyl menülerini geliştirmektir (Indeed Editorial Team, 2023; MasterClass, 2021). Bunları yaparken geleneksel bir kokteylin benzersiz bir versiyonunu ya da yeni kokteylleri geleneksel olmayan bar araçlarını kullanarak ve çeşitli malzemeleri birleştirerek, alanda çalışan diğer profesyonellerle iş birliği yaparak gerçekleştirirler (Indeed Editorial Team, 2023). Bu aşamada miksolog, kokteyl yaratmada olağanüstü beceri, yetenek ve mükemmellik sergileyen, özellikle yetenekli bir barmene verilen fahri unvandır (Bartender Spirits Awards, 2023). Miksologlar bunlara ilave olarak kokteyl trendleri ve yenilikleri ile güncel endüstri gelişimini takip eden, bir dizi kokteyl menüleri ve programları geliştiren, kokteyl tarihi ve evrimi için bilgi araştıran ve üreten kişilerdir. Dolayısıyla alkollü içki üretimi yapan şirketler tarafından da istihdam edilirler (Bartender Spirits Awards, 2023; MasterClass, 2021).

Miksoloji, turizm sektöründe kullanılabilecek yaratıcı bir araçtır. Dolayısıyla turizm ve gastronomi özelinde, özellikle de restoran ve bar işletmelerinde, miksologlar teknik ve yaratıcı bilgilerini kullanarak turistler için çok farklı ürünler sunabilir. Bu açıdan bakıldığında miksologlar turistler için deneyimin önemli bir parçasına hizmet etmektedirler. Örneğin belirli bir bölgenin ya da destinasyonun yerel lezzetlerini ve malzemelerini sergileyerek ve/veya kullanarak benzersiz ve yenilikçi kokteyller yaratabilirler. Bu durum yerel kültür ve geleneklerin tanıtılmasına yardımcı olabilir ve turistlere başkalarıyla paylaşmak isteyecekleri unutulmaz bir deneyim sağlayabilir. Gastronomi endüstrisinde miksologlar, yiyeceklerin lezzetlerini tamamlayan kokteyller oluşturmaları ve yiyecek-içecek eşleştirmeleriyle yemek deneyimini daha iyi bir seviyeye taşımaları nedeniyle genellikle şeflerle eşleştirilir.

Bununla birlikte, tüm barmenlerin miksolog olduğunu, ancak tüm miksologların barmen olmadığını düşünen muhalif görüşler de bulunmaktadır. Bu görüşlere göre miksolog daha çok sosyal prestij ve şöhret kazanmak için kullanılan bir unvan olarak kabul edilmekte, barmenlerin her türden içecek yaratmada başarılı olabileceğini, ancak miksologların kalabalık bir barda içecek servisi yapma konusunda çok da başarılı olamayacakları için barmenlerin yerini dolduramayacağı düşünülmektedir (Bartender Spirits Awards, 2023).

Miksolojide Kullanılan Malzemeler ve Teknikler

Kokteylleri; bowl, cup ve punch (kalabalık gruplar için kâsede hazırlanan kokteyller), cobbler (talaş buz ve meyve parçacıkları ile hazırlanan kokteyller), collins (bol buzla hazırlanan ve geniş hacimli uzun bardaklarda servis edilen kokteyller), cooler (limon kabuğu ilave edilerek hazırlanan serinletici kokteyller), crusta (servis edildikleri bardaklar limon ve şeker ile süslenen kokteyller), daisy (likör çeşitleri ve aromatik şuruplarla hazırlanan kokteyller), egg-nog (sıcak ya da soğuk olarak hazırlanabilen ve içine yumurta konulan kokteyller), fix (goblet bardaklarda buzla servis edilen kokteyller), fizz (ana içki, meyve suyu, şeker ve soda ile hazırlanan kokteyller), flip (alkol, şeker ve yumurta sarısı ile hazırlanan ayıltıcı kokteyller), frappe (talaş buz ve likörlerden oluşan kokteyller), gimlet (ekşi tatta ve kolay hazırlanabilen kokteyller), grog (çok sıcak hazırlanan kokteyller), highball (ana içki, angostura bitters, meyve suyu, soda ve meşrubatla hazırlanan kokteyller), julep (ferahlatıcı kokteyller), pick me up (ayıltıcı kokteyller), pousse cafe (aynı bardakta birbirine karışmadan üst üste koyulan içkilerle hazırlanan kokteyller), rickey (ana içki, misket limonu suyu ve soda ile hazırlanan serinletici kokteyller), sangaree (genellikle kırmızı renkte hazırlanan kokteyller), sling (bol buzlu kokteyller), smash (nane kullanılarak hazırlanan julep benzeri kokteyller), sour (yumurta akı ile hazırlanan, ekşi tada sahip kokteyller), toddy (ana içki, şeker ve sıcak/soğuk su ile hazırlanan kokteyller) olmak üzere 25'e ayırmak mümkündür (Aktaş ve Özdemir, 2005).

Öte yandan kokteylleri miktarına göre; kısa (ortalama 10 cl'ye kadar), orta (ortalama 20 cl'ye kadar) ve uzun kokteyller (ortalama 30 cl'ye kadar) olarak üçe ayırmak mümkündür. Yine içeriğine göre kokteylleri; Pre Dinner (yemek öncesi içilebilen kokteyller), After Dinner (yemek sonrası içilebilen kokteyller), Long Drink (günün her saatinde içilebilen kokteyller) ve Fancy Drink (günün her saatinde içilebilen özel kokteyller) olarak dörde ayırmak da başka bir sınıflandırmadır (Türkiye Barmenler Deneği, n.d.).

Bir miksolog kokteyl türlerinden hangisini hazırlarsa hazırlasın, dengeli ve lezzetli bir içecek yaratmak için bazı tekniklere ihtiyaç duymaktadır. Bu teknikler, miksologların bileşenlerden maksimum lezzet ve aromayı çıkarmasını, benzersiz dokular ve görsel efektler yaratmasını ve

her ieeğinin uygun şekilde soğutulması ve seyreltilmesini sağlamaktadır. Miksoloji terimleri ve teknikleri genellikle İngilizce isimleriyle kullanılmakta olup sıklıkla kullanılan tekniklerden bazıları şunlardır (Hellmich, 2006; Morgenthaler ve Holmberg, 2014; Sipsmith, 2021; Wellmann, 2013):

- i. **Shaking (alkalama):** Şeker, şurup, krema, meyve suları, narenciye ve likör gibi daha bulanık bileşen ieren ieceklerin kokteyl alkalayıcı (*shaker*) ve bol buz kullanılarak karıştırılmasıdır. Bu işlemde malzemeler güçlü alkalamayla tamamen birleştirirken iecek soğutulmakta, ieeğinin yüzeyinde yüzen ferahlatıcı buz paraları elde edilmekte ve karışıma hava kabarcığı ilave edilerek köpüklü bir doku oluşturulmaktadır.
- ii. **Stirring (Karıştırma):** Malzemeleri köpüklü bir doku oluşturmadan bir araya getirmek için kullanılan yumuşak bir tekniktir. Bu teknik berrak bir görüntü ve ağızda yumuşak bir his bırakmasının istendiği Cin Martini, Manhattan gibi iecekler için kullanılmaktadır.
- iii. **Vaporizing (Buharlaştırma):** İeeğe aroma ve lezzet katmak için bitki, ot, baharat, meyve ve iek gibi eşitli bileşenlerdeki uçucu yağlar ve diğere uçucu bileşikler buharlaştırılarak eklenmektedir. Bu işlem, buharlaştırıcı kullanılarak veya bileşenlerin manuel olarak ısıtılması ve ardından buhar olan uçucu bileşiklerin bir kapak veya başka bir örtü ile yakalanıp kokteyl bardağına salınmasıyla gerçekleştirilir. Bu teknik aynı zamanda duman veya buhar ile kokteylin görsel sunumunu geliştirmek için de kullanılmaktadır.
- iv. **Muddling (Ezme):** Paralamak veya ezme anlamına gelen ve bir kokteylde meyvelerin, bitkilerin veya baharatların tat ve aromalarını serbest bırakmak için kullanılan bir tekniktir. Bu teknik ile Mojito, Margarita, Old Fashioned gibi ieeeklere nane yaprağı, turunçgiller ve/veya küp şeker gibi bileşenler dahil edilerek ferahlatıcı ve aromatik iecekler elde edilmektedir.
- v. **Straining (Süzme):** Bir kokteylde katıları sıvıdan ayırma işlemidir. Meyve posası, otlar ve buz gibi katı bileşenleri ıkarmak için ieeği alkaladıktan veya karıştırdıktan sonra süzgeç (*Hawthorne Strainer*) yardımıyla yapılmaktadır.
- vi. **Double/Fine Straining (İkili Süzme):** İeeğinin berrak olması için kokteyl süzgeci ve tel süzgeç kullanılarak yapılan ikili süzme işlemidir.
- vii. **Flaming (Alevleme):** Az miktarda alkolün ısıtılması, ateşe verilmesi ve ardından ieeğinin üzerine dökülmesiyle oluşan bir sunum tekniğidir. Bu teknikle kokteyle hafiften dumanlı bir tat katılmaktadır.
- viii. **Layering (Katmanlama):** Farklı malzemelerin birbirinin üzerine bar kaşığı yardımıyla yavaşça, karıştırmadan, yoğunlukları ve şeker oranı baz alınarak sırasıyla katmanlar halinde

dökülmesi tekniğidir. Böylece renkli ve görsel olarak çekici farklı katmanları olan kokteyller oluşturulmaktadır.

ix.**Building:** İçeceği bir karıştırma bardağında, çalkalayıcıda, blenderde veya başka bir kapta oluşturmak yerine doğrudan soğutulmuş servis bardağına dökülüp, iyice karıştırılıp, çeşnilendirilerek servis edilmesi işlemidir. İşlem, malzemeleri bardağa belirli bir sırayla eklemeyi, dengeli ve lezzetli bir içecek oluşturmak için hafifçe karıştırmayı içermektedir.

x.**Floating (Yüzme):** Genellikle krema veya likör kullanan içeceklerde bu sıvıların bir kaşık yardımıyla alttaki içeceğin yüzeyine dokunmadan yavaşça dökülmesi tekniğidir. Bu teknikle yüzeyde yüzen içeriklerin düşük yoğunlukları ile şeker oranları baz alınarak karıştırmadan katman oluşturulmaktadır.

xi.**Rimming (Kenar Süsleme):** Donmuş veya soğutulmuş bir kokteyl bardağının ağız kısmının narenciye dilimi veya başka bir sıvıyla nemlendirilmesinin ardından ağız kısmın tatlı, mayhoş ve/veya dokulu ve renkli istenen malzemeyi içeren bir tabağa daldırılarak kaplanması işlemidir. İçeceğin tadını veya sunumunu geliştirmek için limon, tuz, şeker, rendelenmiş Hindistan cevizi, limon kabuğu, portakal kabuğu ile yarı tatlı çikolata gibi bileşenler kullanılmaktadır.

Miksoloji teknikleri kokteyl yapma sanatının önemli bir parçasıdır. Genel olarak bu tekniklerde ustalaşmak, miksologların müşterilerini memnun eden ve etkileyen içecekler yaratmasına yardımcı olmaktadır. Miksoloji teknikleri miksolog ve barmenlerin her seferinde tutarlı, yüksek kaliteli içecekler yaratmasına yardımcı olması benzersiz ve yenilikçi kokteyller yaratması için temel sağlaması, yoğun zamanlarda daha verimli ve hızlı çalışmasına yardımcı olması, bar ortamında güvenlik ve hijyeni de desteklemesi sebepleriyle önem arz etmektedir.

Sonuç

Tarihsel süreç içerisinde bakıldığında pek de yeni olmayan ancak günümüzde yeni yeni rağbet gören bir alan olan miksoloji, gerek yeme-içme deneyimini seyahatlerinin en ön planında tutan turistler için, gerekse de yiyecek-içecek sektöründe aktif rol oynayan tüm profesyoneller için gereklidir ve vazgeçilmezdir. Tarımsal üretimin yapılmaya başlanmasıyla birlikte dünya üzerinde yaşamış olan tüm medeniyetlerde alkollü içki kültürünün var olduğu bilinmektedir. Ancak elbette ki her medeniyetin ürettiği dolayısıyla tükettiği alkollü içki birbiriyle farklılık göstermiştir. Burada coğrafya, iklim, toplumların sosyal ve ekonomik anlamda gelişmişlik düzeyleri ve dini inançları gibi pek çok faktör etkili olmuştur. Yine toplumların hangi üretim tekniklerini (fermantasyon, distilasyon vb.) kullanarak alkollü içki ürettikleri de tüketim alışkanlıklarında belirleyici olmuştur.

Geçmişe dönük okumalar yapıldığında pek çok içeceğin tesadüfen bulunduğu, bir kısmının maddi olanaksızlıklar bir başka ifade ile yoksulluk sebebiyle ortaya çıktığı ya da bir gıda maddesinin aşırı üretimi sonucunda -viskinin Amerika'daki fazla mısır üretimiyle ilişkisinde olduğu gibi- elde kalan ürünleri değerlendirme yöntemi olarak ve hatta kanunlarla kısıtlanan ya da yasaklanan alkol tüketimine alternatif çözümler bulmak amacıyla ortaya çıktığı söylenebilir. İlaveten; savaşların ve oradan elde edilen ganimetlerin, getirilen kölelerin, farklı kültürlerden kız alıp verme ya da komşuluk yoluyla aktarılan kültür ve bilginin, son dönemde ise sosyal medyanın gerek alkollü gerekse de alkolsüz içeceklerin tüketilmesinde ve diğer kültürlerle yayılmasında önemli role sahip olduğu bilinmektedir. Ancak koşullar ne olursa olsun insanlar içecekleri hep “karıştırmışlardır”. İnsanların içecekleri karıştırma amaçları arasında; yüksek alkollü bir içeceğin alkol seviyesini düşürmek, lezzetsiz ya da nötr tada sahip bir içeceği lezzetli hale getirmek, göze de hitap eden şık içecekler hazırlamak, içeceklerin organoleptik özelliklerini arttırmak, içecekleri soğutmak gibi amaçlar sayılabilir. Söz konusu miknologlar olduğundaysa “yeni şeyler denemek ya da üretmek” temel motivasyonları olmuş ve böylelikle bir meslek dalı da doğmuştur.

Miknologların aldıkları eğitim, kullandıkları teknik, ekipman ve malzeme göz önünde bulundurulduğunda diğer bar personellerinden bir adım önde oldukları söylenebilir. Özellikle son dönemde moleküler gastronomi alanındaki yeniliklerle birlikte moleküler miknoloji alanında kendini geliştirebilmiş olan miknologlar daha da ön plana çıkmışlardır. Fizik, kimya ve gıda teknolojilerindeki birbirinden farklı teknikleri içeceklerle harmanlayarak değişik tatlar denemek isteyen müşteri kitlelerine farklı alternatifler sunabilen miknologlar bir yandan ürettikleri yeni tatlarla övgüler alırken diğer yandan da kullandıkları katkı maddelerinin sağlığa olası zararları sebebiyle eleştirilere maruz kalabilmektedirler. Öte yandan gıda katkı maddelerine ilişkin söz konusu bu eleştirilerin tek muhatabının miknoloji bilimi ve miknologlar olmadığı da unutulmamalıdır.

Bu çalışma kapsamında; turizm, gastronomi, moleküler gastronomi üzerine oldukça fazla sayıda kitap, kitap bölümü, makale, tebliğ ve tez bulunmasına rağmen miknoloji alanında sınırlı sayıda çalışma yapıldığı, yapılan çalışmaların çoğunlukla yabancı dilde yazılmış kitaplar, kitap bölümleri ve birkaç adet makaleden ibaret olduğu, Türkiye özelinde ise bu araştırmanın yapıldığı tarih itibarıyla miknolojiyle ilgili herhangi bir lisansüstü tezin yazılmadığı sonuçlarına ulaşılmıştır. Yine bu çalışma kapsamında yalnızca miknoloji eğitimi almak isteyenlerin müracaat edebileceği herhangi bir diploma programı olmadığı, eğitimin yalnızca sertifika sunan birkaç kuruluş tarafından verildiği ve söz konusu sertifikaları almak için kurs sürecini

tamamlamak ve yapılan sınavları geçmek gerektiği sonuçlarına ulaşılmıştır. Tüm bunların yanında turizm özelinde değerlendirildiğinde turizm işletmelerinin miksolojiye yatırım yaparak ve miksolojiyi kullanarak müşteri memnuniyetini artırabileceği, yerel kültürü tanıtılabileceği ve bölgeye turist çekme potansiyelini artırabileceği sonucuna erişilmiştir. Elde edilen sonuçlar doğrultusunda sonraki araştırmacılara ve sektör temsilcilerine verilebilecek öneriler şunlardır:

- Miksoloji özelinde yapılan akademik çalışmalar sayıca arttırılmalıdır.
- Türkiye'deki üniversitelerin turizm, yiyecek içecek işletmeciliği, gastronomi ve mutfak sanatları gibi ilgili bölümlerinde bulunan servis ve bar derslerinin müfredatları güncellenerek öğrencilerin miksoloji ile ilgili bilgiler öğrenmesi de sağlanmalıdır.
- Türkiye'de lisansüstü düzeyde yazılan tezlerde bar departmanı, miksoloji ve miksoloji teknikleri özelinde tezler yazılması teşvik edilmelidir.
- Miksoloji alanında yazılan kitapların ve yapılan yayınların büyük çoğunluğunun İngilizce olduğu dikkate alındığında söz konusu kitapların Türkçeye tercüme çalışmalarına ve Türkçe'de de bu bağlamda çalışmaların yapılmasına ağırlık verilebilir.
- Yaratıcı ve benzersiz kokteyller sunan bir işletme, turistlerin ilgisini çekebileceği ve işletmenin popülerliğini artırabileceği için turizm işletmeleri miksolojiye yatırım yapmalıdır.
- Turizm işletmeleri yerel içeceklerin tanıtımında miksoloji ve miksologları kullanmalıdırlar. Özellikle yerel meyveler ve otlar kullanılarak hazırlanan kokteyller, turistlerin yerel kültürü daha iyi tanınmasına ve deneyimlemesine yardımcı olabilir.
- Miksologların yeteneklerini sergilemelerine, insanların miksoloji hakkında daha fazla bilgi edinmelerine olanak tanımak için miksoloji festivalleri ve diğer etkinlikler düzenlenebilir. Böylece insanların o bölgeye gelmeleri ve miksologların sunduğu içecekleri deneyimlemeleri sağlanabilir. Ayrıca bu gibi etkinlikler, miksoloji alanında çalışan kişilerin bir araya gelmesini ve birbirleriyle bilgi alışverişi yapmalarını da sağlayacaktır.

Kaynakça

- Aktaş, E. (2017). Moleküler Gastronomi. H. Kurgun (Ed.) *Gastronomi Trendleri Milenyum ve Ötesi* içinde (s.105-128). Ankara: Detay Yayıncılık.
- Aktaş, A., & Özdemir, B. (2005). *İçki Teknolojisi*. Ankara: Detay Yayıncılık.
- Akyol, C. (2008). *Çatalla Yenecek Raki*. 27 Nisan 2023 tarihinde <https://www.hurriyet.com.tr/gundem/catalla-yenecek-raki-8790519> adresinden erişilmiştir.
- Arnold, D. (2014). *Liquid Intelligence: The Art and Science of the Perfect Cocktail*. WW Norton & Company.
- Bartenders Business (2022). *The Science of Cocktail Making*. 20 Mart 2023 tarihinde <https://bartendersbusiness.com/en/articles/menu-intel-1/the-science-of-cocktail-making-77.htm> adresinden erişilmiştir.
- Bartender Spirits Awards (2023). *What's the Difference Between a Mixologist and a Bartender?* 22 Mart 2023 tarihinde <https://bartenderspiritsawards.com/en/blog/insights-1/whats-the-difference-between-a-mixologist-and-a-bartender-72.htm> adresinden erişilmiştir.
- Caporaso, N., & Formisano, D. (2015). Developments, applications, and trends of molecular gastronomy among food scientists and innovative chefs. *Food Reviews International*, 32(4), 417–435. <https://doi.org/10.1080/87559129.2015.1094818>
- Chivas Regal Global. (2021). *From the Golden Age to the Prohibition Era Here is the History of the Cocktail*. 03 Nisan 2023 tarihinde <https://www.chivas.com/en-US/latest-from-chivas/the-history-of-the-cocktail#:~:text=What%20was%20the%20first%20ever,a%20favourite%20to%20this%20day> adresinden erişilmiştir.
- Çöp, S. (2020). Mixoloji. M. Sarıışık, G. Özbay ve V. Ceylan (Eds.). *A'dan Z'ye Gastronomi Sözlüğü* içinde (s. 372-373). Ankara: Detay Yayıncılık.
- Graham, C. (2022). *What Is Molecular Mixology?* 20 Mart 2023 tarihinde <https://www.thespruceeats.com/molecular-mixology-760312> adresinden erişilmiştir.
- Hellmich, M. (2006). *The Ultimate Bar Book: The Comprehensive Guide to Over 1,000 Cocktails*. San Francisco: Chronicle Books.
- Indeed Editorial Team. (2022). *Mixologist vs. Bartender: What Are the Differences?* 22 Mart 2023 tarihinde <https://www.indeed.com/career-advice/finding-a-job/mixologist-vs-bartender#:~:text=For%20example%2C%20a%20bartender%20typically,rather%20than%20making%20classic%20ones> adresinden erişilmiştir.
- Ivanovic, S., Kresimir M., & Luka P. (2011). Molecular gastronomy in function of scientific implementation in practice. *UTMS Journal of Economics*, 2 (2), 139–150.
- Kanga, S. (2008). *Molecular Mixology*. 22 Mart 2023 tarihinde http://suneetakanga.com/pdf/Molecular_Mixology.pdf adresinden erişilmiştir.
- Kientza, H. T. vo, & Gagnaire, P. (2021). Molecular mixology: Welcome coffee, a cocktail with ten layers. In R. M. Burke, A. L. Kelly, C. Lavelle, H. This (Eds.) *Handbook of Molecular Gastronomy* (pp. 827–828). Boca Raton: CRC Press.
- MasterClass (2021). *What's the Difference Between a Mixologist and a Bartender?* 22 Mart 2023 tarihinde <https://www.masterclass.com/articles/whats-the-difference-between-a-mixologist-and-a-bartender> adresinden erişilmiştir.
- Morgenthaler, J., & Holmberg, M. (2014). *The Bar Book: Elements of Cocktail Technique*. San Francisco: Chronicle Books.
- Ocejo, R. E. (2010). What'll it be? Cocktail bartenders and the redefinition of service in the creative economy. *City, Culture and Society*, 1(4), 179–184. <https://doi.org/10.1016/j.ccs.2011.01.004>

- Piogastrobistro (2015). *What is Mixology?* 20 Mart 2023 tarihinde <https://piogastrobistro.com/knowhow/what-is-mixology/?lang=en#:~:text=Mixology%20can%20be%20defined%20as,the%20craft%20of%20mixing%20drinks> adresinden erişilmiştir.
- Ranasinghe, N., Nguyen, T. N. T., Liangkun, Y., Lin, L.-Y., Tolley, D., & Do, E. Y.-L. (2017). *Vocktail*. Proceedings of the 2017 ACM on Multimedia Conference-MM'17. <https://doi.org/10.1145/3123266.3123440>
- Razvozova, K. (2017). *Degree Programmed in Hotel, Restaurant and Tourism Management Molecular Mixology. Case: Molecular Days in the Restaurant Bar&Bistro*. 05 Nisan 2023 tarihinde <https://www.theseus.fi/bitstream/handle/10024/124273/ksenia.razvozova.molecular.mixology.pdf?isAllowed=y&sequence=1> adresinden erişilmiştir.
- Sipsmith. (2021). *10 Basic Bartending Techniques to Master Now*. 29 Mart 2023 tarihinde <https://sipsmith.com/10-basic-bartending-techniques-master-now-plus-recipes-will-help-practice/> adresinden erişilmiştir.
- Solorzano, J. (2020). *The Surprising (True) Origin of the Word Cocktail*. *Cocktail Hammer*. 05 Nisan 2023 tarihinde <https://www.cocktailhammer.com/blog/the-real-origin-of-the-word-cocktail/> adresinden erişilmiştir.
- Sutcliffe, T. (2020). *A Brief History of Cocktails*. 29 Mart 2023 tarihinde <https://www.diffordsguide.com/encyclopedia/2294/cocktails/a-brief-history-of-cocktails> adresinden erişilmiştir.
- Tez, Z. (2012). *Lezzetin Tarihi*. İstanbul: Hayykitap.
- The American Heritage Dictionary. (n.d.). *Mixology*. 8 Nisan 2023 tarihinde <https://ahdictionary.com/word/search.html?q=mixology> adresinden erişilmiştir.
- Tornroth, M. (2023). *Cocktail Culture: A History of Mixology & its Evolution*. A Bar Above; A Bar Above. 20 Mart 2023 tarihinde <https://abarabove.com/cocktail-culture-a-history-of-mixology-its-evolution/#:~:text=Mixology%20has%20a%20long%20history,evolved%20into%20a%20true%20profession> adresinden erişilmiştir.
- Türkiye Barmenler Deneği. (n.d.). *Kokteyl Yapma Sanatı*. 20 Nisan 2023 tarihinde <https://barmen.org.tr/barmen-egitimi/> adresinden erişilmiştir.
- Wellmann, M. (2013). *Handcrafted Cocktails: The Mixologist's Guide to Classic Drinks for Morning, Noon & Night*. F W Media;Betterway Home.
- Wine & Spirits Education Trust (WSET). (2023a). *WSET Level 1 Award in Spirits*. 20 Mart 2023 tarihinde <https://www.wsetglobal.com/qualifications/wset-level-1-award-in-spirits/> adresinden erişilmiştir.
- Wine & Spirits Education Trust (WSET). (2023b). *WSET Level 2 Award in Spirits*. 20 Mart 2023 tarihinde <https://www.wsetglobal.com/qualifications/wset-level-2-award-in-spirits/> adresinden erişilmiştir.
- Yörükoğlu, İ., & Yörükoğlu, M. A. (1998). *Konaklama-Ağırlama İşletmelerinde Servis Yönetimi*. Ankara: Detay Yayıncılık.

**ENGLISH LANGUAGE EDUCATION IN VIETNAM: A HISTORICAL,
SOCIOCULTURAL PERSPECTIVE**

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Abstract

Teaching and learning English has drawn significant attention in Vietnam and in the world. This interest has emerged as a consequence of the fact that English has become a functional and powerful tool to the world integration and globalization. The Vietnamese youngsters are driven to learn and exploit English as a key to become global citizens. Although teaching and learning English in contemporary context in Vietnam has been extensively studied, there is a big gap in doing research of teaching and learning English in culturally and historically distinctive setting in Vietnam. In this work, Vietnam English education is examined in the lens of historical, sociocultural perspectives. It is suggested that Vietnam English education has undergone five critical changes along with social and political upheavals since the early 1950s to the 2020s. In addition, the article also explores curriculum design and textbook development, teaching methodologies and assessment during the given period. It is noticed that there have been troughs and peaks in English education in Vietnam. But tremendous improvement in curriculum design and textbook development, teaching methodologies and assessment as well as language policies in Vietnam over the last seventy years has been made. English gradually gains its high official status in economic and sociocultural development.

Key words: English Education, curriculum design, teaching methodologies and assessment, a historical, social and cultural perspective.

1. INTRODUCTION

According to Rose (2019), over 500 years, there was a shift from status of English – national language to global language with limited 3 million English Speakers in Great Britain, there has been a surge of nearly 2 billion English speakers worldwide due to the economic and political power of English-speaking economies such as: USA, UK, Canada, Australia and others. Kachru (1986, p.1) claims that “English one into the caste that has power and, more important, that controls vital knowledge about the miracles of science and technology”. There is no secret that English is considered as a master key to enrich knowledge, promote global integration, enter the world of jobs, travel and others.

Very little is known about when English made its first appearance in Vietnam. Unlike Singapore and other countries – former British colonies, Vietnam was a colony of French. Therefore, French was the main foreign language taught in alongside Vietnamese- the national official language from 1859-1954 (Hoang 2020). The period of 1954-1975 saw significant growth of four foreign languages namely, Russian and Chinese which were taught in the North of Vietnam whilst French and English were prominent in the South. In fact, Vietnam was split into two separate regions: The North and the South. The former allied with Soviet Union adopted its education systems and curriculum whereas the later fully aided by the USA borrowed its education systems. It is crucial to notice that the history of the English language and English education systems in Vietnam is closely linked with its politics, economy and social affairs (Wright 2002), and strongly formed bonds with the reform policy known as *Doi Moi (Reform)*, which was voted by the sixth National Congress of the Communist Party in 1986 (MoET 2016).

There was a high awareness of the improvement of the quality of teaching and learning English in the context of globalization, on September 30, 2008, the Prime Minister of the Government of the Socialist Republic of Vietnam signed Decision No. 1400/QĐ-TTg to promulgate the national project entitled “Teaching and Learning Foreign Languages in the National Education System, Period 2008-2020” (The Prime Minister of SRV 2018) (hereinafter referred to as the 2020 Project). The aims of the 2020 Project are to make marked improvement in the quality of curriculum designs and textbook; teaching and learning methods; and assessment in the national education system to enable Vietnamese citizens to use a foreign language confidently in their daily communication, their study and work in an integrated, multi-cultural and multi-lingual environment, making foreign languages a competitive advantage of

the Vietnamese people to serve the cause of industrialization and modernization of the country (Hoang 2016)

2. PREVIOUS STUDIES

Shapiro (1995) makes an investigation into English teaching and learning in Ho Chi Minh, the socioeconomic center of Vietnam. This work has a close look at examining the materials, curriculum, teaching methodology as well as the student and teacher populations of these schools become important guidelines in understanding the nature and development of English language training in Vietnam in the early 1990s.

Nguyen (2017) examines the discipline of teaching and learning English as an international language in Vietnam by exploring the reflections of teachers on the contemporary status of English, the implications of teaching models, cultures as well as teachers' challenges in teaching English as an international language.

Hoang (2020) and Pham (2005) pay attention to the analysis of the roles and status of English as well as communicative approach in present-day Vietnam. Particularly, it provides a brief overview of the *proliferation* of English in the world and interprets in some depth at the roles and status of English in Vietnam, looks at some of the potential threats that may pose to Vietnamese and other foreign languages being taught and learned in Vietnam and makes suggestion for planning a balanced language policy in Vietnam. Hoang (2017) carries out an in-depth analysis of the 2016 National Matriculation and General Certificate of upper secondary school Education English Test which a million Vietnamese 12 graders must take as compulsory to be eligible to receive general certificate of upper school education and a basic requirement for university entrance. The discussion of structure of the 2016 national matriculation and general certificate of upper school education English test is examined in four different categories namely (i) phonology; (ii) Lexicogrammar; (ii) Reading; and (iv) Writing and their percentage in the total score 6.25%, 33.75%, 40% and 20% respectively.

The gains and losses of ELT in general and tertiary education in Vietnam during the past few years have come under scrutiny in Hoang (2017). The key current situational factors that have significant effects on ELT and tertiary education in Vietnam such as language education policy, curriculum development and implementation with comments as well as his recommendations are also discussed in detail. However, teaching methodologies are not mentioned in this study.

3. FINDINGS AND DISCUSSION

It is commonly agreed that there are numerous solutions to the improvement of the quality of teaching and learning foreign languages in general and teaching and learning English in Vietnamese schools in particular. One of the most effective suggestions is probably the renovation in curriculum design and textbook development. It is safe to say that there has been extensive renovation in Vietnamese curriculum design and textbook development over the last seventy years (the early 1950s-2020s). Figure 3.1 demonstrates five distinctive periods of English curriculum in Vietnam between the early 1950s and the 2020s.

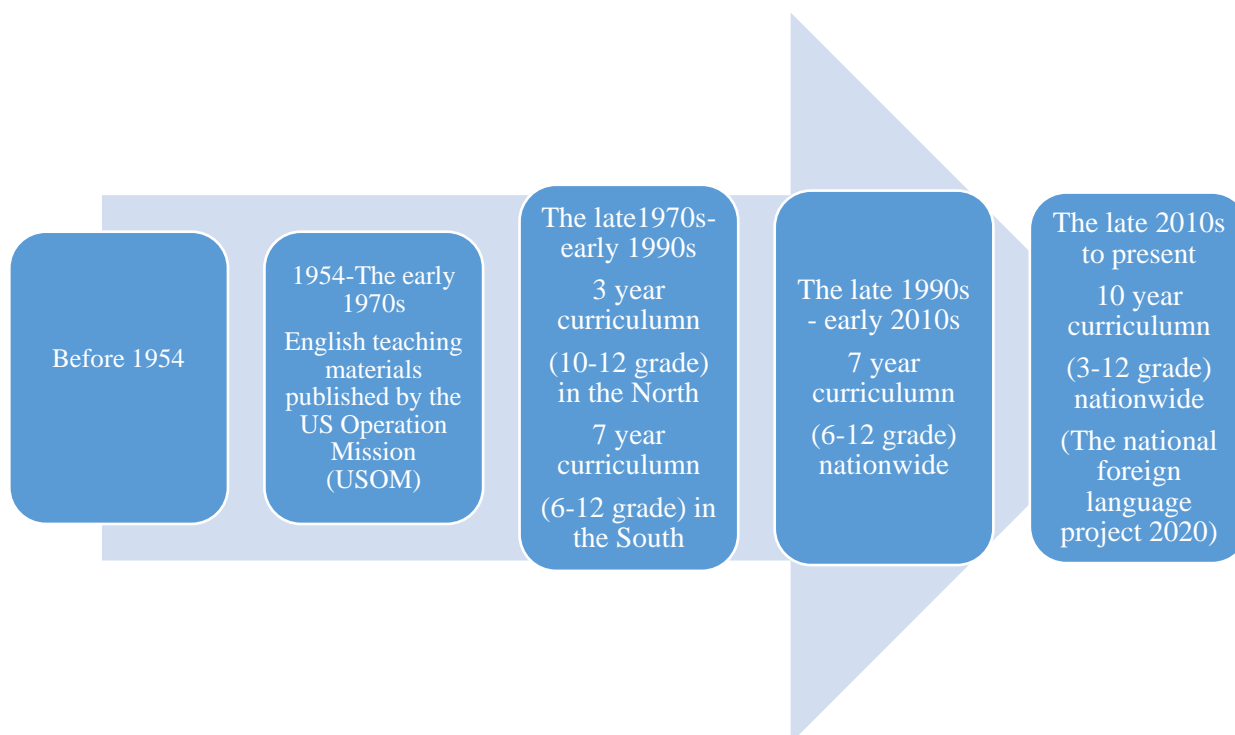


Figure 3.1. Five distinctive periods of English curriculum in Vietnam between the early 1950s and the 2020s

3.1. Formal English Education before 1954

Prior to 1954, it appeared that English came into existence in Vietnam but it was not officially taught during the French colonization and it was definitely less popular than French. Little has been written about teaching and learning English at this time. The most likely explanation is that Vietnam was under the severe destruction of war and there was limited investment and interest in the development of education and curriculum during the war leading to the absence of language policy and planning. In addition, English did not have any power and applied linguistics were completely an emerging discipline in contemporary Vietnam.

3.2. Formal English Education between 1954 and the early 1970s

1954 marked a turning point in Vietnam history as the USA directly got involved in Vietnam war and intervened to govern the South of Vietnam. In other words, the USA backed Ngo Dinh Diem, the president of the Republic of Vietnam (ROV) in all fields and sectors. In particular, with the support of the US Education Aid to ROV, the United State Operation Mission (USOM) helped the government of the South to design and develop the curriculum for teaching English as a foreign language. This agency performed a function to draw up and publish teaching materials and holding English exams for Vietnamese students across the South of Vietnam (Luu and Nguyen 2020). The aims of this project is to train a huge amount of labor force to serve the contemporary regime and to spread the ideology of the Western and latter trade and commerce. In other words, English was initially introduced in the South to support Ngo Dinh Diem's government and meet society's needs. On the contrary, Russian and French were the two required foreign languages in the North. In short, this period witnessed English under the influence of the USA.

3.3. Formal English Education between the late 1970s and the early 1990s

From the early 1970s to the early 1990s saw a slow recovery in Vietnam after the long-lasting war. The Northern of Vietnam defeated Ngo Dinh Diem's regime, took the South and reunified as the Socialist Republic of Vietnam under the control of the Communist Party of Vietnam in 1975. Since then, the government devoted to post-war reconstruction of all fields especially in socioeconomic and political aspects and education. Nevertheless, the embargo of the USA and Cold period of the USA and the Treaty of Friendship and Cooperation with Russia in November 1978 (Asselin 2018) are major hindrance to English education in the contemporary period. Although English was taught in schools, it had a low official status. In fact, the current government took a tough stance on eliminating the remaining influence of Western Civilization by strict control of English education. In fact, foreign native English speakers were not allowed to teach in most of English center during the period of 1975-1985. The period of "reform" in 1985 marked a milestone in Vietnam socioeconomic development and education reform is a critical part of this process. However, the country was still at a very early stage in its transition to a market economy drive with slow growth and improvement. In accordance with the reform, there has been a growing interest and awareness of the need to improve the quality of the nation's education including curriculum development, teaching and learning methods, assessment and learners' outcomes and others. In reality, these matters are the interface between political and professional decision. In other words, substantial

government support such as funding and implementation of educational policy reform as well as the restless efforts of English education professors, textbook experts, English teachers and publishers are extremely essential. In education, curriculum development has long been the source of scholarly unease. The earliest English curriculum designers constructed a new English textbook series to meet the new expectation and goals. Northern regions relied on a three-year syllabus of English but 7-year one in the South. From the very beginning, English syllabus was not considered equal throughout the country. In addition, there was no well-designed textbooks in the educational system (Hoang 2016). Additionally, some language training and reference books: British Streamline English, Person to Person, English Grammar in Use, Headway, Practice your English, Listen Carefully and others were available in a large number of bookstores in Vietnam (Shapiro 1995).

During this period, conventional teaching methods of English emphasizing the acquisition of grammar and vocabulary was crucially predominant in the early 1970s. As a result, students' assessment tests are designed to test the grammatical rules of English rather than English in use and in communication. In particular, the final English tests put an emphasis on grammar acquisition. This reflected that fact that formal English education was restricted by test-driven education philosophy and practice in contemporary Vietnam.

The period is the transforming stage of conventional teaching methods of English emphasizing the acquisition of grammar and vocabulary and Communicative Language Teaching (CLT). In fact, conventional methodology underwent peaks and troughs from a central teaching method to an out-date one since the introduction of Communicative Language Teaching (CLT). Otherwise, to some extent, Grammar - Translation method does not meet the requirements of English learning in the era of integration and globalization. In the early 1990s, CLT, steadily gaining in popularity, was developed by Hymes (1972). He claimed that "knowing a language involved more than knowing a set of grammatical, lexical and phonological rules ... Learners need to develop communicative competence – the ability to use the language they are learning appropriately in a given social encounter (Hymes, 1972,p.193). It can be seen that Hymes (1972) highlighted the significance of communicative competence and appropriateness in particular contexts rather than the accuracy of grammar, vocabulary. Since then CLT has flourished in the 20-century linguistic theory and language learning curriculum design worldwide. Nevertheless, educators, English teachers and learners have faced numerous obstacles with the application of CLT in the class in Vietnam. According to Le (2020), there are at least three challenges namely: (1) goals of gaining communicative

competence; (2) the notion of creating genuine communicative activities and tasks as well as preparing materials that promote communicative language use in CLT and (3) the exam-oriented curriculum in favor of grammar and vocabulary rather than speaking and listening (communicative competence) at both secondary and tertiary levels. It turns out that there is a shortage of real-life interaction and situation in their English exam and the learning outcome mismatches the aims of the syllabus. Particularly, big size and heterogeneous classes are the hindrance to the implementation of communicative and interactive tasks in the tests.

The Foreign Language Certificate Program, a system of written and oral examinations, pursuant to Decision No. 177/QĐ-TCBT dated January 30, 1993 of MoET promulgating the Program of English Practice A, B, C to determine language ability for individuals, became a significant aspect of foreign language training in Vietnam. The "A Level" (beginner) "B Level" (intermediate) and "C Level" (advanced) measurement of English language ability, designed by the Ministry of Education and Training, was a framework for foreign language preparation in Vietnam. The vast majority of individuals seeking English certificates will go for the "B Level" (intermediate) to secure a job opportunity in the foreign companies or incorporates. Each B test taker had to finish a 120-minute written test divided into three parts: Reading Comprehension, Use of English and Listening and following this there was a kind of brief (5-10 minute) "interview" in which the test taker must conduct conversations in English with examiners. Particularly, MoET drew up comprehensive guidelines for exam such as the content and assessment. These are common speaking topics suggested by MoET: 1 Personal Identity 2. Student's House 3. Home life 4. Education and future career 5. Free time, entertainment 6. Travel 7. Shopping 8. Food 9. Foreign Language 10. Weather. (Shapiro 1995)

This interview segment was recorded during observations in the certificate examinations conducted in Ho Chi Minh City:

Examiner: How do you like the weather today?

Student: Yes, I like very much because the weather today is very nice.

Examiner: Very nice? What will you do when you have free time?

Student: I uh, have free time I read a book and watching television.

(Shapiro, 1995, p.14)

The Foreign Language Certificate Program at that time required a vital link between those who facilitate independent language schools or English language centers and the local educational agencies attempting to ascertain linguistic aptitude on the part of the population. There was estimated to be approximately 160 English centers in the community nationwide

between the 1990s and the 2010s (Shapiro 1995). After 26 years of existence and growth, the 1993 Foreign Language Certificate Program completed their historic mission and was officially abolished by stopping testing and granting this specific certificate from January 15, 2020. This era is commonly known as English for modernization and industrialization.

3.4. Formal English Education between the late 1990s and the early 2010s

The US embargo was lifted out of Vietnam in February and Vietnam has normal diplomatic relations with the US and began to open itself to the world in 1995 (Wan 2001) and since then drive to learn English has turned into a national movement. As a result, formal English education has become a crucial part in Vietnam economic and socio development plan. In particular, gaining a membership to the Association of South East Asia Nations in 1997, the Asia Pacific Economic Cooperation in 1998 and the World Trade Organization in 2007 exerted the strong influence of English in Vietnam (Chu & Oliver, 2017). Consequently, expectations of English teaching and learning outcomes are high and this put great pressure on English teachers, schools and educational systems. Therefore, the era of late 1990s - early 2010s saw remarkable progress in national curriculum design and textbook development of English because of the deep concern of Vietnamese government about foreign language teaching and learning in Vietnam in the context of integration and globalization. In fact, all schools covered a 7-year (6-12 grade) national syllabus explicitly and systematically designed with one set of textbooks for secondary schools and two sets of textbooks (the standard and the advanced one) for upper secondary schools (MoET 2006, 2016). In particular, these textbooks are published by Vietnamese Minister of Education and Training (MoET).

By contrast, it was argued that there was no remarkable achievement in teaching and learning English as well as the student's assessment in schooling settings. Partly this slow improvement and innovation reflected the low level of adaptation of the speedy change of curriculum development and the expectation of society. Unfortunately, learners and teachers are key factors to ensure educational reform but they were unprepared and blissfully unaware. The outdated teaching and testing in classrooms still put weight on grammar accuracy and written structures and memorising grammatical rules and improving grammatical accuracy are central to English teaching and learning (Le Ha, 2009; Phuong & Nhu, 2015). On the downside, teachers and learners were driven by test-oriented goals.

3.5. Formal English Education between the late 2010s and the early 2020s

The late 2010s marked a milestone in curriculum design and textbook development by introducing 10-year national syllabus with a series of English textbooks. The output received a

great deal of support from two experienced British applied linguists from the British Council: Professor Rhona Stainthrop (for Pilot English Curriculum for Vietnamese Primary Schools) and Professor David Hay (for Pilot English Curriculum for Vietnamese Secondary Schools and Pilot English Curriculum for Vietnamese Upper Secondary Schools) (Hoang 2016). Unlike 7-year English textbook series, the 10-year English textbooks one put particular emphasis on four language skills: listening, speaking, reading and writing. Specially, two oral skills (listening and speaking) are crucial and are well-focused for English learning beginners. These two oral skills are gradually decreased. In contrast, reading and writing skills are slightly reinforced at higher levels. The percentage of every single language skill at each level is illustrated in table 3.1

Table 3.1. Percentage of listening, speaking, reading and writing at three different levels of the 10-year English textbook series

	Listening	Speaking	Reading	Writing
Primary	35%	35%	15%	15%
Secondary	30%	30%	20%	20%
Upper secondary	25%	25%	25%	25%

(Hoang, 2016, p.16)

From 2020 to present, English language ability testing is pursuant to Circular No: 1/2014/TT-BGDĐT dated January 24th 2014 of MoET promulgating Six-level Foreign Language Proficiency Framework for Vietnam by The Minister of Education and Training in Vietnam. This tailored Framework is based on The Common European Framework of Reference for Languages (CEFR), an international standard for describing language ability. In fact, CEFR describes language ability on a six-point scale, from A1 for beginners, up to C2 for those who have mastered a language. Similarly, Vietnamese Six-level Foreign Language Proficiency Framework is divided into 3 levels (Elementary, Intermediate and Advanced) and 6 levels (from Level 1 to Level 6 and compatible with levels from A1 to C2 in CEFR). A comparison between Vietnamese Six-level Foreign Language Proficiency Framework and CEFR is illustrated in table 3.2.

Table 3.2. A comparison between Vietnamese Six-level Foreign Language Proficiency Framework and CEFR

Vietnamese Six-level Foreign Language Proficiency Framework		CEFR
Elementary	Level 1	A1
	Level 2	A2
Intermediate	Level 3	B1
	Level 4	B2
Advanced	Level 5	C1
	Level 6	C2

(MoET 2014)

Pursuant to Announcement No. 619/TB-QLCL, dated May 8, 2020 of the Department of Quality Management under the Ministry of Education and Training, 14 government-backed units nationwide are eligible for granting foreign language certificates of 6 Levels (A1-C2) within the Vietnam Six-level Foreign Language Proficiency Framework in 2020 and then the granting list was updated to 24 government-run units in February 2022 which are prestigious universities and institutes in Vietnam. It can be seen that English centers are not allowed to grant 6 level certificates and Vietnamese foreign language policies have been gradually enhanced to take strict control of the quality of English language teaching and learning as well as to meet the language requirements of employers and society. It is widely agreed that compulsory English education and the new Vietnam Six-level Foreign Language Proficiency Framework in 2020 is a part of national strategic plan for economic development.

3. CONCLUSION

Formal English education has gone through five different phases between the early 1950s and the early 2020s and English has spread across Vietnam since the period of “reform” in 1985 and has seen a thrive since the late 1990s. Like many other countries in the world, English has become a foremost language and has great impacts on Vietnamese socioeconomic development. Thanks to the polices of the Vietnamese government via regularly updated guidance to cope with new challenges and obstacles in rapidly changing world, English curriculum; teaching methods and assessment have made crucial a lot of radical change and progress over the last seventy years to meet the requirements of employers as well as to keep up with the development of teaching and learning English of some Asian countries like Thailand, Philippines, Malaysia and others. However, numerous and restless efforts in terms of textbook designs, teaching and learning as well as a comprehensive, objective and consistent

assessment much be done to improve the quality of teaching and learning English in digital era with great support from advanced technology and Artificial Intelligence but a lot of potential threats from Covid-19 pandemic, global warming with more severe natural disasters.

REFERENCES

- Asselin, P. (2018). *Vietnam's American War: A History*. UK: Cambridge University Press
- Chu, T.L.H & Oliver, R. (2017.) *Vietnamese's Tesol teachers' recognitions and practices: Developing learner-centered learning*. In Gurzynski-Weiss, L. eds. *Expanding Individual Difference Research in the Interaction Approach: Investigating learners, instructors and other interlocutors*. 173–200. Philadelphia: John Benjamins.
- Kachru, B.B. (1986). *The Alchemy of English: The Spread, Functions, and Models of Non-native Englishes*. Oxford: Pergamon.
- Hoang, V.V.(2010). The Current Situation and Issues of the Teaching of English in Vietnam. *RitsIILCS*. 22(1). 7-18.
- Hoang, V.V.(2016). Renovation in Curriculum Design and Textbook Development: An Effective Solution to Improving the Quality of English Teaching in Vietnamese Schools in the Context of Integration and Globalization. *VNU Journal of Science: Education Research*, Vol. 32, No. 4 (2016) 9-20.
- Hoang, V.V. (2017). The 2016 National Matriculation and General Certificate of Secondary Education English Test: A Challenge to the Goal of Foreign Languages Education in Vietnamese Schools. *VNU Journal of Science: Education Research*, Vol. 33, No. 4 (2017) 1-16.
- Hoang, V.V.(2018). Moet's three pilot english language communicational curricula for schools in vietnam: rationale, design and implementation. *VNU Journal of Foreign Studies*, 34(2), 1-25.
- Hoang, V.V. (2020). The roles and status of English in present-day Vietnam: A Socio-cultural analysis. *VNU Journal of Foreign Studies*, 36(1), 1-21.
- Hymes. D. (1972). *On communicative competence*. In J. B. Pride, and J. Holmes. eds. *Sociolinguistics*, 269–93. Harmondsworth: Penguin.
- Le, H. T. (2013). ELT in Vietnam general and tertiary education from second language education perspectives. *VNU Journal of Foreign Studies*, Vol. 29, No.1 (2013) 65-71.
- Le, H. P. (2009). English as an international language: International student and identity formation. *Language and intercultural communication*, 9(3), 201–214.
- Le, H.P.N. (2020). *The Place of English as an International Language in English Language*. New York: Routledge.
- Luu, V. Q and Nguyen, T.M.H. (2020). Higher Education in South Vietnam in 1965- 1975: An Approach from The Impacts of The Us Education Aid. *Review of International Geographical Education*. 10(4). 804-814.
- Ministry of Education and Training (MoET). (1993). *A, B, C English Practice certificate* promulgated with Decision No 177/QĐ-TCBT. Vietnam.
- Ministry of Education and Training (MoET). (2006). *English Curriculum for Vietnamese Schools* promulgated with Decision No 16/2006/QĐ-BGDĐT. Vietnam.
- Ministry of Education and Training (MoET). (2014). *Six-level Foreign Language Proficiency Framework for Vietnam* promulgated with Circular No 01/2014/TT-BGDĐT. Vietnam.
- Ministry of Education and Training (MoET). (2016). *Format of Level 1 English Competence Test within Six-levels of Foreign Language Proficiency Framework for Vietnam* (Primary school students) promulgated with Decision No 1479/QĐ-BGDĐT. Vietnam.
- Ministry of Education and Training (MoET). (2016). *Format of Level 2 English Competence Test within Six-levels of Foreign Language Proficiency Framework for Vietnam* (Secondary school students) promulgated with Decision No 1475/QĐ-BGDĐT. Vietnam.
- Wan, M. (2001). *Japan Between Asia and the West: Economic Power and Strategic Balance*. New York: Routledge.

- Ministry of Education and Training (MoET). *Format of Level 3 English Competence Test within Six-levels of Foreign Language Proficiency Framework for Vietnam* (Upper secondary school students) promulgated with Decision No 1477/QĐ-BGDĐT dated May 10th 2016.
- Nguyen, T.N. (2017). Thirty Years of English Language and English Education in Vietnam: Current reflections on English as the most important foreign language in Vietnam, and key issues for English education in the Vietnamese context. UK: *Cambridge University Press*.33-35.
- Pham, H.H. (2005). “Imported” Communicative Language Teaching: Implications for local teachers. *English Teaching Forum*. Vol 4. 1-8.
- Phan, T.T.N. (2018). Effective EFL Instruction in the Vietnamese Context: From Beliefs to Actual Classroom Practices. *International Journal of Instruction*. 11(3). 403-418.
- Phuong, L. N. T., & Nhu, T. P. (2015). Innovation in English language education in Vietnam for ASEAN 2015 Integration: Current issues, challenges, opportunities, investments and solutions. *ASEAN Integration and Role of ELT*, 104.
- Rose, H & Galloway, N. (2019). *Global Englishes for Language Teaching*. UK: Cambridge University Press.
- Shapiro, L.A (1995). *English language training in Vietnam in the era of Doi Moi in Ho Chi Minh city: a descriptive case study*. Master of Arts in Teaching degree. The School for International Training, Brattleboro, Vermont.
- The Prime Minister of SRV. (2008). *Teaching and Learning Foreign Languages in the National Education System, Period 2008- 2020* promulgated with Decision No: 1400/QĐTTg. Vietnam
- The Vietnam National Institute of Educational Sciences (VNIES). (2008). *Teaching and Learning Foreign Languages in the National Education System, Period 2008-2020*. Vietnam.
- The Vietnam National Institute of Educational Sciences (VNIES). *An Evaluative Report on the Development of Vietnamese General Education Curricula from 1945 to the Present*. Vietnam. 2012.
- Wright, S. (2002). ‘Language education and foreign relations in Vietnam.’ In Tollefson, J. W. (ed.), *Language Policies in Education: Critical Issues*. London: Lawrence Erlbaum, 225–244.

**TEACHERS' BURNOUT, THE "FATIGUE SYNDROME" OF EDUCATORS'
PHYSICAL, MENTAL AND PSYCHOLOGICAL EXHAUSTION IN ALBANIA**

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ABSTRACT

Over the last few years teachers' burnout has been frequently described as a health condition and phenomenon whose impact is being analyzed in terms of both teachers' and students' achievements. Dictionary definitions of the term "burnout" provide interesting characteristics of this state, such as "the mental or physical condition of having no energy left"¹¹. So, the concept of exhaustion or fatigue goes beyond the physical one, usually dominated by high levels of stress, energy consumption/waste, routine submission, unconscious isolation focusing on one's professional or administrative tasks, etc. merely for the sake of celebrating one's success as an educator. Teachers' workload in the classroom and at home, their search for "professional perfectionism" in diverse, heterogeneous classes, often makes them forget themselves and forget the humans' innate need for energy recuperation and resilience. Consequently, they fall into this vicious circle of boredom, "burnout" from which it is difficult to escape. Therefore, a deeper analysis of the paper aims: to identify substantial reasons or factors that trigger teachers' burnout; to identify possible means that can positively contribute to its reduction and foster a better relationship among teachers and pupils; to analyze the extent to which professional achievement and burnout influence one another; to analyze teacher's burnout as a major reason of being quitted as a profession by the youth, etc. Answering and analyzing the above issues will provide a clearer display of the "burnout" syndrome and how it can be reduced if not omitted, guaranteeing a successful teaching process.

Keywords: Burnout, Exhaustion, Recuperation, Achievements, Teachers, Impact

¹¹ Macmillan English Dictionary for Advanced Learners (2007), p. 193

1. INTRODUCTION

Teaching has always been an appealing profession and yet demanding too, since earlier times. Like many other service occupations, teachers are highly vulnerable to experiencing feelings of burnout due to several reasons including extensive workload, interactions with students, colleagues, students' parents, headmasters, etc. Long hours of commitment and dedication to students and their teaching duties, peers' competitiveness in pursuit of "professional achievements in the classroom often lead to anxiety and exhaustion regardless of their teaching domain" (Santoro, 2011).

Being a workaholic in the teaching arena does not always guarantee professional success, on the contrary, it often leads to professional, mental, and psychological consumption. Empirical evidence has always shown that the feeling of workload in teaching is neither financially nor spiritually nor emotionally rewarding (Friedman, 1995). Furthermore, it is indisputably reflected even in a classroom management skills deficiency on the side of the teachers. The more anxious, and stressed educators seem to be, the more difficult it for them is to control the classroom environment and accomplish their required tasks by the school directory, or individual teaching tasks in the framework of the accomplishment of a successful teaching process following the annual teaching curriculum. Therefore, this multidimensional treatment of the effects of teachers' burnout requires careful consideration and study if we want teachers and students to do well in their teaching environment.

Teachers' burnout is a global worrying phenomenon not only in Albania but even in other countries. It often determines teachers' and student-teachers decisions vs. their future continuation in the teaching profession. It is also worth mentioning that in our country, Albania, this is one of the primary reasons that has dropped significantly the number of students wanting to attend teaching studies at the university level.

The universal global concern of teachers' burnout besides many factors also seems to be connected with the teachers' professional ability in being skilled managers and supervisors of the teaching profession. The more talented they are, professionally speaking, the more self-esteem and "self-efficacy" they have (Yu, et al., 2015). Consequently, this self-efficacy and self-esteem are going to be reflected in their management of burnout levels not only in the school environment but also at home.

Therefore, through empirical research, observations, and interviews of the current Albanian teachers' burnout situation, the paper aims at finding out and highlighting significant

factors that highly influence teachers' burnout, mostly in the 9th-grade school system, which is going to be the target group of this study.

Moreover, constructed interviews it is aimed at identifying possible means or strategies that can be applied by the teachers to soothe the phenomenon, reducing it which will undoubtedly be reflected in both teacher's and student's teaching and learning performance at home and school environment, promising higher results for both of them.

In today's society the diverse classrooms, with students having heterogeneous educational and cultural backgrounds; as well as the decreasing parental control and responsibility versus their children seem to have increased teachers' anxiety towards their prolonged levels of excessive tiredness and boredom highly reflected during the teaching process and their management of the disruptive behaviors in the classroom too (Aloe, et al. 2014). The more research and experience are shared on this issue, the easier it will for teachers and educators in coping with this worldwide global phenomenon.

2. LITERATURE REVIEW

Teacher's burnout, this chronic state of physical, emotional, and mental exhaustion sometimes considered even as a kind of chronic illness is mostly stress-related and caused and influenced by high levels of prolonged stress, boredom, and routine work in the classroom as well as at home (Goddard et al., 2006).

Along with its interesting part, teaching, as well as other "stressful occupations" (Gold& Roth, 1993), is broadly admitted to being a job that offers a high risk for stress and burnout due to several mixed reasons. Chang (2009) mentions in his article an interesting fact about teaching claiming that "it seems to offer for teachers limited interaction with adults" since it mostly focuses on a loose cooperation between educators and pupils/students. This dependent and dynamic interaction in this teacher-student pair makes "teachers feel drained emotionally and intellectually" (Chang, 2009). This feeling of being drained is indisputably reflected in teachers' consumed energy, force, desire, and will while performing in the classroom.

As mentioned above this feeling of isolation on the side of the teachers negatively influences their performing skills in the classroom not only in terms of the explanation but even in terms of the relationships they establish with their pupils. The initial energetic desire in entering the teaching profession soon seems to vanish into a routine process that goes on even at home with the completion of the student's assignments.

Educators' stress and burnout caused by their profession have undoubtedly influenced the workforce at a global level. Not only is it accompanied by a lack of satisfaction, performance, and accomplishment on the teachers' side, but it is also reflected in secondary school students' selection when it comes to entering university studies.

This sad reality concerning the teaching profession and its future is currently evident even in our country. Teenagers' preferences nowadays seem to be classified into three major directions highly influenced by the immigration facilities provided by European countries, that is IT experts, medicine, and nursing. What about teaching? Unfortunately, that stands by the end of the lists' preferences, despite the Albanian government's measures in increasing teachers' salaries. Consequently, these teenagers' retreat from studying to become a teacher influences educational institutions as well as parents in search of a good teacher for their kids. Even those students who end up graduating from university in teaching with high levels of energy, soon fall into the burnout circle, highly reflected in their lack of desire and will. Not being able to escape the burnout phenomenon or this "dull reality" as known by Stern and Cox (1996), the in-service teachers display feelings of boredom, irritation, and anxiety which directly influence students' academic performance.

3. METHODOLOGY

The target group of this research consisted of teachers since the burnout phenomenon is considered in the teaching profession. There were about 147 teachers, from the 9th-grade system as well as elementary school educators who were being interviewed, to generate diverse data in the framework of this professional exhaustion. The selected sample was teaching pupils in both rural areas and urban ones to draw similarities and differences between the two.

The main instrument applied for the collection of the data was semi-structured interviews. These served to conduct both qualitative and quantitative research considering the nature of the theme itself. The topic of burnout fatigue provides diversity since individual teachers do experience it differently. Besides the fixed number of questions, educators were also asked some open questions where they could express their individual experiences and opinion referring to this issue.

Another instrument that was also used was that of observations conducted during teaching. The purpose of these observations was that of catching unconscious features of burnout conditions during the teaching process. Observations were carried out in different schools, in different subjects, and with different teachers. The school staff being observed was

classified into two groups, teachers having long years of teaching experience as well as novice teachers. The purpose of the latter was that of identifying which group experienced more burnout conditions

4. RESEARCH AND FINDINGS

After having realized the semi-structured interviews and the observations, the research was followed by the next step, that of elaborating the collected information.

The data collected relating to this topic of research were impressive. The variables taken into account in the generation of the information were useful since they provided concrete data on the topic being researched. Of teachers working in rural schools, almost 46% surprisingly experienced lower levels of burnout in comparison to the teachers teaching in urban schools.

This was justified by a couple of reasons, one of which was the smaller number of pupils in classes which provided them the opportunity to complete most of the administrative tasks during working hours. The opposite picture was reflected among teachers in urban schools. Under stricter rules of observation, and being characterized by a bigger number of pupils in classes, most of the teachers were obliged to continue home in the evening most of the tasks to complete them.

In elementary school teachers, 38% showed higher levels of burnout due to the correction of the assignments, home, and class ones, because they cover different subjects during a school day. Even in cases when they got them home to be finished, this restricted their family time and tended to increase levels of boredom and stress in their isolated classroom environment the following day. Not only did they suffer individual internal feelings of dissatisfaction, but this was highly reflected through a lack of enthusiasm even in their teaching process.

The abundant number of papers and documents teachers have to complete in terms of the directorates' requirements, teachers experienced immense feelings of energy consumption and mental distraction which was highly evident even during teaching. Students' portfolios and files were time-consuming as well as tiring. 84% of the teachers being interviewed admitted spending more time completing these two documents than realizing extra learning activities for the pupils. Therefore, dealing with the useless completion of papers often made teachers retreat from the fulfillment of their personal and professional achievements. Teaching, instead of an attractive occupation turns out to be considered tiring and not well paid by the people, often leading to a lower number of applications at university teaching courses.

5. CONCLUSION

Analyzing the burnout syndrome among teachers is an endless process that never expects to reach a decisive answer. What we as educators and researchers can do is continuously monitor such phenomena to help teachers:

- overcome difficult challenges,
- fulfill their objectives,
- reach their goals through intentions and determination
- set high expectations for the class achievements and success,
- continue their noble profession and never quit it, etc.

Classrooms dynamics will always be present, at whatever time. Teachers should try their best to successfully achieve their goals regardless of the constraints which often lead them to stress and pressure. Becoming better time managers would be of significant importance and a reasonable opportunity when it comes to dealing with the syndrome of Burnout.

REFERENCES

- Aloe, et.al. (2014). Classroom Management, Self-Efficacy, and Burnout. Vol. 26. No.1. Published by Springer. <https://www.jstor.org/stable/43549786>
- Chang, M. (2009). An Appraisal Perspective of Teacher Burnout: Examining the Emotional Work of teachers. <https://www.jstor.org/stable/23361559>
- Friedman, I.(1995). Student Behaviour Patterns Contributing to Teacher Burnout. Vol.88, No. 6. Published by Taylor and Francis. <https://www.jstor.org/stable/27541987>
- Goddard, et al. (2006). Work environment predictors of beginning teacher burnout. Vol. 32. Nr. 6. Published by Wiley. <https://www.jstor.org/stable/30032711>
- Gold & Roth. (2005). Teachers managing stress and preventing burnout. Published by the Palmer Stress.
- Santoro, D. (2011). Good teaching in difficult times. Demoralization in the pursuit of good work. Volume 118. No. 1. <https://www.jstor.org/stable/10.1086/662010>
- Stern & Cox. (1993). Teacher Burnout: The Dull Reality. Vol. 8. No 3. Published by SAGE. <https://www.jstor.org/stable/3398672>
- Yu, X. (2015). The effect of work stress on job burnout among teachers: The mediating role of self-efficacy. Vol. 122, No.3. Published by Social Indicators Research. <https://www.jstor.org/stable/24721572>

**TOPLUMSAL OLAYLARA TOPLUM DİL BİLİMSEL AÇIDAN NASIL
YAKLAŞILMALIDIR?**

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ÖZET

Dil, doğuştan sahip olunan ve insan zihninde yer alan bir dizgedir. Dünyadaki her dil, insan toplulukları arasında çok uzun zaman içerisinde gelişip meydana gelir. İnsan zihni ile kültür arasında aracı vazifesini yüklenen dil, hem kültürlerin hem de zihinlerin gelişmesinde önemli rol oynamaktadır. Toplumsal yaşamla kaynaştığı için dil, esasen toplumsal bir olaydır. Çünkü dilin birinci işlevi bildirişimdir. Toplum bireyleri birbirine bağlayan, karşılıklı iletişim hâlinde olan tüm insanların oluşturmuş olduğu bir sistem, sosyal ilişkiler bütünüdür. Toplum bilimi ise insanın tüm davranışlarını, ilişkilerini ele alan, sosyal ilişkilerin yapısını ve bu ilişkilerin nasıl ortaya çıkıp, değişip, şekillendiğini inceleyen bir bilim dalıdır. Sosyal eylem bilimi olarak da bilinen bu bilim dalının esas çıkış noktası insanların yaşadığı eylemlerin anlamlandırılmasına, dış dünyaya karşı bir bakış açısı oluşturmalarına yardımcı olmaktadır. Toplum biliminin çeşitli kuramları vardır. Dilbilimciler açısından en dikkat çekici olan yapısal-işlevselci kuramdır. Bu kuramın temel ilkesi topluma çok boyutlu bakmayı ön görmesidir. Bu çalışmada toplum dilbiliminin, dil ile toplumun kesiştiği olguları bir arada incelemesinden yola çıkarak toplumsal olaylara nasıl yaklaşılması gerektiği ile ilgili önerilerde bulunulmuştur. Bu önerilerin en başında toplum biliminin yapısal-işlevselci kuramı bağlamında bir kategoriye oturtularak toplumsal olaylara dilbilimci bir bakış açısıyla yaklaşılması gelmektedir. Toplum dilbilimi, dili işlevsel açıdan ele aldığı için toplumdaki bireylerin toplum değişkenleri (eğitim seviyesi, yaş, meslek gibi) açısından da değerlendirmek durumundadır. Bu sebeple her yönüyle incelenmesi gereken bir dizgeye sahip olan toplum dilbilimi alanında yazılı verilerden ve görsel malzemelerden yararlanılarak elde edilen verilerin toplumsal bir yapı içerisinde analiz edilmesi gerekmektedir. Böylece daha sağlıklı sonuçlara ulaşmak mümkün olacaktır.

Anahtar Kelime: Dil, Toplum, Toplum Dil bilim.

**HOW SHOULD SOCIAL EVENTS BE APPROACHED FROM SOCIAL
LINGUISTIC PERSPECTIVE?**

ABSTRACT

Language is a system that is inherent in the human mind. Every language in the world has evolved over a long period of time among human societies. Language, which assumes the role of intermediary between the human mind and culture, plays an important role in the development of both cultures and minds. Language is essentially a social phenomenon, as it merges with social life. Because the primary function of language is communication. Society is a system, a set of social relations, formed by all people who connect individuals and are in mutual communication. Social science, on the other hand, is a branch of science that deals with all human behaviors and relationships, examines the structure of social relationships and how these relationships emerge, change and take shape. The main starting point of this branch of science, also known as the science of social action, helps people to make sense of their actions and to create a perspective against the outside world. Social science has various theories. For linguists, the most striking is the structural-functionalist theory. The basic principle of this theory is that it foresees a multidimensional perspective on society. In this study, suggestions were made about how social events should be approached, based on the fact that sociolinguistics examines the intersection of language and society together. At the forefront of these suggestions is the approach to social events from a linguistic perspective by categorizing them in the context of the structural-functionalist theory of sociology. Since sociolinguistics deals with language from a functional point of view, it has to evaluate the individuals in the society in terms of social variables (such as education level, age, occupation). For this reason, the data obtained by using written data and visual materials in the field of sociolinguistics, which has a system that needs to be examined in every aspect, should be analyzed within a social structure. Thus, it will be possible to achieve healthier results.

Keywords: Language, Society, Society Linguistics.

Giriş

Dil, insanın evrendeki hem yerini hem değerini belirlemede çok etkin bir nitelik taşımaktadır. Çünkü yaşamın sürdürülebilirliği dil ile gerçekleşmektedir. Bu nitelik dilin farklı tanımlarının ortaya çıkmasına sebep olsa da genel çerçeve ve varılan yol aynıdır. Dilin uzlaşım ile beraber bir sözleşme olması, sanat ve bildirim gibi alanlarda çok önemli bir yeri vardır. Bu yüzden dünyadaki çeşitli bildirişme dizgelerinin en mükemmeli olarak dili kabul etmek mümkündür (Aksan, 2000: 11; Saussure, 1998: 38). Saussure'e göre dil ve söz birbirinden ayrı kavramlardır. Dil tasarıma ihtiyaç duymaz ama söz hem bireyseldir hem de anlık olarak belirmektedir (Saussure, 1998: 9). Dil tüm toplumu ilgilendirir ama söz dilin birey tarafından somut bir kullanımıdır. Dil bu yüzden toplumsal olup söz ise bireyseldir. Dil-söz ayrımı esasen toplum bilim ve ruh bilim çerçevesinde yer almaktadır (Rıfat, 2005: 26). Dil, toplumsal bir araç olduğu kadar aynı zamanda bireyin zihinsel süreçlerinde de çok gerekli bir araç olup insan zihni ile kültür arasındaki insanla başka bir insan arasındaki, dünya ile insan zihni arasındaki tüm ilişkilere aracılık etmektedir. Yani kültürel her gelişimde dilin zihne ve sürece desteği büyüktür (Yıldız, 2014: 132). Toplum, fertleri birbirine bağlayan karşılıklı etkileşim ile insanların oluşturduğu bir sistemdir. Toplum ise sürekli değişim içinde olan bir sosyal ilişkiler ağıdır denilebilir (Marshall, 2009: 732). Aksan'ın da dediği gibi insanlar toplum hâlinde yaşamasalardı dile ihtiyaç duymayacaklardı. Dil olmadan insanların bir arada yaşamaları, anlaşabilmeleri ve bir topluluk oluşturmaları imkânsızdır (Aksan, 2000: 64). Dil ve toplum arasındaki bu ilişki yeni bir alan olan toplum dil bilimini ortaya çıkarmıştır. Toplum dil biliminin alanına değişik dil kullanımlarının betimlenmesi, değerlendirilmesi ve dile yansması girmektedir (İmer, 1990: 15).

Toplum bilimi

Sosyo toplumsal, *loji* ise bilimselliği ifade etmektedir (Tezcan, 2011: 1). Sosyoloji, insan davranışlarını ve ilişkilerini inceleyen, toplumsal olarak nitelendirilen tek başına olmayan insan topluluğunun belli bir grup içindeki tüm hareketlerini kapsayan, insanlar arasındaki sosyal ilişkilerin yapısını ve bu ilişkilerin nasıl ortaya çıktığını, değiştiğini incelemektedir (İçli, 2012:6). Toplum bilimi de tam olarak bir sosyal eylem bilimidir. Toplumun genel yasalarını, yasa benzeri düzenlilikleri, eğilimleri, toplumsal olgular arasındaki neden-sonuç ilişkilerini anlamaya ve tespit etmeye çalışır. Amaç, toplumun ya da toplumsal ilişkilerin bilimsel olarak incelenmesidir. Toplum bilimi kuramlarının başında *yapısalcı-işlevselci kuram* gelmektedir. Bu kuramın temel çıkış noktası biyolojidir. Organizmanın topluma aktarılmış biçimi işlevselcilik anlayışı olarak belirmektedir. Toplum bir sistem olduğu için bu sistemin her bir parçası

diğerinden etkilenir. Toplumun çeşitli parçaları tıpkı bir insanın organizması gibi birbiri ile ilişkilidir ve her biri sistemin işleyişine katkıda bulunmaktadır (Tezcan, 2011: 10). *Çalışmacı kurama* göre, köktenci bir seçenek sunarak toplumdaki ekonomik kaynaklı bölünmeleri öne çıkarmaya çalışmaktadır. Güç-eşitsizlik-mücadele sorunları bu kuramın esas sorunlarıdır. Sosyal çatışma paradigması bağlamında sosyal sınıf, kültürel kimlik, ırk ve cinsiyet gibi faktörler sebebiyle para, güç, eğitim ve sosyal prestijin nasıl dağılım gösterdiğini araştırmaktadır (Bahar, 2009: 16). *Sembolik etkileşimcilik kuramında* ise toplum bir bütün olarak şekillenmektedir. Bu yüzden daha geniş bir perspektife ve büyük resme ihtiyaç vardır. Bu yaklaşımda toplum bireylerin günlük etkileşim ürünüdür. Makro düzey sosyal yapılar bu kuramda göz ardı edilir. Kültür, sosyal sınıf, sosyal cinsiyet, ırk gibi faktörlerin toplum üzerindeki etkileri araştırılmaz (Bahar, 2009: 17). Bu üç kuram da toplum dil bilimine hizmet etmektedir.

Toplum dil bilimi

Toplumsal bir olgu olan dil, söz gibi bireysel değildir. Dil duygu ve düşüncelerin anlatımında kullanılır. Böylece bir birey kendi söz varlığını oluştururken bireylerden oluşan toplum da öz dilini kullanır. Bu oluşumda hem bireyin hem de toplumun düşünce yapısı ve kimliği görülebilir (Günay, 1995: 7). Toplum dil bilimi, dil ile toplumun kesiştiği olguları beraber ele almaktadır. Sebep-sonuç ilişkisi yanı sıra dil ile toplumun farklı boyutlarının bir araya gelmesiyle ortaya çıkan tüm olguları da incelemektedir. Bu inceleme belirli yöntemler ve bilimsel bulgular ile bir amaca hizmet etmektedir (Güven, 2012: 57). Toplum bilim ile dil bilim kavramlarının birleşimi toplum dil bilimi kavramını doğurmuştur. Dilin sosyal işlevini ele alan bu bilim dalı dilin toplum içinde nasıl değiştiğini veya değişebildiğini, bu değişimlerin ne gibi etkilerinin olduğunu açıklar. Toplumdaki bireyin toplumun içindeki değişken durumları da göz önüne alınca eğitim seviyesi, meslek, cinsiyet, yaş gibi faktörler dilin toplumsal işlevi açısından incelenmesine olanak tanır (Selen, 2001: 2). Dil yetisinin incelenmesinde işlev ve gelişim açısından gösterilen sosyal durumlar toplum biliminin sahasına girdiği için dillerin incelenme sahası da toplum dil bilimi sahasına girmektedir. Bildirişim eyleminin toplumsal değerlendirilmesi bu kapsamdadır (Vardar, 1982: 121).

Toplum Dil Biliminin Tarihçesi

Toplum dil bilimi sözcüğü ilk kez 1939 yılında Thomas C. Hodson'ın 'Sociolinguistic in India' makalesinde, dil bilim sahasında ise Eugene Nida'nın *Morphology* eserinde görülmüştür (Nazlı, 41). Toplum dil bilimi Kuzey Amerika'da konuşulan İngilizce ile zencilerin konuştuğu İngilizce arasındaki farkların eğitime olan etkisinin incelenmesiyle başlar,

Fransa'da yönetici ile işçi sınıfının dil kullanımını ve dilsel farklılıklarının tespiti ile devam eder. Almanya'da ise ülkedeki göçmen ailelerin ve eğitim gören göçmen çocukların karşılaştıkları dilsel engellerin üstesinden gelmek için toplum dil biliminin yöntemlerine başvurulur (Selen, 2001: 5-7). Toplum dil bilimi dilin anlatım işlevi ile ilgilendiği için toplumdaki bireylerin yaş, eğitim seviyesi, meslek gibi özellikleri ile bir bütünlük arz etmektedir. Bu yüzden dilsel davranış sadece sözcük dağarcığı, fonetik, morfoloji değildir bu kodların gruba özgü kullanımları da ele alınmaktadır. Bu sebeple toplum dil biliminin de çeşitli kuramları vardır. Dil bilimcileri sıklıkla kullandığı iki kuramı şöyle izah etmek mümkündür:

1. Basil Bernstein'in Eksiklik Kuramı: Bu kurama göre toplumun her katmanında kendilerine has dil kullanımları vardır. Önemli olan bu has dil kullanımlarındaki kodları çözümlenektir. Kodlar bildirişim sağlayan en önemli göstergelerdir. Çocukların okul başarısında dil katmanları önemlidir. Çünkü alt katmanı gelişmemiş bir çocuğun üst katmandaki dile hâkim olması zorlaşmaktadır. Okul gelişmiş dil kodları ile eğitimin sunulduğu bir yerdir. Halk dili de dilsel biçimi belirleyen uyarıcılarla oluşur. Halk dilinde kısa emirler, basit bildirimler ve sorular sıkça yer alır. Vurgu mantık yolu ile değil duygusallık yolu ile yapılır. Orta sınıfın dili ise daha zengin, daha karmaşık ve daha dinamiktir (İmer, 1990: 24).

2. William Labov'un Ayrılık Kuramı: Bu kuramda ölçünlü olmayan biçimlerin kullanımının çocukların mantıksal düşüncelerini yavaşlattığı ve eğitim açısından bir eksiklik doğurduğu fikrine karşı çıkmaktadır. Bu kuram, anlatım yetisi, sözcük zenginliği, ölçünlü dil kullanmayanların mantığı gibi noktalardan yola çıkarak ölçünlü olmayan İngilizcenin de kendine özgü bir dizge olduğunu ve ölçünlü dil içinde iyi veya kötü olarak bir değerlendirmenin yapılamayacağı toplumsal kullanımların varlığını kabul etmektedir. Dilsel değişimlerle, konuşurların toplumsal konumu arasındaki ilişki ve gözlemler aynı zamanda dil değişimleridir. Dil değişkenliği dil bilimsel açıklamaya dayanır. Dilsel dizgelerin nasıl ve hangi işlevlere ayrıldığı ve toplum konuşurlarının yalnız ölçünlü türlere değil bölgesel, toplumsal ve işlevsel türlere de yer verilmesine olanak sağlanması en uygun olanıdır (Kıran, 2012: 272).

Toplum dil bilim çalışma alanlarına bakıldığında dil ilişkisi, ödünç alma, çokdillilik, ikidillilik, ilişki dilleri, kreoller, geçer dil, kod değiştirimi, diyalekt, sosyolekt, dil ve eğitim, geniş ve dar kodlar, dil siyaseti, erkek ve kadın dili, dil ve kültür, dil ve düşünce, dilsel gereklilik, dilsel ve toplumsal eşitsizlik, dilsel davranışlarını sıralamak mümkündür (Güven, 2015: 20).

Toplum dil bilimi veri olarak konuşanın etnik kökenini, sosyo-ekonomik seviyesini, mesleğini ele alıp dili inceler. Aynı zamanda dinleyicinin bakış açısı da değerlendirme

kapsamına alınabilir. Toplumsal özellikler barındıran söylemler de bu bilim dalı çerçevesinde ele alınabilir. Bildirişim eyleminin gerçekleştiği koşullar ile belli bir toplumsal statüde yer alan bireylerin konuşma biçimi, eğitim seviyesine göre değiştiği için benzer ve farklı dil edinimleri bu kapsam alanında değerlendirilebilir (Rıfat, 2005: 99).

Dil türlerinin hepsi toplum dil bilimin çalışma sahasındadır. Bireysel, işlevsel ve toplumsal dil türü belirlendikten sonra belirli bir kuram çerçevesinde anket, görüşme, ses kaydı veya yazılı metinlerden yola çıkarak toplum dil bilimsel bir inceleme yapılabilir. Bireylerin dil davranışı bulunduğu topluma, zamana ve mekâna göre de ayrılıklar gösterdiği için belirlenecek olan malzemenin hangi kurama uygun olup olmadığı tespit edilmelidir.

Toplum ve dil homojen kurumlar olmayıp dil farklılıklarını yaratan etkenlerin en belirgin olanları zaman, coğrafya ve toplumsal yapı iken dil etnik özellikler, eğitim, aile, cinsiyet gibi etkenlere bağlı olarak değişkenlik gösterir (Eker, 2007: 127).

Toplum dilbiliminin ortaya çıkışında dilbilimin içinde bulunduğu çıkmazın büyük bir rolünün olduğunu savunanlar oldukça fazladır. Dil biliminde yapısalcılığın dilde toplumsal olanı reddeden bir anlayış ile kurulmuş olması onu dış gerçeklerden uzaklaştırarak soyutluğa inmesine yol açmıştır bu durum toplum dilbiliminin doğuşunu sağlamıştır (Bosnalı, 2008: 9). Her kültürün dili o toplumun kurumsallığını, eylemlerini, düşüncelerini yansıtan söz dizimi ve anlam yapıları ile kültürel ideolojilerle harmanlanarak ortaya çıkar (Büyükkantarıcıoğlu, 2006: 36). Saussure göre dil yeteneğinin hem bireysel hem de toplumsal bir yanı vardır. Ama dil ile dil yeteneği birbirinden ayrılır. Çünkü dil, dil yeteneğinin bireylerce kullanılabilmesi için toplumun benimsediği zorunlu bir uzlaşımın bütünü olarak tanımlanabilir. Dilin varlığı dolayısıyla topluluk üyeleri arasındaki bir tür sözleşmeden doğar demek mümkündür (Saussure, 1998: 37-44).

Dil, toplumun genel yaşantı ve davranış biçimleri, inanışlarıyla, çevreyi algılama şekliyle ve düşünce dünyasında yer alan tüm gelişmelerle ilgili olduğu için tüm değişikliklerden doğrudan veya dolayla etkilenebilmektedir. Bu yüzden ki herhangi bir topluluk veya bölge halkı hakkında bilgi sahibi olunabilmesi için titizlikle gerçekleştirilen bir dil incelemesi topluluk hakkında nesnel veri sunmaya yeterli olacaktır (Günay, 1995: 19). Bu yüzden toplum dilbiliminin konularına toplumsal katmanlarda yer alan dillerden hareketle bir yargıya varmak mümkündür. Ama şunu da unutmamak gerekir ki kendini ifade ediş biçimi sadece sözel bir sunum ile gerçekleşmez. Toplumsal durumlar resim, müzik, anlatı, davranışlarla da izah edilebilir.

Sonuç

Dil ile ifade edilenler toplumda meydana gelir. Bu yüzden dildeki anlam toplumun içinde belli bir sistem içerisinde ortaya çıkmaktadır. Bu duruma uzlaşım bütünü de demek mümkündür. Birey sisteme bağlıdır bu yüzden toplum dilbilim incelemesi yaparken göstergebilimden yararlanmak kaçınılmazdır. Toplumda yer alan her kodda bir ileti gizlidir. Bu yüzden toplum dilbilimsel bir inceleme yapılırken mutlaka göstergebilimden yararlanmak gerekir. Gösterenler, göstergeler ve gönderge sisteminde yer alan her kod toplum dil bilimsel analiz ile yoğrulur. Yapılandırılmış bir düzen içerisinde gösterilen her varlık toplum dil biliminin bir malzemesidir. Ele alınan konunun malzemesine göre uygun bir kuram tercih edilecek olsa bile göstergebilim olmadan iletiler tam olarak çözülemeyeceği için göstergebilimden mutlaka yararlanmak gerekecektir.

Kaynakça

- Aksan, D. (2000). *Her Yönüyle Dil Ana Çizgileriyle Dilbilim*, Türk Dil Kurumu Yayınları, Ankara.
- Bahar, H. İ. (2009). *Sosyoloji*, 3. Baskı, Uluslararası Stratejik Araştırmalar Kurumu Yayınları, Ankara.
- Büyükkantarcıoğlu, N. (2006). *Toplumsal Gerçeklik ve Dil*, İstanbul: Multilingual Yayınları.
- Bosnalı, S. (2008). *Toplumdilbilim: Disiplinler Arası (Özerk) Bir Alan*, Dil Haber, Sayı 2, s. 9,
- Eker, S. (2007). "Toplum-dilbilim, Dil Planlamaları ve Kamu Mensuplarının Dil Kullanımı", *Gazi Türkiyat*, 1, 127-135.
- Günay, D. V. (1995). "Roman Çözümlemesine Toplumdilbilimsel Bir Yaklaşım", *Dil Dergisi AÜ TÖMER Yayınları*, 35, s. 5-24.
- Güven, A., (2012). "Toplumsal Dilbilimin Kapsam Alanı", *Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 13, s. 55-62.
- Güven, A. (2015). *Türkiye'de Günümüze Kadar Yapılmış Toplumsal Dil Bilim Çalışmaları*, (Yayımlanmamış Yüksek Lisans Tezi), Pamukkale Üniversitesi Eğitim Bilimleri Enstitüsü, Denizli.
- İçli, G. (2012). *Sosyolojiye Giriş*, 6. Baskı, Anı Yayıncılık, Ankara.
- İmer, K. (1990). *Dil ve Toplum*, Gündoğan Yayınları, Ankara.
- Kıran, Z. (2012). Eziler Kıran, A., *Dilbilime Giriş*, Seçkin Yayınları, Ankara.
- Marshall, G. (2009). *Sosyoloji Sözlüğü*, çev. Osman Akınhay-Derya Kömürcü, Bilim Sanat Yayınları, Ankara.
- Nazlı, E. H. (2016). "Toplumdilbilime Genel Bir Bakış", *Sosyal Bilimler Araştırma Dergisi*, XIV/28, s. 37-66.
- Rifat, M. (2005). *XX. Yüzyılda Dilbilim ve Göstergebilim Kuramları 1. Tarihçe ve Eleştirel Düşünceler*, 3. Baskı, Yapı Kredi Yayınları, İstanbul.
- Saussure, F. (1998). *Genel Dilbilim Dersleri*, çev. Berke Vardar, Multilingual Yayınları, İstanbul.
- Selen, N. (2001). *Toplumsal Dilbilime Giriş*, 2. Baskı, Anadolu Üniversitesi Yayınları, Eskişehir.
- Tezcan, M. (2011). *Sosyolojiye Giriş*, 6. Baskı, Anı Yayıncılık, Ankara.
- Vardar, B. (1982). *Dilbilimin Temel Kavram ve İlkeleri*, TDK Yayınları, Ankara.
- Yıldız, T. (2014). "Saussure'den Bakhtin'e Dil-Kültür İlişkisi: Tümü Kapsayıcı Olgu", *İdil Sanat ve Dil Dergisi*, III/11, s. 115-136.

**DETERMINING CRITICAL SUCCESS FACTORS OF GREEN SUPPLY CHAIN
MANAGEMENT PRACTICE**

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ABSTRACT

Supply chain management (SCM) is the management of the flow of goods, data, and finances related to a product or service, from the procurement of raw materials to the delivery of the product at its final destination. Managing this process effectively and efficiently plays a very important part in the business's success. Nowadays various supply chain activities contribute to growing environmental issues, forcing industries to move towards socially responsible green supply chain management (GSCM) practices. Environmental sustainability and green attention have been becoming increasingly popular among all stakeholders such as researchers, practitioners, and other business environments. Rising environmental issues have pushed industries towards becoming socially responsible for GSCM practices. In addition, business entities receive huge pressure to oblige green solutions in their operations for several reasons mainly for profitability and being eco-friendly. For this reason, implementation of GSCM might be considered a compulsory process for effective business management to become much more successful in business operations. Converting into green supply chain management takes too much effort and investment for a business. The aim of the study is to emerge critical success factors (CSF) in the management of the green supply chain. In this respect, the systematic literature review will be performed in order to reveal the critical success factors for green supply chain management that the enterprises will encounter in the green supply chain management program. CSFs are grouped by categories top management commitment, technology and digitalization, government regulation and standards, and organizational adaptation This work will not be specific to any type of business. For this reason, the results of the study could be implemented in all kinds of businesses that want to transform the supply chain process into green supply chain management.

Keywords: Supply chain management, green supply chain management, critical success factors, literature review

Introduction

The main importance of green supply chain management (GSCM) lies at the heart of human print on the planet. These impacts vary according to the operations of a business. Many business implications put a heavy burden on increasing environmental concerns. One of the major positive effects of GSCM is to decrease those pressures by applying green solutions. In this perspective, GSCM has a promising business venture for business operations, by changing the operations of the business decreases the carbon print of business on the planet and gets appreciation from all stakeholders as well as environmentalists in addition to being a lucrative business organization.

A set of managerial procedures known as "sustainable supply chain management" is defined as including all of the following: minimizing urgent environmental impact; taking into account all processes along the complete value chain for each product; and a multidisciplinary strategy that considers a product's complete lifecycle (Erdem, 2022).

Growing environmental and social issues have generally resulted from various supply chain activities, forcing businesses to keep forward on the way to socially responsible green supply chain management applies. Environmental sustainability and green attention have become increasingly popular among researchers and practitioners in business organizations. Various activities causing severe environmental and social issues such as waste and emission enforce industries to be responsible for GSCM practices. In this respect, industries are being scrutinized and getting more attention for the integration of green practices from all aspects into traditional supply chain management. Green Supply Chain Management is to be consist of life cycle of product as well as sourcing, selection, design of material and product, while managing delivery of end product and disposition process. Business whose aim is to create profit and having competitive image in the market can make use of GSCM for their strategic aim in order to achieve their organizational purposes. Organizations might have some goals, such as improving brand image, competitiveness, optimal use of resources, better customer service, environmental and socially accepted image, improved effectiveness, and many more. Organizations use, different business strategies to achieve these goals. GSCM can be logically good for the stabilization of ecological, economic, and social benefits and it came into life as a game changer strategic tool for business organizations to become more environmentally friendly, and to spend money more efficiently and competitively way (Luthra et al., 2015).

In order to increase productivity and profitability, green supply chain management (GSCM) integrates sustainability concerns into manufacturing, procurement, supply and

distribution, sales, and related areas. Environmental activities are incorporated into GSCM practices to guarantee eco-friendly goods or services and to lower costs throughout its value chain. In order to achieve GSCM waste minimization activities, various practices that are applied through the numerous application such as remanufacturing, reducing, reworking, refurbishing, reclaiming, recycling, reusing, etc. must be created or controlled. This includes the implementation and monitoring of environmental management programs. GSCM is a coordinated supply network that takes environmental concerns into account. Green supply chain management (GSCM) incorporates sustainability considerations into business applications such as procurement, sales, manufacturing, supply, distribution, and the other associated areas in order to boost productivity and profitability. GSCM practices integrate environmental activities to ensure eco-friendly products or services and to reduce costs across its value chain. Many green practices implemented through the several green activities such as remanufacturing, reducing, reworking, refurbishing, reclaiming, recycling, reusing, etc. must be developed or controlled in order to accomplish GSCM waste minimization activities. Environmental management initiatives are implemented and monitored in this. A coordinated delivery network that considers environmental issues is known as GSCM. At first, supply chain management was primarily concerned with incorporating sustainability problems such as green production, green distribution, and green marketing to improve the environment. To increase environmental and social welfare, supply chain management (GSCM) now includes a variety of sustainability issues, including green production, green distribution, and green marketing. Initially, GSCM primarily concentrated on green logistical issues (Nekmahmud et al., 2020).

According to Grimm et al. (2014), the three pillars of sustainable development economic, environmental, and centered on the requirements of customers and stakeholders have given rise to the social concept of sustainable supply chain management (SSCM). In addition, the goal of SSCM is to link environmental operations with finance, strategy, policy, product design, supplier relations, and post-consumer product management in a way that benefits all parties. (Panjehfouladgaran & Bahiraie, 2014).

The main importance of this study is to describe critical success factors according to literature. In literature, success factors described based on industry and research area but general descriptive success factors constitute gap in literature. Clustering main critical success factors in literature is considered to be helpful to bridge gap in this sense.

Methodology

The qualitative research method is employed in this study by combing through the literature review. In this respect, systematic literature screening is performed in order to reveal the critical success factors that enterprises might encounter in the green supply chain management program. Systematic literature screening is performed as follows:

- Planning of literature review research
- Conducting literature review research
- Analyzing and reporting data

As the very first step database research has been conducted via Ankara Yıldırım Beyazıt University Database, Science Direct, Springer, and YOK which is higher education institution web page for dissertations' full-text access in Türkiye. In research, green supply chain management, critical success factors of green supply chain management have been used as keywords. For the keyword 'Critical Success Factors of Green Supply Chain Management' nothing has been found as dissertation in Türkiye's Higher Institution online database and research has been extended to other keywords as 'Green Supply Chain Management' than 25 study has been identified. On the other hand, for the research 'Critical Success Factors of Green Supply Chain Management' 579 articles are found in Ankara Yıldırım Beyazıt University Database, Science Direct, Springer as total. Related studies which are open to free access are eliminated carefully and most related articles are sorted out accordingly key words and subject field to screen critical success factors in GSCM. After this careful examination 29 articles and 12 dissertation study refined to be investigated along with research question. Among those studies, 12 articles have been considered as the most related studies to be used in this study for the elimination of critical success factors for GSCM.

Findings

After careful examination of studies, critical success factors standing out from the literature were refined and cross-references were sorted out accordingly. By combing through the literature, the critical success factors that have been found in research are grouped under 4 main topics to define critical success factors in GSCM with a holistic approach. These are top management commitment, technology–digitalization, government regulations-standards, and organizational adaptation.

Top management commitment

Top management commitment does have the most crucial priority among CSFs, which is playing a significant part in the implementation of sustainable GSCM. The choices made by

the company's top management team allow it to adapt to changes in demands as well as discontinuous changes in competitors, technology, and regulatory requirements. The top management team frequently creates a board or management group to address environmental issues as part of sustainable GSCM activities, which demonstrates their commitment to stewardship. Therefore, top management's commitment to the environment is likely to encourage the company to develop skills in green manufacturing and product design (Agrawal et al., 2022).

Organizational factors among critical factors have the biggest impact on success factors for the implementation of GSCM. Among the organizational factors, the most significant factor is top management's commitment to creating a favorable business environment and leading role in GSCM (Prasad et al., 2018).

To guarantee awareness, comprehension, and obligation for the implementation of environmental strategy and corporate policy throughout the organization, senior management support and leadership are essential. It is important to offer tools and financial assistance. Environmental concerns should be included in strategic planning, the company should work on environmental initiatives, and expertise should be valued as a key organizational resource. The success of GSCM initiatives depends on senior management's dedication. For effective supplier management, people must be educated, trained, and made aware of environmental problems, environmental audits, the necessity of an ERP (Enterprise Management System) and certifications (Chiappetta Jabbour et al., 2017).

Technology and digitalization

One of the most significant impacts of technological advancements on businesses is thought to be digitalization. The process of integrating digital technologies into business operations in order to alter business procedures, open up new revenue-generating possibilities, and so forth is known as digitization. Therefore, digitalization is a socio-technical process that is used in harmony by people, groups, and societies. It is not just the digitization of transactions (Erdem, 2022).

IT implications are a crucial part of supply chain management activities since they might improve hugely SCM activities. Efficient, accurate, integrated, cost-effective, real-time communication ability, transparent, reliable, quality, and automation systems are some effective parts of IT applications on GSCM. Companies' competitive edge or ability to compete against other companies will be greatly impacted by their adoption of IT in accordance with

requirements. The biggest opportunity for developing and accumulating extensive knowledge about current clients, suppliers, and market demand is offered by SCM IT implementation (Fernando, 2018).

Government regulations and standards

According to institutional theory, companies are driven to take strategic action by outside pressures. Governmental organizations, laws, important customers and suppliers, rivals, trade associations, special interest groups, and the media are examples of external stakeholders who put pressure on supply chains to be more responsible. These outside constraints encourage companies to adopt a supply chain strategy that is sustainable. External influences come in three forms: normative (market), derivative (competitive), and coercive (regulatory). The most crucial force behind environmental efforts among manufacturing firms is coercive pressure, which is defined as conformity brought about by influence from those in authority. Practically speaking, government agencies have the power to sway an organization's behavior by implementing environmental regulations (Prasad et al., 2018).

It has been determined that the organizational element has the greatest impact on GSCM adoption. By raising labor productivity and business social responsibility, it can encourage the adoption of GSCM. The involvement of the government is also equally crucial. In order to guarantee that businesses undergo a green transformation, the government should increase support for SMEs by providing the necessary finance and technology as well as by developing pertinent policies and regulations. Additionally, increasing product services and design, lowering operating costs, establishing an enterprise's green brand image, and creating a good business environment and enterprise cooperation can all successfully contribute to the green transformation of enterprises (Lin et al., n.d.,2022).

Organizational adaptation

According to Leyh and Thomschke (2015), some critical success factors are management change, user training, project management, clear goals and objectives, communication, organizational structure, business process reengineering, troubleshooting, knowledge management, project champion, and vendor tools and implementation methods (Leyh & Thomschke, 2015). These factors could be described under the organizational adaptation of GSCM since these are directly related to the organizational adaptation of GSCM. Patil and Kant (2013) also highlighted "*the direct participation of staff to help SC fulfill its mission and meet its objectives by applying their own ideas, expertise and efforts toward solving*

problems and making decisions” in their study to define CSF in SCM (Patil & Kant, 2014). In conclusion, organizational adaptation for GSCM includes a range of success factors such as employee involvement, training, business culture, collaboration, and communication.

Conclusion

In this study, critical success factors, which are important for businesses that will implement the green computing program, were determined as a result of the literature study. These critical success factors are grouped under 4 main headings. It is seen that critical success factors of green supply chain management are top management commitment, technology–digitalization, government regulations-standards, and organizational adaptation.

In the generic concept, CSFs are grouped by internal and external factors (Alhamali, 2019). When it is broken down into categories, it differentiates according to business needs and future expectations. Among the critical success factors, top management commitment stands out as a vitally important factor, since it affects everything in the adaptation of GSCM. As a leading factor, it seems to have an influence on other factors to have them successfully implemented. From the financial decisions to technological adaptations, GSCM takes many steps to be implemented, in this respect, top management commitment seems compulsory as a necessary factor to be taken essential steps.

Technological improvement is another essential means of business operations for GSCM. This aspect is closely related to organizational adaptation. As an umbrella term organizational adaptation includes many activities happening in this quest. Changing the business culture in the organization, training employees, and creating collaborative communication skills in the business environment could be taken as the main objectives. Another driving factor in GSCM is government regulations and standards. It is essentially important as a driving factor for the adaptation of GSCM. Decision-makers need to have their organizations complied these regulations and standards. It coerces business owners to take green applications decision.

In this study CSFs are grouped by categories of top management commitment, technology and digitalization, government regulation standards, and organizational adaptation, there are many sub-factors for CSFs though. Many sub-factors belong to these groups, although many of them delineate according to different business branches. Organizational adaptation covers business features. This aspect might be described as overarching for a number of

business implications such as employee involvement, organizational education and business culture.

Every study has some limitations, but this study's first and major limitation is to reside on a literature review. This study is limited to a literature review. For future studies, researchers can conduct interviews with managers or use online surveys to employees to reveal and examine the CSF of the GSCM program.

References

- Agrawal, V., Mohanty, R. P., Agarwal, S., Dixit, J. K., & Agrawal, A. M. (2022). Analyzing critical success factors for sustainable green supply chain management. *Environment, Development and Sustainability*.
- Alhamali, R. M. (2019). Critical success factors for green supply chain management practices: An empirical study on data collected from food processing companies in Saudi Arabia. *African Journal of Business Management*, 13(5), 160–167.
- Chiappetta Jabbour, C. J., Mauricio, A. L., & de Sousa Jabbour, A. B. L. (2017). Critical success factors and green supply chain management proactivity: shedding light on the human aspects of this relationship based on cases from the Brazilian industry. *Production Planning and Control*, 28(6–8), 671–683.
- Erdem, M. B. (2022). Comparative Assessment Of Critical Success Factors In Sustainable Supply Chain Management From A Traditional And Digital Perspective. *Nevşehir Hacı Bektaş Veli Üniversitesi SBE*
- Fernando, E. M. W. H. K. R. A. E. (2018). Critical success factor of Information Technology Implementation of Supply Chain Management.
- Leyh, C., & Thomschke, J. (2015). Critical success factors for implementing supply chain management systems - The perspective of selected German enterprises: Full paper. *Proceedings of the 2015 Federated Conference on Computer Science and Information Systems, FedCSIS 2015*, 1403–1413.
- Lin, C.-L., Tseng, M. L., & Zhou, Y. (n.d.). Critical success factors for adopting green supply chain management and clean innovation technology in the small and medium-sized enterprises: A structural equation modeling approach.
- Luthra, S., Garg, D., & Haleem, A. (2015). An analysis of interactions among critical success factors to implement green supply chain management towards sustainability: An Indian perspective. *Resources Policy*, 46, 37–50.
- Nekmahmud, M., Rahman, S., Sobhani, F. A., Olejniczak-Szuster, K., & Fekete-Farkas, M. (2020). A systematic literature review on development of green supply chain management. *Polish Journal of Management Studies*, 22(1), 351–370.
- Panjehfouladgaran, H., & Bahiraie, N. (2014). Role of Critical Success Factors in Sustainable Supply Chain Management. In *Journal of Applied Research on Industrial Engineering* (Vol. 1, Issue 5).
- Patil, S. K., & Kant, R. (2014). Knowledge management adoption in supply chain: Identifying critical success factors using fuzzy DEMATEL approach. *Journal of Modelling in Management*, 9(2), 160–178.
- Prasad, D. S., Pradhan, R. P., Gaurav, K., Chatterjee, P. P., Kaur, I., Dash, S., & Nayak, S. (2018). Analysing the critical success factors for implementation of sustainable supply chain management: An Indian case study. *Decision*, 45(1), 3–25.

**MİNERAL VE FARKLI SENTETİK BAZ YAĞLAR İLE HAZIRLANAN KALSİYUM
SÜLFONAT KOMPLEKS GRESLERİN TRİBOLOJİK ÖZELLİKLERİNİN
İNCELENMESİ**

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ÖZET

Sentetik baz yağlar, greslere aşınma, düşük sıcaklık performansı, termal ve oksidatif stabilite gibi istenen özellikleri kazandırmak için mineral baz yağlara alternatif olarak kullanılmaktadır. Bu çalışmada mineral baz yağlarla hazırlanan kalsiyum sülfonat kompleks gresi (CSX), polialfaolefin (PAO) ve yağ asidi esteri gibi sentetik baz yağlar kullanılarak da üretilmiş ve tribolojik özellikleri incelenmiştir. Kullanılan baz yağların viskoziteleri ISO VG 100'e ayarlanarak NLGI sınıfı 1,5 olan gresler elde edildi. Yapılan deneysel çalışmalar, greslerin düşük sıcaklıktaki pompalanabilirlik performansının bir ölçüsü olan soğuk akış basıncı değerinin, sentetik baz yağlarla hazırlanan greslerde daha iyi olduğu tespit görülmüştür. Ayrıca sentetik baz yağlarla hazırlanan greslerin aşınma izi çaplarının, mineral baz yağlarla hazırlanan greslere göre oldukça düşük olduğu tespit edilmiştir. Buna ek olarak da 4-bilya aşınma çapları ölçülen bu greslerin metal bilyelerdeki aşınma izleri üç boyutlu mikroskop altında incelenmiş ve derinlik ölçümleri yapılmıştır.

Anahtar Kelimeler: Yağlayıcı, gres, triboloji, soğuk akış basıncı, sentetik baz yağlar

**INVESTIGATION OF THE TRIBOLOGICAL PROPERTIES OF CALCIUM
SULFONATE COMPLEX GREASE PREPARED WITH MINERAL AND
DIFFERENT SYNTHETIC BASE OILS**

ABSTRACT

Synthetic base oils are used as an alternative to mineral base oils in order to impart desired properties such as wear, low temperature performance, thermal and oxidative stability to greases. In this study, calcium sulfonate complex grease (CSX) prepared with mineral base oils was also produced using synthetic base oils such as polyalphaolefin (PAO) and fatty acid ester, and their tribological properties were investigated. The viscosity of the base oils used was adjusted to ISO VG 100 and NLGI 1,5 grade greases were obtained. Experimental studies have shown that the cold flow pressure value, which is a measurement of the pumpability performance of greases in cold weather, are better in greases prepared with synthetic base oils. In addition, it has been determined that the wear scar diameters of the greases prepared with synthetic base oils are significantly lower than the greases prepared with mineral base oils. In addition, the wear scars on the metal balls of these greases, of which 4-ball wear diameters were measured, were examined under a three-dimensional microscope and depth measurements were made.

Keywords: Lubrication, grease, tribology, cold flow pressure, synthetic base oils.

1. INTRODUCTION

Lubricating greases are still the most widely used lubricants that reduce friction between surfaces and moving parts and remove heat surfaces in practical mechanical systems like bearings or gears.

Greases can be classified in many ways according to their consistency, thickener type (soap and non-soap) and base oil viscosity grade. Lubricating greases consist of three main components: thickeners, oils and performance enhancing additives. Thickeners which occur from saponification reactions of metal hydroxides with fatty acids are 3%-35%, base oils are 65-95% and additives are 0-10% of grease (Mackwook, 2016).

Grease Base oils, which are the main components of the greases can be any type from Groups I-V. Most are made from Group I and II, but there are many greases made with synthetic oils from Groups III, IV and V like polyalphaolefin (PAO), natural and synthetic esters.

In recent years, calcium sulfonate complex greases started to attract the attention of the grease industry by its comprehensive, excellent performance such as high temperature performance, mechanical stability, colloidal stability, extreme pressure and anti-wear performance, water resistance and excellent corrosion resistance. It features excellent rust and wear protection, a high dropping point and excellent mechanical stability even in the presence of water with their thickening structure. Unlike other grease types, these performance characteristics are achieved without the use of any additional raw materials (Acar, 2021; Bjornstad, 2016; Jiwei, Shutian, Wei, and Baojie, 2018; Lorimor-Kay, 2017).

Another reason why calcium sulfonate greases have become more preferred in recent years is their low cost and the fact that the raw material source such as lithium is not limited and easily available. Calcium sulfonate complex-based greases have wide range of application areas such as iron and steel industry, marine and paper mills, off-road, harbor facilities, construction and mining equipment and even in the food processing industry (Acar, 2021).

Çınar and Karaaslan carried out cold flow pressure measurements of different types of greases such as calcium, lithium, lithium-calcium, polyurea, calcium sulfonate complex greases at -20 degrees to investigate the effect of grease thickener and base oil type on low temperature fluidity of grease. As a result, they have reported that both thickener type and base oil type effect the cold flow properties of greases and they determined that especially complex greases have high cold flow pressure (Çınar and Karaaslan, 2021).

Ağtoprak and Karaaslan also investigated the effect of base oil type on low temperature fluidity of lithium-based thickener type. They have reported that lithium soap grease prepared

with PAO type base oil showed lowest flow pressure than naphthenic and paraffinic type base oil (Ağtoprak and Karaaslan, 2022).

Razak and Ahmad examined the tribological properties of complex calcium soap grease using with palm ester type base oil. They have found that palm ester-based complex calcium grease demonstrated good friction-reducing and anti-wear properties comparing to the commercial greases (Razak and Ahmad, 2021).

Jain and Krishnaswamy studied water spray-off resistance of simple lithium soap grease, lithium/calcium mixed soap grease, lithium complex grease and calcium sulfonate complex grease. They have detected that calcium sulfonate complex grease has the highest water spray-off resistant properties than the others due to having over based calcium sulfonate used for making complex calcium structure (Jain and Krishnaswamy).

2. MATERIALS AND METHOD

Within the scope of this study mineral base oil, polyalphaolefin (PAO) and fatty acid ester based NLGI 1,5 grade calcium sulfonate complex greases were prepared in laboratory scale grease reactor. The base oil viscosity of these greases was adjusted to ISO VG 100.



Ester Based

PAO Based

Mineral Oil Based

Figure 1: The Appearance of Calcium Sulfonate Complex Greases Prepared with Laboratory Grease Reactor

HERZOG branded kinematic viscosity instrument was used to measure the kinematic viscosity of base oils at 40°C and 100°C. Properties of base oils used to prepare grease formulations in this study were given in Table 1.

Table 1: Base Oil Properties

Technical Properties	Mineral Base Oil	Ester Base Oil	PAO Base Oil
Kinematic Viscosity at 40°C, mm ² /s	100	100	100
Kinematic Viscosity at 100°C, mm ² /s	10,9	18,36	16,95
Viscosity Index	92	204	185
Flash Point, °C	270	254	240
Pour Point, °C	-9	-39	-52

The worked penetration measurements of the greases were made according to ASTM D 217 at 25°C by using HERZOG branded penetrometer. Before the measurement, greases were worked at 60 strokes by using a mechanical grease worker.

Cold flow pressure measurements were done with MINITEST-FFK equipment according to DIN 51805 (Kesternich Technique) method at -30°C. The pressure value at which the grease exits the nozzle gives the pressure value required for the grease to flow at the selected temperature.

The wear preventive characteristics of the greases was tested with 4-ball and SRV test instrument. For this measurements, Optimol brand and SRV 4 System model SRV test instrument according to ASTM D 5707 method and Stanhope Seta-Shell 4-ball test instrument according to ASTM D 2266 method were used.

SRV wear measurements were done at a load of 200 N, 50°C temperature, 50 Hz frequency, 1 mm stroke amplitude for 2 hours.

The wear preventive characteristics of the greases with 4-ball test machine were tested at a load of 40 kgf, 75°C temperature, 1200 rpm for 60 minutes.

The 4-ball tester was also used in this study to determine the extreme pressure properties (EP) of these greases. Measurements were done according to the ASTM D 4172 method. Test conditions are 600 kgf, 1760 rpm for 10 seconds.

The depth of wear scar of greases on metal ball surface obtained from 4-ball test instrument were examined with a 3D microscope. Measurements were made with Olympus brand and DSX model 3D microscope.

The resistance of greases to water spray-off test was performed with grease coated on a stainless-steel panel and sprayed with a water at 38±0,5°C temperature and 40±1 psi pressure according to the ASTM D 4049 with Koehler brand spray-off tester.

3. RESULTS AND DISCUSSION

In this study, we have examined calcium sulfonate complex greases with mineral oil, PAO and ester-based CSX greases and discussed the results of the experiments. The studies were carried out by measuring the worked penetration of the greases with penetrometer after 60 strokes at 25°C. As it seen on Table 2, NLGI class 1.5 greases were obtained.

Table 2: Worked Penetration Results of CSX Greases

Greases	Base Oil Viscosity (40°C, cSt)	Worked Penetration (0.1mm)	NLGI Class
CSX Grease (Ester Based)	100	308	1.5
CSX Grease (PAO Based)	100	298	1.5
CSX Grease (Mineral Oil Based)	100	309	1.5

As it seen on Table 3, dropping points of the greases were found >300°C. These results show that the saponification reaction of the greases was occurred efficiently.

Table 3: Dropping Point Results of CSX Greases

Greases	Dropping Point (°C)
CSX Grease (Ester Based)	> 300
CSX Grease (PAO Based)	> 300
CSX Grease (Mineral Oil Based)	> 300

Table 4 shows the cold flow pressure results of calcium sulfonate complex greases prepared with different base oils. It was found that mineral oil-based CSX grease gave the highest flow pressure value with a result of 1920 hPa. Also, it was determined that CSX greases prepared with synthetic base oils (ester and PAO) gave the similar result.

Table 4: Cold Flow Pressure Results of CSX Greases

Greases	Cold Flow Pressure Properties (FFK) (-30°C, hPa)
CSX Grease (Ester Based)	600
CSX Grease (PAO Based)	660
CSX Grease (Mineral Oil Based)	1920

On Table 5, according to the water spray-off results of these greases, it was determined that % loss of ester based and PAO based CSX greases were found similar and lower value than mineral-based CSX grease. Also, it was detected that mineral oil-based CSX grease gave the lowest water spray-off resistance with high % loss.



Figure 2: Appearance of Ester Based CSX After Water Spray-Off resistance Test



Figure 3: Appearance of PAO Based CSX After Water Spray-Off resistance Test



Figure 4: Appearance of Mineral Oil Based CSX After Water Spray-Off resistance Test

Table 5: Water Spray-Off Resistance of CSX Greases

Greases	Water Spray-Off (% loss)
CSX Grease (Ester Based)	23,35
CSX Grease (PAO Based)	25,9
CSX Grease (Mineral Oil Based)	42,68

According to the 4-ball weld load results given on Table 6, extreme pressure (EP) performance of these greases was found to be excellent with a result of > 600 kgf.

Table 6: Four Ball Weld Load Results of CSX Greases

Greases	Four Ball Weld Load (kgf)
CSX Grease (Ester Based)	> 600
CSX Grease (PAO Based)	> 600
CSX Grease (Mineral Oil Based)	> 600

As it seen in Table 7, as it seen in Table 8, although the wear scar diameters of all the greases were found close to each other, it was determined that the wear scar diameter of the mineral oil-based CSX grease is relatively high and the PAO-based CSX grease has the lowest wear scar diameter.

Table 7: Four Ball Wear Scar Diameter Results of CSX Greases

Greases	Four Ball Wear Scar Diameter (40 N, 1 hour, 75°C, mm)
CSX Grease (Ester Based)	0,361
CSX Grease (PAO Based)	0,348
CSX Grease (Mineral Oil Based)	0,368

According to SRV wear scar results given in Table 8, it was determined that the wear scar diameter of the mineral-based CSX grease is the highest than the others.

Table 8: SRV Wear Scar Diameter Results of CSX Greases

Greases	SRV Wear Scar Diameter (200 N, 2 hour, 50°C, mm)
CSX Grease (Ester Based)	0,358
CSX Grease (PAO Based)	0,366
CSX Grease (Mineral Oil Based)	0,389

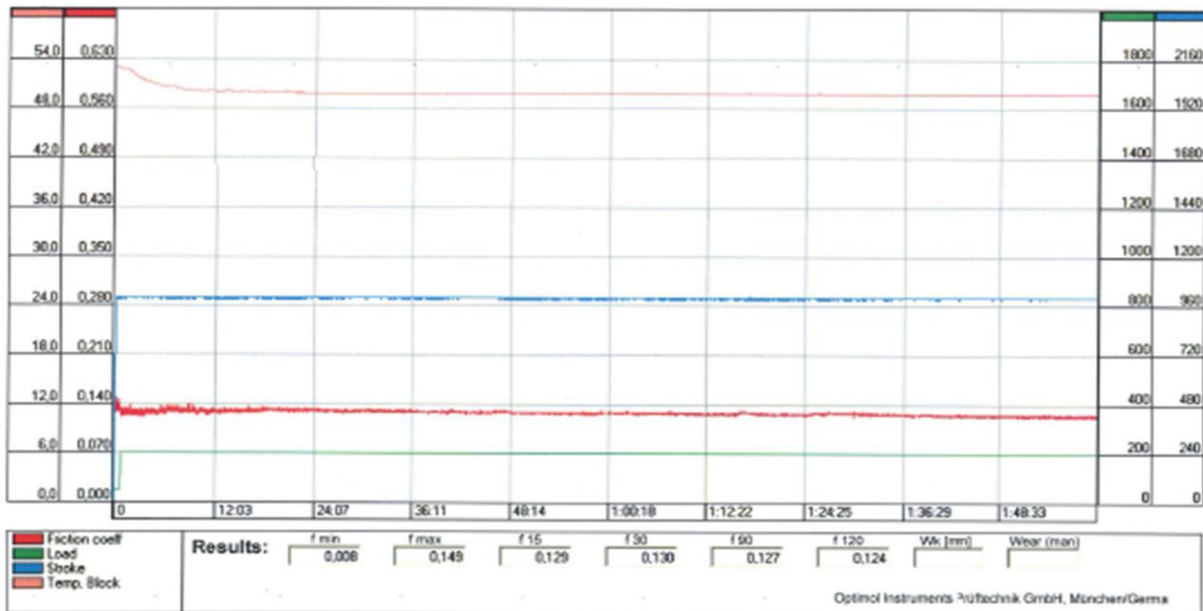


Figure 5: An Example of SRV Friction Test Result of Ester-Based CSX Grease

According to SRV friction test results of these greases given on Table 9, it was determined that PAO and ester-based CSX greases gave the same and lower friction coefficient result, than

mineral oil-based CSX. Figure 5 shows an example of friction test result graphic of ester-based CSX grease.

Table 9: SRV Friction Test Results of CSX Greases

Greases	f min	f max	Friction Coefficient
CSX Grease (Ester Based)	0,008	0,149	0,124
CSX Grease (PAO Based)	0,006	0,171	0,123
CSX Grease (Mineral Oil Based)	0,012	0,170	0,130

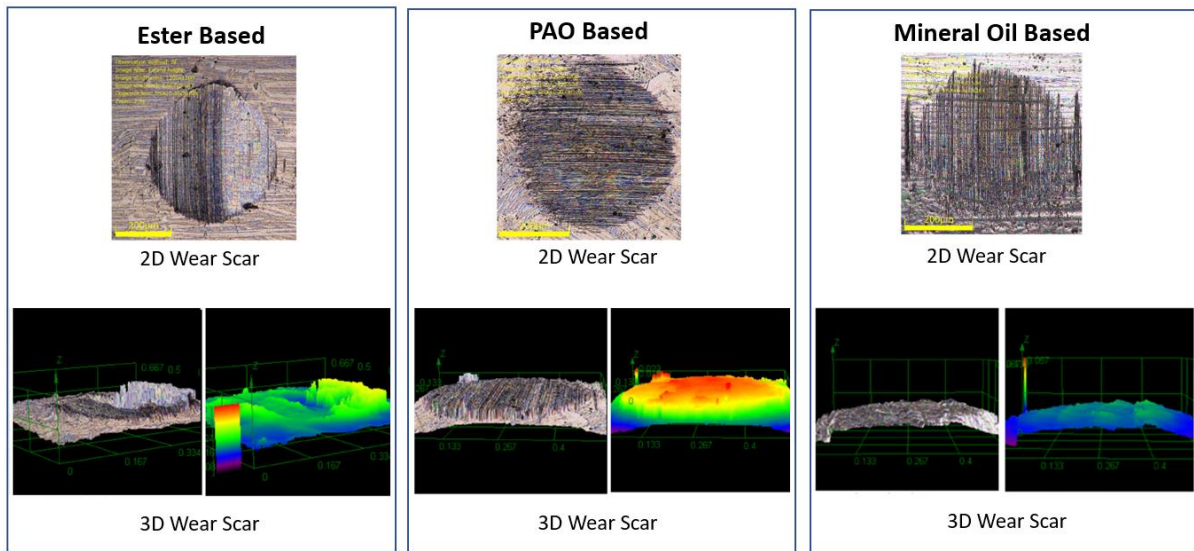


Figure 6: 4-Ball Wear Scar Microscope Images

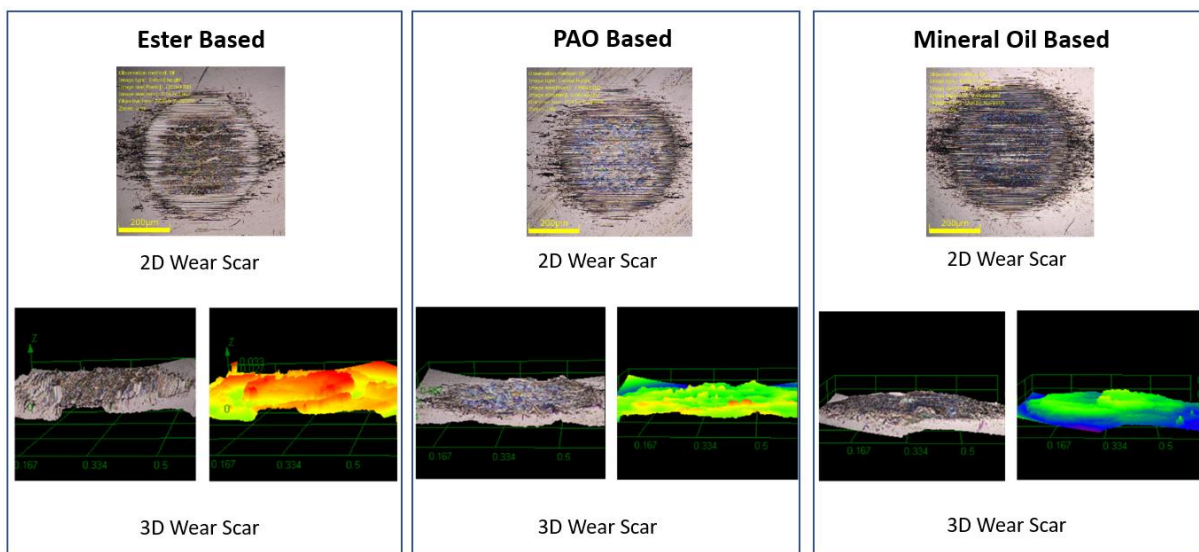


Figure 7: SRV Wear Scar Microscope Images

The 3D microscope allows detailed 2-dimensional and 3-dimensional observation of the wear scars of CSX greases on the metal ball surfaces measured by 4-ball and SRV test machine. It also gives colorful image of 3D wear scar. Figure 6 and 7 show 2D and 3D microscope images of 4-ball and SRV wear scars of ester, PAO and mineral oil-based CSX greases on metal ball surfaces. According to the 3D image analysis, it was observed that mineral oil-based CSX grease has the highest wear value than synthetic greases.

4. CONCLUSION

To summarize this study, calcium sulfonate complex grease (CSX) was prepared with mineral, PAO and ester type base oil with same base oil viscosity and NLGI class. Then, their tribological properties were examined.

When the physical appearances of the greases are examined, it has been observed that the color of the CSX grease made with ester is lighter and brighter than the others.

According to the results of this study, mineral oil-based CSX grease gave the highest flow pressure value at -30°C . The reason of these results is about the differences of molecular structure of synthetic and mineral base oils. Because of not having any wax content, synthetic base oils have low pour point value and as a result of this, their cold flow pressure is better.

According to the friction test results made with 4-ball and SRV device, it was determined that the wear scar diameter and friction coefficient of the mineral oil based CSX grease was higher than the CSX grease made with synthetic base oils, but no significant difference was detected between them. The reason for this is about calcium content and structure of calcium sulfonate complex besides high EP properties of these greases and, consequently, the high film strength.

Also weld load test results found higher than 600 kgf support this conclusion.

The lowest water spray-off resistance was obtained from mineral oil-based CSX grease.

PAO and ester-based CSX greases were found close to each other and better than mineral oil-based CSX grease. The reason of these results is related with base oil's molecular structure. Synthetic base oils have smooth molecular structure than mineral base oils so they remove more difficult from the surface. Regardless of the type of base oil used, it has been determined that the reason for the high dropping point of greases is due to the grease's own structure.

At the end of the this research, it was detected that calcium sulfonate complex greases prepared with synthetic base oils show excellent water resistance, good low temperature pumpability and tribological properties.

REFERENCES

- Acar, E. (2021). Calcium sulfonate complex greases in the iron and steel industry, Retrieved from <https://lubricant-world.com/en/calcium-sulfonate-complex-greases-in-the-iron-and-steel-industry/>. 14 April 2023.
- Ağtoprak, K. and Karaaslan, U., (2022). Effect Of Base Oil Type On Grease Flow Pressure Behavior, *IENSCI International Conference on Engineering Sciencess*, Baku, November 12-13, 227-286.
- Bjornstad, E. (2016). Lithium Complex vs. Calcium Sulfonate Grease – The Workhorses of the Industry, Retrieved from <https://www.bellperformance.com/bell-performs-blog/lithium-complex-vs.-calcium-sulfonate-grease-the-workhorses-of-the-industry>. 14 April 2023.
- Çınar, N. and Karaaslan, U., (2021). Low temperature fluidity properties of lubricating greases and the effect of pour point additive on grease fluidity, *Ispec International Congress On Multidisciplinary Studies*, Adana, November 12-13, 219-236.
- Jain, A.K., and Krishnaswamy, C.S. Water Resistance Property of Greases – An Outlook, Hindustan Petroleum Corporation Limited, R&D Centre.
- Jiwei, L., Shutian, C., Wei, Z., & Baojie, W. (2018, April). The Typical Application of Calcium Sulfonate Complex Greases in Steel Mills, *NLGI Spokesman*, 1-11.
- Lorimor, J. J., Kay, J. S. (2017, June). *The STRATCO® Contactor™ reactor and its use in the production of calcium sulfonate based greases*. Presented at the NLGI 84th Annual Meeting, <https://stratcoinc.com/wp-content/uploads/2020/10/AXEL-Stratco-2017-NLGI-Paper.pdf>.
- Mackwook, W. (2016, October). Calcium sulfonate complex greases, *Tribology & Lubrication Technology*, 28-40.
- Razak, I.H.A., and Ahmad, M.A. (2021). Tribological Behaviour of Calcium Complex Pal-Biogrease with Green Additive, *Tribology Industry*, 43(1), 139-149. DOI:[10.24874/ti.1002.11.20.02](https://doi.org/10.24874/ti.1002.11.20.02).

**EFFECT OF DIFFERENT POLYMERS ON WATER SPRAY RESISTANCY OF
CALCIUM SULFONATE COMPLEX GREASES**

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ABSTRACT

Calcium sulfonate complex (CSX) greases, which are used as semi-liquid lubricants, are more suitable for use than lithium-based greases thanks to their excellent mechanical, rust and wear protection, and high dropping point. Since additives are not used in the content of CSX greases, they are low cost compared to lithium-based greases. In this study, NLGI 2 grade CSX grease was obtained using paraffinic base oil. The viscosity of the base oils was adjusted to ISO VG 100 and ISO VG 460. CSX greases are known for their water-absorbing properties due to their nature. Therefore, water spray off properties were investigated. In this light, the water spray off behavior of different polymers such as Ethylene-Propylene Copolymer (OCP), Polyisobutylene (PIB) and Polymethylmethacrylate (PAMA) types on these greases is presented in this study. All polymers improved the water spray resistancy. Grafted-OCP polymers gave the best performance. Following this, OCP, PIB and PAMA polymers improved water spray off, respectively. It is also known that polymers effect the cold flow pressure. All polymers negatively effected the flow pressure. It was found that the grease thickness as the amount of polymer increases.

Keywords: Lubricant, calcium sulfonate complex, grease, polymer, paraffinic base oils.

INTRODUCTION

Thickener, base oil, and additives are the main components of grease. Also, grease is known as a semi-liquid lubricant. They are used in a wide variety of equipment and sectors as a result of this feature. Greases are used to reduce friction and wear between surfaces in moving systems. Greases used in some equipment are also required to be water resistant. Calcium sulfonate complex greases, a new and more environmentally friendly grease type, meet all these specifications. Calcium sulfonate complex greases (CSX), which are gel type lubricating greases, are known for their ability to absorb water. These greases suitable for working in aqueous environments. CSX greases are known their low cost because they do not need additives such as lithium-based greases. Also, their efficiency higher than lithium-based greases. CSX are considered an excellent technology for use under heavy and shock loads at high temperatures. It offers excellent rust and wear protection and a high dropping point.

Water is a significant contamination which effects the life or operation of the machine by mixing the lubricating grease. Duncanson and Fitch were said on their work, water contamination often considerably alters the rheological and chemical properties of grease and leads to accelerated failure of equipment through intensified corrosion, oxidation, leakage, and oil flow restriction. For this reason, it is important for users to choose the appropriate grease (Duncanson., 2005; Fitch., 2008).

Gurt and Khonsari reported, the most pertinent characteristics of a water-resistant grease are water solubility, formation and adequacy of lubricant film thickness, non-reactivity with water, retention of consistency, proper adhesion to surfaces, and prevention of corrosion. They said, to prevent damage to machinery and bearings, surfaces must be coated with a lubricant that will not be subject to corrosion. They also reported the biggest factor causing corrosion is water. This effect is reduced if the selected grease can absorb water. These effects can significantly reduce the fatigue life of a bearing. Any strong ingress of water will soften the grease and cause it to wash out. To prevent softening, grease with the right balance between base oil viscosity and polymer additives should be selected (Gurt and Khonsari., 2020).

Çınar and Karaaslan investigated on their study, they found that PAMA type polymer additive negatively effect of flow pressure at low temperature (-20°C) (Çınar and Karaaslan., 2021). In our previous study, also we reported that OCP, PIB and PAMA type polymer doesn't improve flow pressure at low temperature (-20 °C and - 30°C) (Ağtoprak and Karaaslan., 2022).

Though CSX greases have a good water resistance property to improve it, polymeric type additives may be used. This study examined the polymer effect on water resistance performance of calcium sulfonate grease. Beside this, polymer effects on flow pressure and penetration properties were investigated.

MATERIALS AND METHOD

Materials

In this study mineral type of base oil, different type of polymer as Ethylene-Propylene Copolymer (OCP), Polyisobutylene (PIB) and Polymethylmethacrylate (PAMA) commercially available and NLGI number 2 calcium sulfonate complex grease were used as a material.

Methods

The kinematic viscosity of base oils of greases at 40°C and 100°C were measured with HERZOG branded kinematic viscosity instrument according to ASTM D 445.

Penetration measurements were done by HERZOG branded penetrometer according to ASTM D 217 at 25°C. Before the measurement, greases were worked at 60 strokes by using a mechanical grease worker.

The water spray-off resistance measurements by KOEHLER device of greases were performed with grease coated on a stainless-steel panel and sprayed with a water at 38±0,5°C temperature and 40±1 psi pressure according to the ASTM D 4049, Standard Test Method for Determining

the Resistance of Lubricating Grease to Water Spray. This test provides a realistic determination of how much grease will be removed when water is sprayed on it.

Cold flow pressure measurements were made with MINITEST-FFK equipment according to DIN 51805 (Kesternich Technique) standard at -30°C. With this device, the flow pressure of lubricating greases is measured in the range of -50 C to +30 C, up to a maximum pressure of 300 kPa (3000 mbar).

RESULTS AND DISCUSSION

Within the scope of this study mineral base oil based NLGI 2 grade calcium sulfonate complex greases were prepared in laboratory scale grease reactor and their base oil viscosities were adjusted to 100 and 460 mm²/s (Table 1). Grease was produced with OCP, PIB, Grafted-OCP and PAMA types to see effect of the polymers on the CSX greases water spray resistance improvement. Water spray off and flow pressure analyzes were performed on NLGI 2 class CSX greases and NLGI 2 class CSX greases prepared using different polymer types. In addition, the penetration number was also measured for CSX greases produced with Grafted-OCP polymer type.

Table 1. The Technical Properties of The Base Oils

Technical Properties	Mineral Base Oil-ISO VG 100	Mineral Base Oil-ISO VG 460
Kinematic Viscosity at 40°C, mm ² /s	100	460
Kinematic Viscosity at 100°C, mm ² /s	10,9	29,48
Viscosity Index	92	92
Flash Point, °C	270	290
Pour Point, °C	-9	-9

Separately NLGI 2 class CSX greases were produced using base oil viscosity 100 and 460 mm²/s. Technical properties of these CSX greases are given in Table 2.

Table 2. Technical Properties of CSX Greases

Technical Properties	Method	CSX (100)	CSX (460)
Thickener	-	Calcium sulfonate	Calcium sulfonate
Base Oil	-	Mineral	Mineral
Base Oil Viscosity (40°C, mm ² /s)	ASTM D445	100	460
Worked penetration (25°C, 60 strokes)	ASTM D217	275	284
NLGI (#)	DIN 51818	2	2
Dropping point (°C)	ASTM D566	> 300	> 300

Table 3 shows water spray off results of CSX greases prepared with different base oil viscosities without polymer. As a result, when base oil viscosity increases, loss of grease from plate decreases. Therefore, all experiments focus on CSX grease producing with 460 mm²/s base oil viscosity.

Table 3. Water Spray Off Results of CSX Grease without Polymer

Grease	Water Spray Off (%)
CSX ISO VG 100	20,65
CSX ISO VG 460	18,03

Figure 1 shows the images of CSX grease before application of water spray off test, the grease without polymer after application and the grease with polymer after application test. From Fig. 1.b, it is clearly seen that grease has been loss on the plate after application of the test. Fig. 1.c shows grease with polymer after application. Here, it can be seen that there is no visible distribution on the plate. As visually It is seen that polymer improve water spray off performance of CSX.

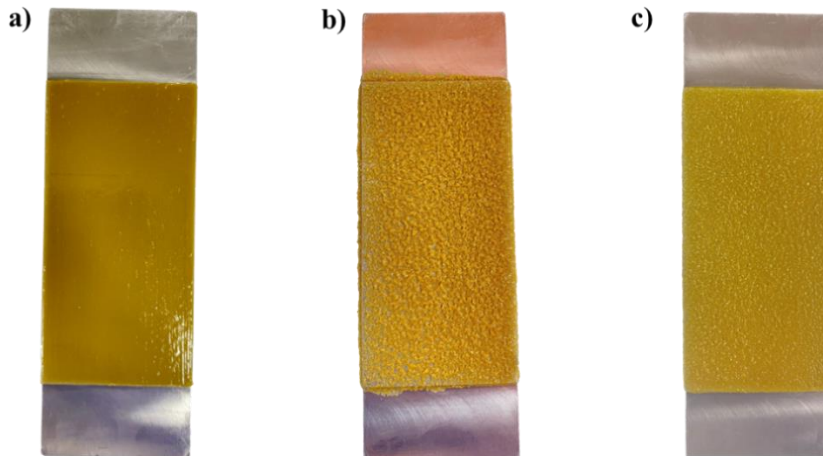


Figure 1. Effect of Polymer on Water Spray Off **a)** Grease Before Application, **b)** Grease without Polymer After Application, **c)** Grease with Polymer After Application

Water spray off results of CSX greases made with commercially available polymer types is given in Table 4. Firstly, all the CSX grease production were made with using same ratio polymers. Then, different ratios of the same polymer type (PIBx and PIB10x) were tested. As a result, it has been determined that water spray off performance of PAMA type polymer gives worst result compared to other types of polymers. PIB polymer showed better performance then PAMA, but the best water spray off results were obtained with using Grafted-OCP. Also, it has been determined that even if the PIB polymer ratio increase 10 times, it did not improve the water spray off performance of the grease and gives the same result with low ratio polymer.

Table 4. Water Spray Off Results of CSX Grease with Different Polymers

Grease	Polymer Type	Water Spray Off (%)
CSX ISO VG 460	PAMA (x)	13,25
	OCP1 (x)	7,19
	OCP2 (x)	6,94
	High MW PIB1 (x)	9,797
	High MW PIB1 (10x)	9,06
	Grafted-OCP (x)	2,902

Due to the best water spray off results were enhanced with Grafted-OCP and ISO VG 460 viscosity base oil, second part of the study was carried out by using different ratios of Grafted-OCP and 460 mm²/s base oil. Water Spray off results of CSX grease with different ratio Grafted-OCP polymers were given in Table 5. Likewise, Figure 3 shows water spray off results of CSX grease with different ratio Grafted-OCP polymers as a graphical. Consequently, the loss of

grease removed with water decreased when the polymer ratio increased. This indicates that the grease loss is lower in the pressurized water environment. Best performance gave with Grafted-OCP x as ratio.

Table 5. Water Spray Off Results of CSX Grease with Different Ratio Grafted-OCP Polymers

Grease	Polymer Type	Water Spray Off (%)
CSX ISO VG 460	without polymer	18,03
	Grafted-OCP (0,1x)	17,02
	Grafted-OCP (0,3x)	14,78
	Grafted-OCP (0,5x)	12,48
	Grafted-OCP (x)	2,902

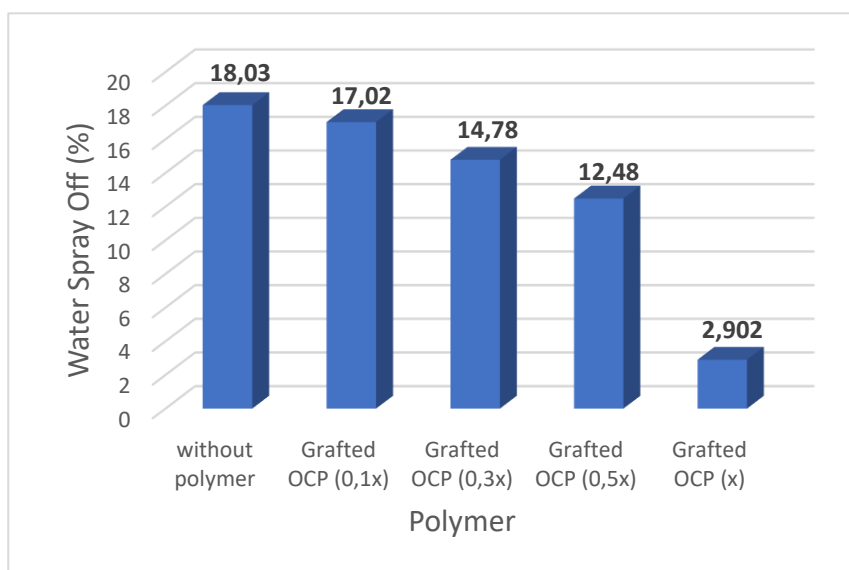


Figure 3. Water Spray Off Results of CSX Grease with Different Ratio Grafted-OCP Polymers

To see the cold flow performances of CSX greases and the effect of polymer addition on cold flow performance, measurements were carried out at -30°C . Table 6 shows the cold flow pressure results of calcium sulfonate complex greases prepared with different base oil viscosities and by adding different type of polymer. It was determined that base oil viscosity effect the flow pressure. Best performance has with $100\text{ mm}^2/\text{s}$ compared to $460\text{ mm}^2/\text{s}$. Addition of polymer negatively effects the flow pressure in greases. In fact, some samples could not be measured.

Table 6. Flow Pressure Results of CSX Grease with Different Polymers

Grease	Polymer Type	Flow Pressure (-30°C , hPa)
CSX ISO VG 100	without polymer	870
	without polymer	1590
CSX ISO VG 460	PAMA (x)	2550
	OCP1 (x)	NA
	OCP2 (x)	NA
	High MW PIB1 (x)	NA
	High MW PIB1 (10x)	NA
	Grafted-OCP (x)	NA

Table 7 shows flow pressure results of CSX grease with Grafted-OCP polymers. Addition of polymer negatively effects the flow pressure in greases. This case is explained with polymers

shrink at low temperatures also they expand at high temperatures. This is the important for flow pressure of greases at low temperature.

Table 7. Flow Pressure Results of CSX Grease with Grafted-OCP Polymers

Grease	Polymer Type	Flow Pressure (-30°C, hPa)
CSX ISO VG 460	without polymer	1590
	Grafted-OCP (0,1x)	3000
	Grafted-OCP (0,3x)	3070
	Grafted-OCP (0,5x)	3150
	Grafted-OCP (x)	NA

Polymers also have an impact on penetration. Table 8 shows the effect of the polymer on the thickening of the grease. According to Table 8, when polymer ratio increases the thickness is increased. And Figure 4 explain it as graphical.

Table 8. Penetration Results of CSX Grease with Grafted-OCP Polymers

Grease	Polymer Type	Worked penetration (25°C, 60 strokes)
CSX ISO VG 460	without polymer	284
	Grafted-OCP (0,1x)	282
	Grafted-OCP (0,3x)	278
	Grafted-OCP (0,5x)	274
	Grafted-OCP (x)	265

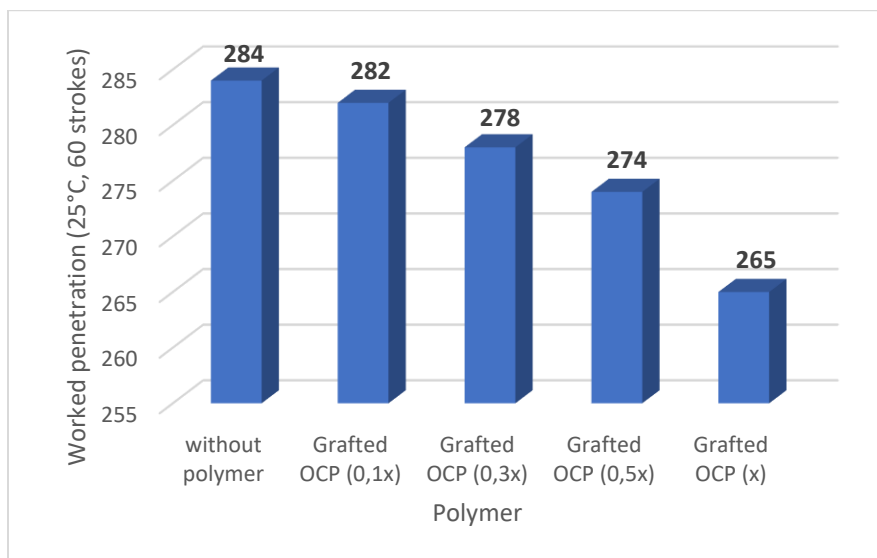


Figure 4. Penetration Results of CSX Grease with Grafted-OCP Polymers

CONCLUSION

In conclusion, the results show that the water spray resistance of grease depends on the base oil's viscosity. The best performance was observed with 460 mm²/s compared to 100 mm²/s. All polymers were found to improve the water spray resistance. The best performance was obtained with Grafted-OCP polymers. OCP, PIB, and PAMA polymers has also improve the water spray off results, respectively. On the other hand, it was determined that the polymers negatively effected the flow pressure performance of the greases.

This is attributed to the shrink of the polymers with the grease at low temperatures. As a result, thickness of grease related with an increase in the amount of polymer. It was found that the grease thickness as the amount of polymer increases. Overall, the findings suggest that choosing the right combination of base oil viscosity and polymers is crucial in improving the water spray resistance of grease. Also, the polymer type and concentration directly effect the pumpability of the grease.

REFERENCES

- Ağtoprak, K. & Karaaslan, U. (2022). Effect of base oil type on grease flow pressure behavior. *International Conference on Engineering Sciences*, Nov. 11-12, 277-286.
- Çınar, N. & Karaaslan, U. (2021). Low temperature fluidity properties of lubricating greases and the effect of pour point additive on grease fluidity. *Ispcc international congress on multidisciplinary studies*, Nov. 11-12, 219-236.
- Duncanson, M. (2005). Detecting and controlling water in oil. *Practicing Oil Analysis Magazine*, 22-4.
- Fitch, J. (2008). How water causes bearing failure. *Machinery Lubrication*, 7, 2-4.
- Gurt, A., & Khonsari, M. (2020). An overview of grease water resistance. *Lubricants*, 8(9), 86.

**RESEARCH ON THE FINANCIAL EFFICIENCY OF THE RICE-LOTUS
ROTATION MODEL – A CASE STUDY IN THE VIETNAM MEKONG
DELTA**

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Abstract

Rice-lotus rotation model includes one crop of rice and one crop of lotus cultivation in one year. After harvesting rice, the straw is buried in the soil to provide fertilizers for lotus seeds. After three months of growing, the farmers can harvest lotus products for three months. The rice-lotus rotation model is adaptive in the context of climate change in the Vietnam Mekong Delta. In particular, this model reduces pests and diseases, increasing soil fertility. The model also reduces the cost of rice cultivation, bringing economic and social benefits. In addition, the model also contributes to reducing the initial investment costs when cultivated conversion of crops. Farmers will take advantage of fertilizer usage for rice cultivation with this model because of the reserve of rich sludge in the topsoil from growing lotus. This model is also highly appreciated when dealing with dangerous diseases on the lotus. We conducted this study to evaluate the financial efficiency of the rice-lotus rotation model in Chau Thanh district, An Giang Province, Vietnam. We collected production data from 60 rice-lotus rotation cultivation households in the studied area through face-to-face interviews. This study used several methods, including descriptive, cost-benefit analysis, and multiple variable regression analysis. The research results showed that the rice-lotus rotation model achieved 0.81 of the profitability and investment index and 0.45 of the profitability and total income index. The total cost and income of RLR cultivation per 1,000 m² yr⁻¹ was 9,478,200 VND and 17,191,300 VND, respectively. Profits was 7,713,100 VND 1,000 m⁻² yr⁻¹. The factors that affected the financial efficiency of the RLR model included agrochemicals cost, hired labor cost for crop care, and selling price (significant level of 10%).

Keywords: financial efficiency analysis, agricultural rotation model, rice-lotus cultivation, Vietnam Mekong Delta

1. Introduction

The Mekong Delta is one of the most deltas seriously affected by climate change (Kuenzer & Renaud, 2012). Therefore, the efficiency of agricultural production, especially rice in the Mekong Delta, will be a great challenge (Tran et al., 2020; Whitehead et al., 2019). The impact of climate change on Vietnam is severe and is an existential threat to the goal of poverty reduction. In the Mekong Delta, only about 20% of the population lives in urban areas; the rest, about 80%, live in rural areas (Kuenzer & Renaud, 2012). As a result, agriculture has long been the region's main economic activity. Most agricultural land is used for rice cultivation, high-yield shrimp farming, and fruit and vegetable crops (Nguyen Thanh et al., 2021; Olson & Morton, 2018; Tran et al., 2018). Rice production is critical in Vietnam's agricultural and rural economic development and the Mekong Delta.

Thanks to the renewal of the economic management mechanism, Vietnam has achieved great achievements in rice production in recent years. In particular, the Mekong Delta contributes half of the country's rice production. It contributes to making Vietnam among the world's top three rice exporting countries, with annual exports of 3-4 million tons of rice, along with Thailand and India (Yuan et al., 2022). In addition, the combination of intensive farming, alternating or changing other plants and animals has been focused on and implemented more commonly in recent years. Much of the Mekong Delta is facing significant problems due to the impacts of climate change, such as floods, severe saline intrusion, and natural drainage that makes the soil acidic (Le et al., 2018; Renaud et al., 2015; Van Ni et al., 2012). With high toxic aluminum and low soil phosphorus content, crop rotation is a suitable farming solution to improve soil environmental health. Besides, crop rotation will also contribute to increasing income and ensure farmers' quality of life.

Agriculture significantly contributes to economic growth and is vital to income generation, poverty alleviation, and sustainable development, especially in rural areas. Most people with low incomes in developing countries live in rural areas. Most of them directly or indirectly depend on agriculture as the primary source of livelihood, of which rice production and aquaculture are two critical sectors in the agricultural production structure of the country. Thus, in the context of increasingly complex developments of climate change, continuing a traditional agrarian production system is facing three challenges: ensuring food security, adapting to climate change, and mitigating the effects of climate change (Campbell et al., 2016; Schneider & Asch, 2020; Vervoort et al., 2014). Taking climate change adaptation as a premise, experts began paying attention to and studying model transformation and climate change response, climate-smart agricultural – CSA. This is also a suitable model for the development of the Mekong Delta. Many sustainable agricultural models for this response include salt-tolerant, alum-tolerant rice varieties; salt-tolerant, alum-tolerant fruit trees; shrimp-forest; shrimp-rice rotation; and lotus cultivation (specialized in cultivation or rotation). The selected farming models apply depending on the specific natural conditions in each region of the Mekong Delta.

The lotus farming model (specialized lotus, rice-lotus, lotus-fish, tourist lotus) is considered a sustainable and adaptive agricultural model, with advantages such as flood storage, cost reduction, financial efficiency, environmentally friendly, livelihood improvement, job creation, and climate change adaptation, is a relatively new form of agriculture. This model also ensures multi-functionality (cultural value, income improvement, job creation, ecological balance), harmonizes the costs and benefits of lotus cultivation and is suitable for the rotation pattern model. On the other hand, when a specific CSA model is only suitable for application in certain contexts. In other words, a CSA model only makes sense for application when the model is ideal for the needs and conditions. For specific requirements in the locality, the lotus cultivation model is now considered the most suitable for people's life in the region.

The lotus rice rotation model is assessed to be suitable for the conditions of land, water resources, infrastructure, and market, as well as the culture, customs, qualifications, and investment ability of farmers in the Mekong Delta region. The lotus farming model is a model with low investment costs, increased income, and high economic efficiency, improves the environment for local people and has excellent potential for tourism development (Dang et al., 2021; Loi et al., 2022; Macedo et al., 2022; Ngoc, 2017; Vo et al., 2021). In An Giang province, people have applied the lotus farming model for many years and achieved high economic efficiency. This farming model is considered suitable for areas prone to seasonal salinity and alum due to the impact of erratic climate from climate change. In addition, it is urgent to study the application of the rice-lotus rotation model with appropriate farming techniques, production scale, and higher economic efficiency than traditional forms of rice intensification.

For the above reasons, we conducted this study to provide a more scientific basis to help local households, policymakers, and local agencies in comprehensive assessment and make appropriate decisions suitable for future agricultural economic production of the region in the context of current climate change.

2. Materials and methodology

Primary data collection: We used a system of pre-prepared interview questions to collect data to serve the situation research and assess the need to improve people's ability to access livelihood capital, recommendations, mechanisms, and policies to help them access livelihood resources. Our study was conducted in Chau Thanh district, An Giang province (Figure 1). We interviewed 60 households to collect information on livelihood and income, and families were selected by non-probability sampling.

Secondary data collection: We collected secondary data from various sources, including documents published by the Ministry of Agriculture and Rural Development, Statistical Yearbooks, scientific reports, and annual reports summarizing the economic activities of the Chau Thanh District Economic Department.

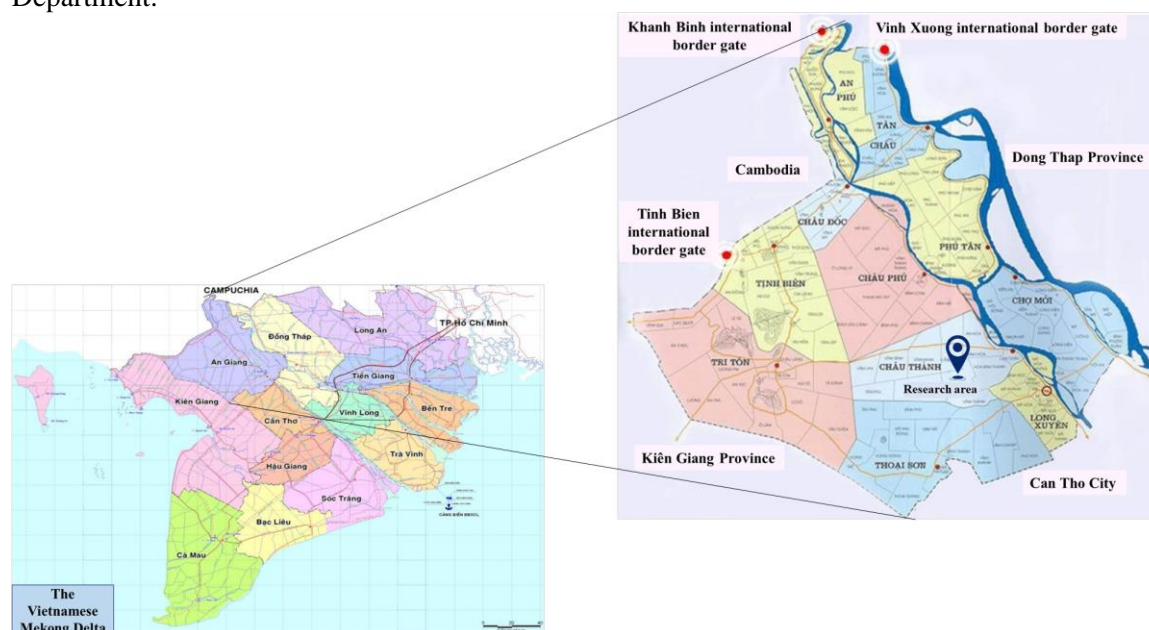


Figure 1. Research area

This study uses SPSS and Excel software to manage and analyze research data. We use descriptive statistics to analyze the current status of livelihood resources to meet production activities and household life. Specifically, the frequency distribution method aims to describe and learn about the distribution characteristics of a raw data sample and tabulate the frequency distribution. A frequency table is a table that summarizes the data arranged in different groups. Then determine the cluster frequency by counting the number of observations within that cluster, and the results are presented in a table or graph. Rated maximum value, minimum value, and average value. We also use the correlation regression analysis method to determine several household characteristics that affect the family's total income.

The criteria for calculating results and production efficiency:

$$\text{Gross return} = \text{Output} \times \text{Price of the product}$$

$$\text{Yield} = \text{Harvested output} / \text{Planted area}$$

$$\text{Total cost} = \text{Material cost (seed, mechanization, energy, fertilizer)} + \text{Labor cost (include or exclude family labor cost and hired labor cost)} + \text{Others cost}$$

$$\text{Net return} = \text{Gross return} - \text{Total cost (Include or exclude family labor cost)}$$

$$\text{Gross return Cost Ratio (GCR)} = \text{Gross return} / \text{Total cost (Include or exclude family labor cost)}$$

$$\text{Benefits Cost Ratio (BCR)} = \text{Net return} / \text{Total cost (Include or exclude family labor cost)}$$

$$\text{Net return Gross return Ratio (NGR)} = \text{Net return} / \text{Gross return}$$

The correlation regression analysis method was used to analyze the factors affecting the net return of the rice-lotus rotation production model. The regression equation has the form of the following:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n$$

In which:

+ Dependent variable: Y is net return of the model (1000 VND 1000 m⁻² year⁻¹)

+ X₁: Agrochemicals cost applied for rice (1000 VND 1000 m⁻² crop⁻¹)

+ X₂: Fertilizers cost applied for rice (1000 VND 1000 m⁻² crop⁻¹)

+ X₃: Hiring labor cost of rice cultivation (1000 VND 1000 m⁻² crop⁻¹)

+ X₄: Rice selling prize (1000 VND)

+ X₅: Agrochemicals cost applied for lotus (1000 VND 1000 m⁻² crop⁻¹)

+ X₆: Fertilizers cost applied for lotus (1000 VND 1000 m⁻² crop⁻¹)

+ X₇: Hiring labor cost of lotus cultivation (1000 VND 1000 m⁻² crop⁻¹)

+ X₈: Lotus selling prize (1000 VND)

Note: 1,000,000 VND = 42.61 USD

3. Results and discussions

3.1 Investment for cultivation

The cultivation process of rice-lotus crops includes the following costs: seed cost, land preparation cost, fertilizers cost, agrochemicals cost, family labor cost, hired labor cost, and fuel costs. Table 1 summarizes the average cost ranges per 1000 m² to produce the rice-lotus rotation model of farmers.

Table 1. Invested cost for agricultural activities

Unit: 1000 VND 1000 m⁻²

Investment	Rice		Lotus	
	Average	Std.	Average	Std.
Seeds	155.43	2.92	187.00	53.97
Land preparations	160.33	15.19	160.33	15.19
Fertilizers	303.10	18.83	1096.30	59.37
Agrochemicals	372.00	113.96	1033.33	118.41
Family labor cost	650.80	306.14	2473.10	1181.55
Hiring labor cost	347.83	69.00	2283.60	772.22
Fuels	127.27	11.07	127.27	11.07
Total cost	217.3	247.21	7361.40	564.95

Seed cost: Seed is one of the crucial factors in agricultural production and affects the quality of the yield obtained. Therefore, choosing high-quality varieties suitable for natural conditions and soil is also necessary. Of the total production costs, the average cost of seed per 1000 m² of production land is 242,400 VND, the lowest cost of seed is 281,000 VND, and the highest cost of seed is 445,000 VND. The average cost of lotus seed is 187,000 VND per 1000 m² of rice is 155,430 VND per 1000 m². The cost of using seeds of farmers has a relatively significant difference. The reason is the difference in seed use and planting density, leading to the difference in seed costs.

Land preparation cost: 100% of the farmers rent a tiller to till the soil before sowing to help the soil become loose, allowing the rice and lotus seeds to develop the root system quickly. Investment cost to prepare land accounts for 3% of the total cost of the lotus rice rotation model over 1000 m². The average land preparation cost per 1000 m² is 620,600 VND, the lowest is 300,000 VND, and the highest is 400,000 VND. The average cost of preparing land for planting lotus per 1000 m² is 160,330 VND. Meanwhile, the average cost of preparing rice land is 160,330 VND 1000 m². The difference in land preparation costs is mainly due to the time of sowing of the farmers. If farmers sow seeds simultaneously, the rental price of cultivators will be high, making land preparation costs high and vice versa.

Fertilizers cost: Fertilizer is a vital input factor that directly affects the yield of the model. For crops, the primary nutrient source is soil minerals, chemical fertilizers, and other fertilizers. However, fertilizers must be applied reasonably, at the right time, at the correct dose, and without overuse of chemical fertilizers. The fertilizers used are mainly Urea, DAP, NPK (20-20-15, 16-16-8), organic fertilizers, and others. The average fertilizer cost per 1000 m² of the lotus-rice rotation model is 1,399,600 VND, the highest is 1,506,000 VND, and the lowest is 1,241,000 VND, accounting for 15% of the total production cost of the model. The average fertilizer cost for lotus and rice cultivation is 1,096,300 VND and 303,100 VND, respectively.

Agrochemicals cost: In the production process, agrochemicals cost is relatively high. The cost of agrochemicals accounts for about 15% of the total cost of production, second only to the cost of family labor and the cost of hired labor. The average cost of pesticides per 1000 m² is 1,405,300 VND, the lowest is 1,150,000 VND, and the highest is 1,405,300 VND. The cause of the difference is mainly due to the farming techniques of each household and the situation of pests and diseases in each field. Particularly for lotus, the average cost of pesticides per 1000 m² is 1,033,330 VND. Meanwhile, the average cost of pesticides for rice is 372,000 VND.

Family labor cost: Family labor accounts for the highest proportion of total investment costs for producing the rice-lotus crop rotation model. The cost of family labor is calculated by multiplying this amount by the average labor cost in local agricultural production. This cost accounts for 33% of the total cost. Most of the stages in the production process are used by households using family labor, such as seeding, fertilizing, spraying, tending, and harvesting. However, family labor cost also depends on the number of family members, cultivated area, and farming techniques. Therefore, the cost of family labor in each household is different, averaging about 3,124,100 VND; the highest is 6,964,000 VND, and the lowest is 1,100,000 VND. The family labor cost of lotus cultivation is 2,473,100 VND, and the family labor cost of rice cultivation is 650,800 VND.

Hired labor cost: Hired labor cost of households is the second highest proportion, accounting for 28% of total costs, only after family labor costs. The high labor cost is because the rice-lotus rotation model requires a lot of labor, such as in the stages of sowing, spraying, fertilizing, and harvesting. The average labor cost of the rice-lotus crop rotation model is 2,631,500 VND, the highest is 4,203,000 VND, and the lowest is 882,000 VND. Particularly for lotus cultivation, the average labor hire is 2,283,600 VND, and for rice is 347,830 VND.

Fuels cost: Besides fertilizers and nutrients, supplied water is crucial in helping lotus and rice grow well. However, the cost of fuels farmers use is meager, accounting for only 3% of the total cost. On average, each farmer only spends about 254,680 VND, the lowest is 216,000 VND, and the highest is 270,000 VND.

3.2 Financial efficiency analysis

Productivity: Productivity is the expected outcome. Productivity is the amount of output obtained per unit area of arable land. Productivity depends on inputs and factors such as weather, soil, farming form, amount of water, and experience. The higher the productivity, the higher the farmer's profit. The average lotus yield is about 1272 kg 1000 m⁻². The average yield results show that the farmer's harvest is relatively high. This proves that the natural conditions in the study area are suitable for farmers to grow lotus. The average rice yield is about 616.6 kg 1000 m⁻². Due to rice cultivation in the Winter-Spring growing season with favorable weather conditions, the average yield is relatively high.

Selling price: The selling price is the amount a farmer gets when he sells a product unit. That is a factor that all farmers are interested in when cultivating, especially at the time of harvesting. The selling price of lotus fluctuates quite a lot, depending on the market and the quality of the product. Production techniques are different, so the lotus seed-pod quality differs among producing households. Depending on the quality of the lotus seed-pod, lotus rhizome, and lotus root, the price of lotus products fluctuates with an average price of about 10,700 VND kg⁻¹. The selling price of rice is also highly dependent on the market, seed-pod quality, varieties, and farming techniques of each household. The average selling price of rice is about 5200 VND kg⁻¹. Farmers mainly sell rice to traders. Although, the price that traders buy is lower than that sold directly to processing facilities or companies. However, because farmers harvest in large quantities, only traders can purchase their entire output, so they are willing to sell their products to traders.

Gross return: Revenue is the total money obtained from selling all products to the market. Revenue is determined by the selling price multiplied by the output. Revenue is directly proportional to productivity and selling price. If the selling price and productivity are high, the income is high, and vice versa. The average revenue from growing lotus of farmers in the study area is 13,524,000 VND 1000 m⁻², and the average revenue of rice is 3,669,300 VND 1000 m⁻².

Net return: Profit is considered the remainder after total revenue is subtracted from total costs, including family labor. The average profit from growing lotus is 6,161,900 1000m² and from growing rice, the average is 1,551,200 VND 1000 m⁻². The gain from combining the rice-lotus rotation model of farmers in the study area is 7,713,100 VND 1000 m⁻².

Benefit and cost ratio (BCR): The average BCR of lotus cultivation is 0.83. This BCR means that for every 1 VND invested in lotus production, 0.83 VND of profit is generated. Meanwhile, the average BCR of rice farming is 0.73. This BCR of the rice-lotus rotation model is 0.81.

Gross return and cost ratio (GCR): The average GCR of lotus cultivation is about 1.83. This index means that with 1 VND of investment costs, 1.83 VND of revenue is obtained. Meanwhile, the average GCR index of rice cultivation is 1.73, and the GCR of rice-lotus crop rotation is 1.81.

Net return and gross return ratio (NGR): The average NGR of lotus cultivation is about 0.45. NGR means that with 1 VND of revenue that farmers receive, it will include 0.45 VND of profit. Meanwhile, the average NGR of rice is 0.42. This index of the rice-lotus rotation model is 0.45.

The financial indicators show that the farmers producing the rice-lotus rotation model in the study area are economically efficient. However, if family labor costs are not included, profits, income, and revenue will be much higher than when family labor costs are included.

Table 2. Financial efficiency analysis

		<i>Unit: 1000 VND 1000 m⁻²</i>					
	Unit	Rice		Lotus		Rice-Lotus rotation	
		Mean	Std.	Mean	Std.	Mean	Std.
Productivity	kg 1000 m ⁻²	616.6	31.3	1272.0	96.5		
Price	1000 VND kg ⁻¹	5.2	1.5	10.7	2.5		
Total cost	1000 VND 1000 m ⁻²	2117.3	274.2	7361.4	564.9	9478.2	500.0
Gross return	1000 VND 1000 m ⁻²	3669.3	968.6	13,524.0	2747.8	17,191.3	2368.1
Net return	1000 VND 1000 m ⁻²	1551.2	1004.7	6161.9	2912.6	7713.1	2528.9
BCR	times	0.73		0.83		0.81	
GCR	times	1.73		1.83		1.81	
NGR	times	0.42		0.45		0.45	

3.3 Analysis of factors affecting to financial efficiency of the model

To better analyze the financial performance of the model, we analyze the factors affecting profitability through a multivariate regression model. Many different factors influence the profitability of farmers producing the rice-lotus rotation model. However, within the scope of this study, the regression equation only mentions some key factors assumed to affect profits as follows: cost of pesticides applied to rice cultivation, application fertilizer fee for rice cultivation, labor cost for hiring rice cultivation, selling rice price, cost of pesticides used for lotus cultivation, cost of fertilizer application for lotus cultivation, cost

labor hire to grow lotus, price of sale of lotus. Based on the multivariable linear regression model established in the analytical methods section, we use SPSS software to support the analysis. The results are presented in Table 3.

Table 3. Analysis factors affect the financial efficiency of the rice-lotus rotation production model

Factors	B	Sig.	VIF
Constant	-4300.813	0.115	
X ₁ : Agrochemicals cost applied for rice (1000 VND 1000 m ⁻² crop ⁻¹)	1.648	0.084*	1.391
X ₂ : Fertilizers cost applied for rice (1000 VND 1000 m ⁻² crop ⁻¹)	-3.968	0.059*	1.607
X ₃ : Hiring labor cost of rice cultivation (1000 VND 1000 m ⁻² crop ⁻¹)	-6.975	0.001*	1.919
X ₄ : Rice selling prize (1000 VND)	609.541	0.000*	1.415
X ₅ : Agrochemicals cost applied for lotus (1000 VND 1000 m ⁻² crop ⁻¹)	-1.151	0.244 ^{ns}	1.681
X ₆ : Fertilizers cost applied for lotus (1000 VND 1000 m ⁻² crop ⁻¹)	-1.423	0.405 ^{ns}	1.285
X ₇ : Hiring labor cost of lotus cultivation (1000 VND 1000 m ⁻² crop ⁻¹)	0.905	0.000*	2.159
X ₈ : Lotus products selling prize (1000 VND)	1168.54	0.000*	1.112
R ² :	0.984		
Adjusted R ² :	0.978		
Sig.F:	0.000		
Durbin-Watson test:	2.389		

Note: ^{ns}: non-significant; * : 10% significant level

The analysis results in Table 3 show that the coefficient sig.F of the model = 0.000 is smaller than the significance level $\alpha = 10\%$, so the regression model is significant, consistent with the data set, and has good results and is usable. The independent variables affect the dependent variable Y. The model's adjusted R² coefficient is 0.978 or 97.8%, which means that the variation in rice-lotus rotation model profitability can explain the factors included in the model without the phenomenon of autocorrelation. The results from factors demonstrate the remaining 97.8%, and the remaining 2.2% depended on the elements outside the model. The Durbin-Watson coefficient of the model is 2.389 with $1 < D = 2.389 < 3$, showing that the model does not have autocorrelation. Besides, the model's Variance Inflation Factors (VIF) is much smaller than 10, so we conclude that the factors included in the model do not have multicollinearity (Liem et al., 2023b, 2023a; Liem, Tinh, Kim, et al., 2022; Liem, Tinh, Loan, et al., 2022).

The analysis results show that three out of eight variables included in the model have statistical significance (sig. 10%). Six variables with statistical significance are Agrochemicals cost applied for rice (X₁), fertilizers cost applied for rice (X₂), hiring labor cost of rice cultivation (X₃), rice selling prize (X₄), hiring labor cost of lotus cultivation (X₇), and lotus products selling prize (X₈). Four variables are positively correlated with the profitability of rice-lotus rotation cultivation, and two variables are negatively correlated with the profitability of rice-lotus rotation cultivation.

The regression equation has the form of the following:

$$Y = -4300.813 + 1.648X_1 - 3.968X_2 - 6.975X_3 + 609.541X_4 + 0.905X_7 + 1168.54X_8$$

4. Conclusion

The rice-lotus rotation model is adaptive in the context of climate change in the Vietnam Mekong Delta. In particular, this model reduces pests and diseases, increasing soil fertility. The model also reduces the cost of rice cultivation, bringing economic and social benefits. In addition, the model also contributes to reducing the initial investment costs when cultivated conversion of crops.

References

- Campbell, B. M., Vermeulen, S. J., Aggarwal, P. K., Corner-Dolloff, C., Girvetz, E., Loboguerrero, A. M., Ramirez-Villegas, J., Rosenstock, T., Sebastian, L., & Thornton, P. K. (2016). Reducing risks to food security from climate change. *Global Food Security, 11*, 34–43.
- Dang, K. K., Doan, M. T., Le, T. H. L., Nguyen, T. T. N., Pham, D. T., Do, H. T., Ngo, S. D., Vu, T. B. N., & Nguyen, P. A. (2021). Assessing the Performance of Climate Smart Rice Production Systems in the Upper Part of the Vietnamese Mekong River Delta. *Asian Journal of Agriculture and Development, 18*(1), 15–29. <https://doi.org/10.37801/ajad2021.18.1.2>
- Kuenzer, C., & Renaud, F. G. (2012). Climate and environmental change in river deltas globally: expected impacts, resilience, and adaptation. *The Mekong Delta System: Interdisciplinary Analyses of a River Delta*, 7–46.
- Le, T. N., Bregt, A. K., van Halsema, G. E., Hellegers, P. J. G. J., & Nguyen, L. D. (2018). Interplay between land-use dynamics and changes in hydrological regime in the Vietnamese Mekong Delta. *Land Use Policy, 73*(February), 269–280. <https://doi.org/10.1016/j.landusepol.2018.01.030>
- Liem, L. T. T., Tinh, P. V. T., Kim, N. T. B., Nhan, P. N., Phuoc, N. T. K., & Hien, N. T. (2023a). An Evaluation of Watermelon Production Efficiency in a Peri-urban Area – A Case Study in Cai Rang District, Can Tho City, Vietnam. In Y. KARADAĞ & S. SEYDOŞOĞLU (Eds.), *ISPEC 11th International Conference on Agriculture, Animal Sciences and Rural Development* (pp. 396–406). ISPEC Publishing House.
- Liem, L. T. T., Tinh, P. V. T., Kim, N. T. B., Nhan, P. N., Phuoc, N. T. K., & Hien, N. T. (2023b). The status of livelihood and proposals for households income improvement in a suburban of Can Tho City, Vietnam. In M. ŞAHİN (Ed.), *5th Internamntional Ankara Multidiciplinary Studies Congress* (pp. 969–977). IKSAD.
- Liem, L. T. T., Tinh, P. V. T., Kim, N. T. B., & Phuoc, N. T. K. (2022). Research on the financial efficiency of the cultivated maize on paddy rice land in Soc Trang Province, Vietnam. In M. Ilkim & A. Amanzholova (Eds.), *2nd Baskent International Conference on Multidisciplinary Studies* (Vol. 1). IKSAD GLOBAL. https://www.researchgate.net/profile/Massoud_Massoudi/publication/343499230_International_Conference_on_Covid19_Studies/links/5f2cca3ca6fdcccc43b03183/International-Conference-on-Covid19-Studies.pdf
- Liem, L. T. T., Tinh, P. V. T., Loan, N. D. N., Kim, N. T. B., & Hien, N. T. (2022). Analysis of financial efficiency of a specialties fruit production in Vietnam Mekong Delta - Cau Duc pineapple of Hau Giang Province. In M. NARİN (Ed.), *International Ankara Congress on Scientific Research VI* (pp. 1027–1038).
- Loi, L. Van, Mai, L. T. P., Hang, P. T., & Anh, N. T. (2022). Adapting to climate change based on natural farming model. *Can Tho University Journal of Science, 58*(SDMD), 225-230. In Vietnamese. <https://doi.org/10.22144/ctu.jvn.2022.208>
- Macedo, I., Roel, A., Velazco, J. I., Bordagorri, A., Terra, J. A., & Pittelkow, C. M. (2022). Intensification of rice-pasture rotations with annual crops reduces the stability of sustainability across productivity, economic, and environmental indicators. *Agricultural Systems, 202*(August). <https://doi.org/10.1016/j.agsy.2022.103488>
- Ngoc, P. T. Q. (2017). *Evaluating the effectiveness of lotus cultivation model in the context of climate change – Case study in Thap Muoi district, Dong Thap province*. Ho Chi Minh University of Natural Sciences.
- Nguyen Thanh, B., Le Van Thuy, T., Nguyen Anh, M., Nguyen Nguyen, M., & Nguyen Hieu, T. (2021). Drivers of agricultural transformation in the coastal areas of the Vietnamese Mekong delta. *Environmental Science and Policy, 122*(April), 49–58. <https://doi.org/10.1016/j.envsci.2021.04.010>
- Olson, K. R., & Morton, L. W. (2018). Polders, dikes, canals, rice, and aquaculture in the Mekong Delta. *Journal of Soil and Water Conservation, 73*(4), 83A-89A.
- Renaud, F. G., Le, T. T. H., Lindener, C., Guong, V. T., & Sebesvari, Z. (2015). Resilience and shifts in agro-ecosystems facing increasing sea-level rise and salinity intrusion in Ben Tre Province, Mekong Delta. *Climatic Change, 133*, 69–84.

- Schneider, P., & Asch, F. (2020). Rice production and food security in Asian Mega deltas—A review on characteristics, vulnerabilities and agricultural adaptation options to cope with climate change. *Journal of Agronomy and Crop Science*, 206(4), 491–503.
- Tran, D. D., Nguyen, C., Quang, X., Duy Tien, P., Tran, G., Long, P. K., Van Hoa, H., Ngoc, N., Giang, H., Thi, L., & Ha, T. (2020). *Livelihood Vulnerability and Adaptation Capacity of Rice Farmers under Climate Change and Environmental Pressure on the Vietnam Mekong Delta Floodplains*. 12, 3282. <https://doi.org/10.3390/w12113282>
- Tran, D. D., van Halsema, G., Hellegers, P. J. G. J., Ludwig, F., & Wyatt, A. (2018). Questioning triple rice intensification on the Vietnamese mekong delta floodplains: An environmental and economic analysis of current land-use trends and alternatives. *Journal of Environmental Management*, 217, 429–441. <https://doi.org/10.1016/j.jenvman.2018.03.116>
- Van Ni, D., Safford, R., & Maltby, E. (2012). Environmental change, ecosystem degradation and the value of wetland rehabilitation in the Mekong Delta. In *Living with environmental change* (pp. 144–157). Routledge.
- Vervoort, J. M., Thornton, P. K., Kristjanson, P., Förch, W., Ericksen, P. J., Kok, K., Ingram, J. S. I., Herrero, M., Palazzo, A., & Helfgott, A. E. S. (2014). Challenges to scenario-guided adaptive action on food security under climate change. *Global Environmental Change*, 28, 383–394.
- Vo, H. T. M., Van Halsema, G., Hellegers, P., Wyatt, A., & Nguyen, Q. H. (2021). The Emergence of Lotus Farming as an Innovation for Adapting to Climate Change in the Upper Vietnamese Mekong Delta. *Land*, 10(4), 1–19. <https://doi.org/10.3390/land10040350>
- Whitehead, P. G., Jin, L., Bussi, G., Voepel, H. E., Darby, S. E., Vasilopoulos, G., Manley, R., Rodda, H., Hutton, C., & Hackney, C. (2019). Water quality modelling of the Mekong River basin: Climate change and socioeconomics drive flow and nutrient flux changes to the Mekong Delta. *Science of the Total Environment*, 673, 218–229.
- Yuan, S., Stuart, A. M., Laborte, A. G., Rattalino Edreira, J. I., Dobermann, A., Kien, L. V. N., Thúy, L. T., Paothong, K., Traesang, P., & Tint, K. M. (2022). Southeast Asia must narrow down the yield gap to continue to be a major rice bowl. *Nature Food*, 3(3), 217–226.

THE NEXUS BETWEEN EARTHQUAKES AND HOUSE PRICES: A SYSTEMATIC LITERATURE REVIEW¹²

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ABSTRACT

House price is an important factor determining economic and social well-beings of both individuals and societies. Since, house prices directly affect sheltering need and also determine the rate of overall inflation, it's critical to detect the factors influencing them. However, it's sure that there are numerous factors determining the house prices. By following the related literature, those factors can be listed as house-specific factors (indoor and outdoor properties of the house), location, migration, security, input prices, public policies, foreign exchange rates, economic trends and natural disasters. As a less examined topic across the counted ones, natural disasters are important determinants, especially in less developed and developing countries. More specifically, today it's widely accepted that earthquakes have critical importance in this study field. In this manner, the main purpose of this study is to shed light on the nexus between earthquakes and house prices by the help of a systematic literature review. It's expected to make a significant contribution to this study field by examining the impacts of earthquakes on house prices in terms of a review analysis. Following this purpose, after a brief introduction, the socio-economic importance of house prices is given in the first section. Moreover, the relationship between earthquakes and house prices are also explained. Then, in the second section, a systematic literature review is given. In the third section, a basic meta-analysis for the related literature is developed. Lastly, in the conclusions, a brief discussion in the context of the review is enhanced.

Keywords: House Prices, Earthquakes, Literature Analysis, Systematic Review

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1. INTRODUCTION

Natural hazards are important factors affecting socio-economic conditions directly. In historical manner, mankind has faced with many challenges against the nature. Some has been overcome and some other still exists in our lives. Technological breakthroughs have provided many tools to prevent floods, landslides and fires, and also they made it possible to overcome the consequences of unprevented hazards like earthquakes, volcanic eruptions, hurricanes and tsunamis. However, there is still a long way to adapt our societies and economies to the realities that we are a part of the nature, and we cannot sustain the development without cooperation with our planet. Today, still we build our houses on riverbeds, foothills and coastal areas by ignoring the possibilities of floods, landslides and tsunamis. We still build unresistant houses by ignoring earthquakes and storms. In this manner, it's critical to accept that natural hazards will always take a part in our lives and we should take precautions against them. At this point, understanding the nexus between natural hazards and their economic consequences has a critical importance in the policy formation and implication processes. In this context, this study aims to shed light on the relationship between earthquakes and house prices by the help of a systematic literature review. Following this aim, after a brief introduction, the socio-economic importance of house prices is given in the first section. Moreover, the relationship between earthquakes and house prices are also explained. Then, in the second section, a systematic literature review is given. In the third section, a basic meta-analysis for the related literature is developed. Lastly, in the conclusions, a brief discussion in the context of the review is enhanced.

2. THE NEXUS BETWEEN EARTHQUAKES AND HOUSE PRICES

Housing, which serves the need for shelter, is considered as a heterogeneous product taking an important part in people's lives. The characteristics of each house differ in terms of interior features such as size, number of rooms, heating system and material quality; and also differ in terms of external features such as parking lot, security, pool, and view. Since all these interior and exterior features come together with different combinations, each house can have different characteristics. This causes house pricing to vary according to space, time and consumer preferences. At this point, it has a special importance to determine the micro and macro determinants of the house prices. While the mentioned interior and exterior features of houses are defined as micro determinants of prices, many other factors such as exchange rate, interest rate, national income, land and environmental conditions are also defined as macro determinants. Therefore, it is necessary to take into account the micro and macro determinants together while evaluating the movements of house prices in a particular region or country. It's

widely accepted that natural hazards are important determinants for house prices. Since they cause damages in houses, they are directly linked to the evaluation of houses. In this context, there are many studies examining this relationship, and their findings are important to shed light on the roots of changes in house prices in many regions and countries.

One of the very first studies about the empirical relationship between earthquakes and house prices is Brookshire et al. (1985). They examined the Californian house market by the help of an expected utility function and found that earthquake risk perception directly affects prices by demand channel. As another study examining house prices in California, Murdoch et al. (1993) found that San Francisco Earthquake decreased the house prices in the region. In forthcoming years, new studies about California have emerged as Beron et al. (1997), Fekrazad (2019), Singh (2019) and Jung & Smith (2022). Also, some other studies were conducted for Oklohoma in USA. Metz et al. (2017), Cheung et al. (2018), Burnett & Mothorpe (2021), Mothorpe & Wyman (2021) and Halkia & Ludwig (2022).

Since Japan is a country with high seismic activity, there emerged many studies about this topic. Kawawaki & Ota (1996) conducted a research for Great Hanshin Earthquake that hit Japan in 1995 and they investigated that it affected hedonic house price index significantly. As some other examples, both Nakagawa et al. (2007) and Naoi et al. (2009) have investigated the earthquake risk and house prices relations in Japan. Hidano et al. (2015) found that if seismic activity is high, then house prices get lower in Tokyo. Seko (2019), Ikefuji et al. (2022) and Kawabata et al. (2022) are other studies investigating earthquake and house prices relationships in Japan.

It seems from the literature that New Zealand and Türkiye are other important countries for earthquake research. Staer & LaCour-Little (2016), Bond & Dermisi (2017), Logan (2017), Huang (2021) and Shi & Naylor (2023) investigated similar results as Canterbury Earthquake decreased the house prices in that region and risk perception changed the movements as time passes. Önder et al. (2004), Keskin (2008), Yayar & Gul (2014), Keskin et. al. (2016), Alas & Ulger (2019), Arslanlı (2020), Ak Çetin & Akpınar (2021) and Er et al. (2023) conducted research for different cities of Türkiye to detect the impacts of large earthquakes on house prices. It seems that main discussion topic in these studies is readiness of Istanbul and other metropolitan cities to expected earthquakes.

Moreover, another branch of the literature has emerged in the historical manner. In this new branch, impacts of human – induced earthquakes on house prices have been analysed. Koster

& van Ommeren (2015) conducted a survey on a wide sample to observe the impacts of earthquakes arised due to the natural gas extraction, on house prices in Netherlands, Gröningen. They underlined that human-induced earthquakes decrease the house prices in that region. There are also some other studies investigating this relationship. Boelhouwer & van der Heijden (2018) and Duran & Elhorst (2023) got the similar results for the same region. Gibbons et al. (2021) conducted a research to analyse the nexus between shale-gas extraction and house prices in United Kingdom. They got similar results as human-induced seismic activity decreases house prices in the region. Lastly, Halkia & Ludwig (2022) analysed the impacts of natural gas extraction impacts on house prices over seismic activity and underlined that these human-induced quakes decrease house prices in Oklahoma.

To sum up, there are numerous studies analyzing earthquakes and house prices relationship for different regions and countries. Empirical findings underline that earthquakes decrease house prices in the relevant region, but increases in neighborhoods. Apart from the fact, risk perception and expectations are important determinants for house prices.

3. SYSTEMATIC LITERATURE REVIEW

Literature review is a qualitative analysis tool to analyse the studies in the related topic. Literature reviews are used widely in social sciences to be able to have an overview about the research topic. In recent years, literature reviews have been enhanced by the emergence of quantitative methods, and systematic reviews and meta analyses have emerged. Systematic analyses have firstly applied in medical sciences and then spread to other scientific fields (Mangas – Vega et al., 2018). Systematic reviews, analyze and synthesize the literature with a systematic and unbiased review. Objectivity is higher in systematic reviews (Kysh, 2021). Moreover, meta-analysis has also developed in medical sciences at the beginning of 1900s and then spread to other scientific fields. Meta-analysis uses mathematical observations and statistical tools to evaluate the literature (Glass, 1976). In this study, firstly a systematic literature review is made and then a meta-analysis is developed. In this manner, the main research question is: “Do earthquakes change house prices?”. In this context, our main hypothesis is that strong earthquakes and expected earthquakes affect house prices. Literature analysis has been conducted in Web of Science and Google Scholar Databases, in order to check the validity of our hypothesis. Time period has been chosen as 1985 – 2023 due to the fact that the first well-known empirical study about the nexus between earthquakes and house prices was conducted in 1985. Totally, 39 studies were included in literature review. The literature review points out that the studies can be distinguished as expectations-based studies and facts-based

studies. Expectations-based studies rely on risk-perception, earthquake expectations and induced purchasing and selling behaviors. However, facts-based studies rely on the occurred earthquakes and their impacts on prices. Table 1 summarizes all studies as to this distinction.

Table 1: Literature Classification as to Expectations and Facts

Expectations-Based Studies	Facts-Based Studies
Brookshire et al. (1985)	Murdoch et al. (1993)
Beron et al. (1997)	Kawawaki & Ota (1996)
Önder et al. (2004)	Keskin (2008)
Nakagawa et al. (2007)	Staer & LaCour-Little (2016)
Naoi et al. (2009)	Bond & Dermisi (2017)
Yayar & Gül (2014)	Metz et al. (2017)
Hidano et al. (2015)	Cheung et al. (2018)
Koster & van Ommeren (2015)	Arslanlı (2020)
Logan (2017)	Gibbons et al. (2021)
Boelhouwer & van der Heijden (2018)	Mothorpe & Wyman (2021)
Fekrazad (2019)	Halkia & Ludwig (2022)
Seko (2019)	Pulido et al. (2022)
Singh (2019)	Jung & Smith (2022)
Alas & Ulger (2019)	Er et al. (2023)
Burnett & Mothorpe (2021)	Duran & Elhorst (2023)
Huang (2021)	
Ak Çetin & Akpınar (2021)	
Modica et al. (2021)	
Ikefuji et al. (2022)	
Kawabata et al. (2022)	
Shi & Naylor (2023)	
Tu et al. (2023)	

Source: Formed by the authors.

The literature can also be classified as to the sample. Table 2 gives the literature from the sample perspective.

Table 2: Literature Classification as to the Sample

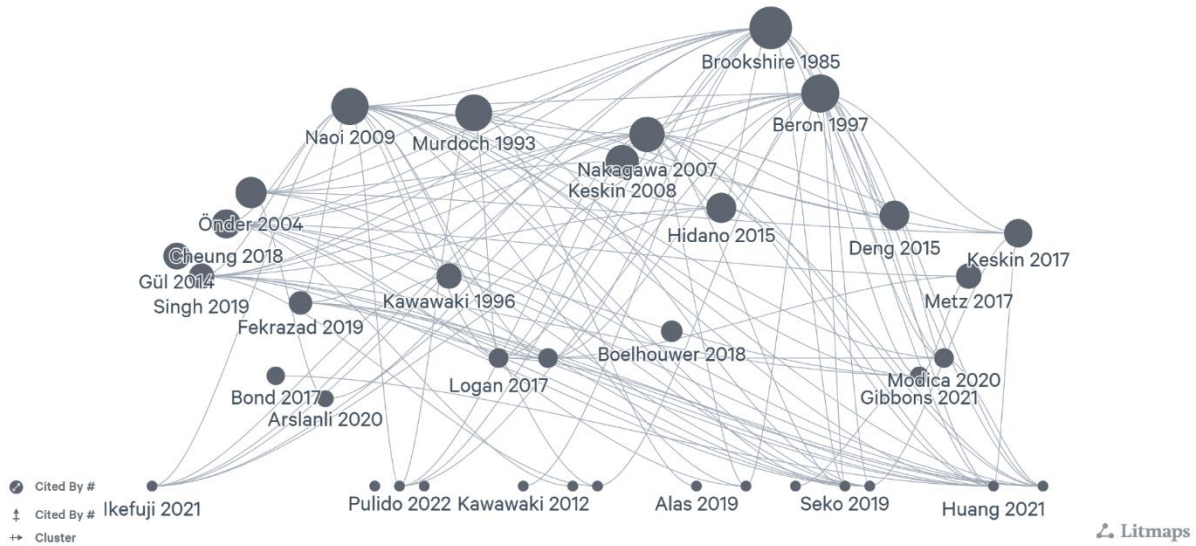
USA	Japan	New Zealand	Netherlands	Türkiye	Other Countries
Brookshire et al. (1985)	Kawawaki & Ota (1996)	Staer & LaCour-Little (2016)	Koster & van Ommeren (2015)	Önder et al. (2004)	Modica et al. (2021)
Murdoch et al. (1993)	Nakagawa et al. (2007)	Bond & Dermisi (2017)	Boelhouver & van der Heijden (2018)	Keskin (2008)	Pulido et al. (2022)
Beron et al. (1997)	Naoi et al. (2009)	Logan (2017)	Duran & Elhorst (2023)	Yayar & Gül (2014)	Tu et al. (2023)
Metz et al. (2017)	Hidano et al. (2015)	Huang (2021)		Keskin et al. (2016)	
Cheung et al. (2018)	Seko (2019)	Shi & Naylor (2023)		Alas & Ülger (2019)	
Fekrazad (2019)	Ikefuji et al. (2022)			Arslanlı (2020)	
Singh (2019)	Kawabata et al. (2022)			Ak Çetin & Akpınar (2021)	
Burnett & Mothorpe (2021)				Er et al. (2023)	
Mothorpe & Wyman (2021)					
Halkia & Ludwig (2022)					
Jung & Smith (2022)					

Source: Formed by the authors.

4. META-ANALYSIS

Meta-analysis is based on mathematical and statistical tools to analyze and understand deeper the literature. In this manner, network graph is an important mathematical tool to show relationships between analyzed studies. These types of graphs rely on mainly reference and citation relationships between studies. Recently, some artificial intelligence tools have emerged to construct such graphs for meta-analyses. Figure 1 has been drawn by using Litmaps application, which is also an artificial intelligence literature mapping tool.

Figure 1: Literature Network Map



Source: Drawn by the authors.

Network scheme points out that first study searching earthquakes and house prices nexus in Brookshire et al. (1985). Since the research field is quite narrow and the number of published studies is still limited, it is seen that the network diagram is based on very dense network relations. Almost all of the studies refer to each other or cite to the majority of the studies in the related field. When examined from a historical perspective, it is seen that the number of studies examining the relationship between earthquake and house prices has increased remarkably especially after 2015. What is more is that the network diagram in Figure 1 is a multi-scaling network diagram. In other words, the diagram does not only show the links between studies but also shows some other facts. First of all, the size of the dots expresses the volume of citations by other studies. Larger dots are the studies getting more citations. Secondly, clustering behaviors through the connections of studies to each other, can be observed from the map. Studies that are close to each other in terms of distance on the scheme are studies that are closer to each other in terms of subject interest.

After examining the network relations in the literature, it's important to analyze the publication scopes. In this context, journal analysis can be helpful to understand the roots of the studies. It seems that 6 studies were published in "Regional Science and Urban Economics". What is more is that "Journal of Urban Economics" published 2 papers; "Journal of Housing

and the Built Environment” published 2 papers; “International Journal of Disaster Risk Reduction” published 2 papers; “Journal of Housing Research” published 2 papers and the rest of the papers was published in different journals. It seems that the journals paying the highest attention on the nexus between earthquakes and house prices are the journals about regional and urban economics.

5. CONCLUSIONS

Earthquakes as one of the strongest and unforeseen natural hazards, have been one of the important determinants of house prices in several countries. However, it’s observed from the related literature that the number of studies are still limited, indicating that earthquakes are underestimated in house price determination processes. Our study tries to shed light on the nexus between earthquakes and house prices by systematic and meta analyses of the related literature. The empirical findings in the related literature validate our hypothesis that earthquakes determine the house prices. However, there are some further findings from the literature. First of all, earthquakes and risk of earthquakes decrease house prices in the relevant geographical area but increase prices in neighborhood regions. So there is a spillover effect on house prices over earthquakes. Secondly, since risk perception can be managed by media tools, house prices can also be managed. Higher risk expectations cause risk-averse behaviors and hence decrease house prices. Lastly, recently human-induced earthquakes caused to decrease house prices in some regions. In this context, it’s important to conduct efficient cost-benefit analyses in terms of house prices, before natural-gas and shale-gas extractions in regions.

Endnote: We dedicate this study to those who lost their lives in the huge earthquake disaster that occurred in Türkiye on February 6, 2023, and their grieving families.

REFERENCES

- Ak Çetin, D. & Akpınar, O. (2021). Seferihisar'da Konut Fiyatlarını Etkileyen Hedonik Model ile Belirlenmesi Araştırması. *İzmir İktisat Dergisi*. 36(1): 43 – 59.
- Alas, B. & Ülger, B. C. (2019). The Impact of Earthquake Risk Upon Housing Prices in the Riverbeds: Istanbul Sample. *Disaster Science and Engineering*. 5(1): 11-31.
- Arslanlı, K. Y. (2020). Analysis of House Prices: A Hedonic Model Proposal for Istanbul Metropolitan Area. *Journal of Design for Resilience in Architecture & Planning*. 1(1): 57 – 68.
- Beron, K. J., Murdoch, J. C., Thayer, M. A. & Vijverberg, W. P. M. (1997). An Analysis of the Housing Market Before and After the 1989 Loma Prieta Earthquake. *Land Economics*. 73(1): 101 – 113.
- Boelhouwer, P. & van der Heijden, H. (2018). The Effect of Earthquakes on the Housing Market and the Quality of Life in the Province of Groningen, the Netherlands. *Journal of Housing and the Built Environment*. 33: 429 – 438.
- Bond, S. & Dermisi, S. (2017). Using GIS to Measure the Impact of the Canterbury Earthquakes on House Prices in Christchurch, NZ. *International Journal of Disaster Resilience in the Built Environment*. 8(2): 123 – 138.
- Brookshire, D. S., Thayer, M. A., Tschirhart, J. & Schulze, W. (1985). A Test of the Expected Utility Model: Evidence from Earthquake Risks. *Journal of Political Economy*. 93(2): 369 – 389.
- Burnett, J. W. & Mothorpe, C. (2021). Human-Induced Earthquakes, Risk Saliency, and Housing Values. *Resource and Energy Economics*. 63 (101212): 1 – 82.
- Cheung, R., Wetherell, D. & Whitaker, S. (2018). Induced Earthquakes and Housing Markets: Evidence from Oklahoma. *Regional Science and Urban Economics*. 69: 153 – 166.
- Deng, G., Gan, L. & Hernandez, M. A. (2015). Do natural disasters cause an excessive fear of heights? Evidence from the Wenchuan earthquake. *Journal of Urban Economics*. 90: 79 – 89.
- Duran, N. & Elhorst, J. P. (2023). Induced Earthquakes and House Prices: The Role of Spatiotemporal and Global Effects. *Journal of Geographical Systems*.
<https://doi.org/10.1007/s10109-022-00403-8>
- Er, M., Özdarıcı-Ok, A. & Nefeslioğlu, H. A. (2023). The Impact of Various Geological Factors on the Real Estate Valuation Using AHP Analysis: Case Studies from Turkey. *Environment, Development and Sustainability*.
<https://doi.org/10.1007/s10668-023-03008-3>
- Fekrazad, A. (2019). Earthquake-Risk Saliency and Housing Prices: Evidence from California.

Journal of Behavioral and Experimental Economics. 78: 104 – 113.

Gibbons, S., Heblich, S. & Timmins, C. (2021). Market Tremors: Shale Gas Exploration, Earthquakes and Their Impact on House Prices. *Journal of Urban Economics*. 122(103313): 1 – 17.

Glass, G. E. (1976). Primary, Secondary and Meta-Analysis of Research. *Educational Researcher*. 5(10).

Halkia, G. & Ludwig, L. G. (2022). Household Earthquake Preparedness in Oklahoma: A Mixed Methods Study of Selected Municipalities. *International Journal of Disaster Risk Reduction*. 73 (102872): 1 – 14.

Hidano, N., Hoshino, T. & Sugiura, A. (2015). The Effect of Seismic Hazard Risk Information on Property Prices: Evidence from a Spatial Regression Discontinuity Design. *Regional Science and Urban Economics*. 53: 113 – 122.

Huang, Y. (2021). Salience of Hazard Disclosure and House Prices: Evidence From Christchurch, New Zealand. *Regional Science and Urban Economics*. 88 (103679): 1 – 24.

Ikefuji, M., Laeven, R. J. A., Magnus, J. R. & Yue, Y. (2022). Earthquake Risk Embedded in Property Prices: Evidence From Five Japanese Cities. *Journal of the American Statistical Association*. 117(537): 82 – 93.

Jung, J. H. & Smith, G. (2022). Earthquakes and Home Prices: The Napa and Ridgecrest Quakes. *Journal of Housing Research*. Online First. 1 – 14.

Kawabata, M., Naoi, M. & Yasuda, S. (2022). Earthquake Risk Reduction and Residential Land Prices in Tokyo. *Journal of Spatial Econometrics*. 3(5): 1 – 21.

Kawawaki, Y. & Ota, M. (1996). The Influence of the Great Hanshin – Awaji Earthquake on the Local Housing Market. *Review of Urban & Regional Development Studies*. 8(2): 220 – 233.

Keskin, B. (2008). Hedonic Analysis of Price in the Istanbul Housing Market. *International Journal of Strategic Property Management*. 12(2): 125 – 138.

Keskin, B., Dunning, R. & Watkins, C. (2016). Modelling the Impact of Earthquake Activity on Real Estate Values: A Multi-Level Approach. *Journal of European Real Estate Research*. 10(1): 73 – 90.

Koster, H. R. A. & van Ommeren, J. (2015). A Shaky Business: Natural Gas Extraction, Earthquakes and House Prices. *European Economic Review*. 80: 120 – 139.

Kysh, L. (2021). “What’s in a name? The difference between a Systematic Review and a Literature Review, and why it matters” University of Southern California - Norris Medical Library. https://guides.libraries.psu.edu/ld.php?content_id=36146097

Logan, C. (2017). Quantifying Changes in Risk Perception Through House Price Differentials Following the Catastrophic Canterbury Earthquake Event. *Pacific Rim Property Research Journal*. 23(1): 51 – 74.

Mangas-Vega, A., Dantas, T., Sánchez-Jara, J. M., & Gómez-Díaz, R. (2018). “Systematic Literature Reviews in Social Sciences and Humanities: A Case Study”, *Journal of Information Technology Research (JITR)*, 11/1, 1-17.

Metz, N. E., Roach, T & Williams, J. A. (2017). The Costs of Induced Seismicity: A Hedonic Analysis. *Economics Letters*. 160: 86 – 90.

Modica, M., Zoboli, R., Meroni, F., Pessina, V., Squarcina, T., & Locati, M. (2021). ‘Near miss’ housing market response to the 2012 northern Italy earthquake: The role of housing quality and risk perception. *Urban Studies*, 58(11), 2293–2309.

Mothorpe, C. & Wyman, D. (2021). What the Frack? The Impact of Seismic Activity on Residential Property Values. *Journal of Housing Research*. 30(1): 34 – 58.

Murdoch, J. C., Singh, H. & Thayer, M. (1993). The Impact of Natural Hazards on Housing Values: The Loma Prieta Earthquake. *Real Estate Economics*. 21(2): 167 – 184.

Nakagawa, M., Saito, M. & Yamaga, H. (2007). Earthquake risk and housing rents: Evidence from the Tokyo Metropolitan Area. *Regional Science and Urban Economics*. 37: 87 – 99.

Naoui, M., Seko, M. & Sumita, K. (2009). Earthquake Risk and Housing Prices in Japan: Evidence Before and After Massive Earthquakes. *Regional Science and Urban Economics*. 39(6): 658 – 669.

Naoui, M., Sumita, K. & Seko, M. (2010). Estimating Consumer Valuation of Earthquake Risk: Evidence from Japanese Housing Markets. *International Real Estate Review*. 13(2): 117 – 133.

Onder, Z., Dökmeci, V. & Keskin, B. (2004). The Impact of Public Perception of Earthquake Risk on Istanbul’s Housing Market. *Journal of Real Estate Literature*, 12(2): 181 – 194.

Pulido, J. A. L., Arias-Martelo, C., Jim´enez-Quiroga, C. I., Soloaga, I., Uribe-Sanchez, M. & Guevara-Sanguin, A. (2022). Short- and mid-term effects of the September 19 Earthquake in Mexico city on the housing market. *International Journal of Disaster Risk Reduction*. 79: 103178.

Seko, M. (2019). Valuation of Earthquake Risk in Housing Markets. *Housing Markets and Household Behavior in Japan*. Ss. 177 – 192.

Shi, S. & Naylor, M. (2023). Perceived Earthquake Risk in Housing Purchases. *Journal of Housing and the Built Environment*. <https://doi.org/10.1007/s10901-023-10012-6>

Singh, R. (2019). Seismic Risk and House Prices: Evidence From Earthquake Fault Zoning. *Regional Science and Urban Economics*. 75: 187 – 209.

Staer, A. & LaCour-Little, M. (2016). Earthquakes and Price Discovery in the Housing Market: Evidence from New Zealand. *International Real Estate Review*. 19(4).

Tu, C-H., Andersson, D. E., Shyr, O.F. & Lin, P-H. (2023). Earthquake Risk, Flooding Risk and Housing Prices: Evidence From Taichung, Taiwan. *Applied Spatial Analysis and Policy*. <https://doi.org/10.1007/s12061-023-09513-2>

Yayar, R. & Gül, D. (2014). Mersin Kent Merkezinde Konut Piyasası Fiyatlarının Hedonik Tahmini. 14(3): 87 – 100.

BİTKİLERDE ABİYOTİK STRESE KARŞI BİTKİ BÜYÜME DÜZENLEYİCİLERİNİN ROLÜ

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ÖZET

Bitkilerin yaşamları boyunca karşı karşıya kaldığı sıcaklık, kuraklık, tuzluluk, ağır metal, ışık, pestisit ve düşük sıcaklık gibi abiyotik stresler faktörleri büyüme ve gelişmelerini olumsuz yönde etkilemektedir. Tarımsal amaçlı ekilebilir arazilerin yaklaşık %90'ında bulunan kültüre alınmış bitkiler, üretim dönemleri boyunca abiyotik stres faktörlerinden bir veya daha fazlasına maruz kalmaktadır. İklim değişikliği temel alınarak oluşturulan ürün verimi modellemelerine göre gelecekte pirinç, buğday ve mısır gibi başlıca bitkilerin üretim verimi düşmeye devam edecek ve gıda güvenliği için ciddi bir tehdit oluşturacaktır. Küresel ortalama sıcaklık değerleri 2100 yılına kadar 2,0–4,9 °C artacak, yağış modellerine göre ise, küresel ısınmanın neden olduğu evapotranspirasyondaki artış nedeniyle kuraklık stresi daha yaygın ve şiddetli hale gelecektir. İklim değişikliğinin sonucu olarak düşük veya yüksek sıcaklık, yetersiz veya gereksiz su kullanımı, yüksek tuzluluk, ağır metaller ve radyasyon gibi abiyotik stres faktörleri, bitki gelişimini tehdit ederek dünya genelinde ürün veriminde düşüşe neden olacaktır. Abiyotik strese maruz kalan bitkiler, moleküler düzeyde yanıt olarak hücrelerde reaktif oksijen türlerini üretir. Bitki büyüme düzenleyici uygulamaları, bitki hücresi için zararlı olan reaktif oksijen üretimini engelleyerek oksidatif stresi önlemeye ve bitki hücrelerinde osmolit birikimini artırmaya yardımcı olur. Transgenik bitkilerde oksidatif strese karşı direnç kazanmasını sağlamak için büyüme düzenleyicilerin biyosentezinde, sinyal yolunu içeren genlerin çalışmasının anlaşılması önemlidir. Bu derleme çalışma ile bu konuda yapılan güncel çalışmalar literatür taraması ile bir araya getirilmiştir.

Anahtar Kelimeler: Abiyotik stres, Bitki Büyüme Düzenleyicileri, Tarımsal üretim, İklim Değişikliği,

**THE ROLE OF PLANT GROWTH REGULATORS AGAINST ABIOTIC STRESS IN
PLANTS**

ABSTRACT

Abiotic stress factors such as heat, drought, salinity, heavy metals, light, pesticides and low temperatures that plants face throughout their lives negatively affect their growth and development. Cultivated plants found in approximately 90% of agricultural arable land are exposed to one or more of the abiotic stress factors during their production period. According to the crop yield models based on climate change, the production yield of major crops such as rice, wheat and corn will continue to decline in the future, posing a serious threat to food security. Global average temperature values will increase by 2.0–4.9 °C by 2100, and according to precipitation models, drought stress will become more widespread and severe due to the increase in evapotranspiration caused by global warming. As a result of climate change, abiotic stresses such as low or high temperature, insufficient or unnecessary water use, high salinity, heavy metals and radiation will threaten plant growth and cause a decrease in crop yields worldwide. Plants exposed to abiotic stress produce reactive oxygen species in cells in response at the molecular level. Plant growth regulator applications help prevent oxidative stress and increase osmolyte accumulation in plant cells by inhibiting the production of reactive oxygen, which is harmful to the plant cell. It is important to understand the operation of genes involved in the signaling pathway in the biosynthesis of growth regulators to enable transgenic plants to acquire resistance to oxidative stress. This review brought together current studies on this subject with a literature review.

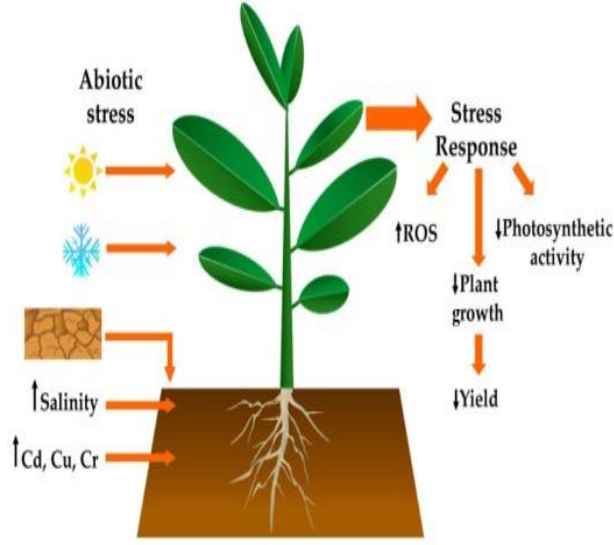
Keywords: Abiotic stress, Plant Growth Regulators, Agricultural production, Climate Change,

1. GİRİŞ

Bitkiler özellikle zirai üretim amaçlı kültüre alınanlar için abiyotik stres faktörleri, verimi sınırlayan bir sorundur (Canter, 2018; Hossain et al., 2022; Zörb et al., 2019). Aşırı sıcaklıklar, kuraklık, sel, tuzluluk ve ağır metal stresine maruz kalma, zirai bitkilerin büyümesi ve verim üzerinde olumsuz bir etkiye sahiptir (Waqas et al., 2017; Zafar et al., 2018). Yeryüzündeki ekilebilir arazilerin yaklaşık %90'nı abiyotik stres faktörlerinin biri veya daha fazlasına karşı hassastır (Reis et al., 2012). İklim değişikliği ve ürün verimi modellerinin entegrasyonuna dayalı tahminlere göre, gelecek yüzyılda pirinç, buğday ve mısır gibi başlıca zirai ürünlerin verimliliği düşmeye devam edecek ve potansiyel olarak gıda güvenliği ve sürdürülebilirliği için ciddi bir tehdit oluşturacaktır (Tigchelaar et al., 2018). Son meta-analiz çalışmasına göre, küresel ortalama sıcaklık 2100 yılına kadar 2,0–4,9 °C artmış olacaktır (Raftery et al., 2017). Küresel ısınmanın neden olduğu evapotranspirasyondaki artış nedeniyle bitkiler üzerinde kuraklık stresi daha yaygın ve şiddetli hale gelmiştir (Dai, 2011). Yapılan matematiksel modellere dayalı tahminlerde iklim değişikliğinin bir sonucu olarak ısınma, kuraklık, sel ve fırtına olaylarının daha sık ve aşırı hale gelmesi, özellikle tropik ve subtropik bölgelerde ürün verimini daha da azalması beklenmektedir. Bu çalışma ile bitkilerin maruz kaldığı abiyotik stres faktörlerine karşı bitki büyüme düzenleyicilerin rolünün anlaşılması ile ilgili yapılan araştırmaları güncel literatür taraması ile bir araya getirmektedir.

2. KURAMSAL TEMELLER

Yüksek veya düşük sıcaklık, yetersiz veya aşırı su, aşırı tuzluluk, ağır metaller ve radyasyon gibi majör abiyotik stresler, bitki gelişimini etkilemekte, dünya genelinde ürün veriminde büyük boyutlarda düşüşe neden olmaktadır (Shao et al., 2015). Kuraklık, ısı, patojen saldırısı, ağır metal, tuzluluk ve radyasyon gibi stresler bitkiler üzerinde olumsuz etki yaratmaktadır (Şekil 1) (Tablo 1) (Wada and Murata, 2007).



Şekil 1 Bitkilerde abiyotik stres faktörleri (Wada and Murata, 2007)

İklim değişikliğinin sonucu olarak zirai ürünlerde, mahsul veriminin azalmasının olumsuz etkilerini azaltmak ve ekonomik tarım uygulamaları için fayda verim analizleri yapılmaktadır. Bu yönde yapılan bilimsel araştırmalar bitkilerin endojenik olarak müdahalelerle abiyotik stres direncinin artırılmasına yönelik hız kazanmıştır (Wang et al., 2016).

Tablo 1. Abiyotik streslerin farklı ana ürünler üzerindeki etkisi (Wada and Murata, 2007)

Başlıca ürünler	Stresler
Nohut	Kuraklık
	Kadmiyum (Cd) toksisitesi
	Bakır (Cu) toksisitesi
Mısır	Kuraklık
	Sıcaklık
	Arsenik (As) metal stresi
Soya fasulyesi	Kuraklık
Buğday	Kuraklık
Pirinç	Kuraklık
	Sıcaklık
Hardal	Kadmiyum (Cd) toksisitesi

2.1. ABİYOTİK STRES FAKTÖRLERİ

2.1.1 Sıcaklık

Bitkiler ısı stresine maruz kaldıklarında, tohum çimlenmesi ve fotosentetik yetenekleri zarar görür, ürün verimleri azalır. Sıcaklık, canlı organizmaların fizyolojik davranışını ve dağılımını, ayrıca bitki büyümesini ve gelişimini etkileyen önemli bir ekolojik faktördür. Optimum sıcaklık değerlerinde, bitkilerin stresli ortamlara karşı fizyolojik, morfolojik, biyokimyasal ve hücrenel olarak en üst düzeyde cevap verdiği bilinmektedir (Basbouss-Serhal et al., 2016; Raza et al., 2020).

Isı stresi bitkilerin büyüme fonksiyonlarını, fizyolojik süreçlerini ve verimleri yönünden olumsuz olarak etkiler (Hasanuzzaman et al., 2012). Oksidatif strese neden olan reaktif oksijen türlerinin (ROS) aşırı üretimi, yüksek sıcaklık stresinin en ciddi sonuçlarından biridir (Hasanuzzaman et al., 2013).

Isı stresi, osmo-protektanların, detoksifiye edici enzimlerin, taşıyıcıların ve düzenleyici proteinlerin ekspresyonunu kontrol eden genlerin ekspresyonunu değiştirir (Chinnusamy et al., 2007). Bitkilerde ısıya en duyarlı fizyolojik süreçlerden biri fotosentezdir (Crafts-Brandner et al., 2002). Yüksek sıcaklıklar, C4 bitkileriyle karşılaştırıldığında, özellikle C3 bitkilerinde, bitkinin fotosentetik kapasitesi üzerinde daha büyük bir etkiye sahiptir (Yang et al., 2006).

Isı stresi, büyüme ve gelişme aşamalarında tüm bitki dokularını etkilerken, üreme dokuları en savunmasız olanlardır. Çiçeklenme döneminde birkaç derecelik sıcaklık artışı tüm bitkinin kaybına neden olabilir (Sato et al., 2006).

Hava sıcaklığındaki 1,5 °C artış, bitkiler üzerinde, çiçeklerin olmaması veya çiçeklerin meyve vermemesine sebep olarak ürün verimi üzerinde önemli seviyede olumsuz etkisi vardır (Maheswari et al., 2012; Warland et al., 2006). Tahıllar (pirinç, buğday, arpa, sorgum ve mısır), baklagiller (nohut, börülce) ve yağlı tohumlar (hardal) dahil olmak üzere birçok zirai ekili ürün, ciddi bir verim düşüşü göstermiştir (Ahamed et al., 2010; Hatfield et al., 2011; Kalra et al., 2008; Tubiello et al., 2007). Sıcaklık stresi, toprak ve hava sıcaklığının, bitki gelişimi ve ilerlemesinde kalıcı hasar meydana getirir (Easterling et al., 2007).

2.1.2. Kuraklık

Bitkiler için, yağışın yetersiz olduğu ve erişilebilir suyun kısıtlı olduğu kuru veya yarı kurak yerlerde, büyük bir tehlikedir ve ürün veriminde düşüşe neden olur (Hussain et al., 2019). Bu duruma bitkiler, büyüme ve gelişim dönemlerinde morfolojisinde değişiklikleri ile farklı şekillerde uyum sağlar. Su kıtlığı ve toprak tuzluluğu, oksidatif, ozmotik ve sıcaklık stresleri köklerdeki su taşınması, suya erişilebilirliği bitkilerin yok olmasına sebep olabilecek boyutlara ulaşabilir. Kuraklığın bitkiler üzerindeki temel etkisi, zayıf çimlenme ve zayıflamış fide oluşumudur. Hasat zamanında ise kuru tane ağırlığının azalması çimlenme ve fide gelişiminin olumsuz sonuçlarının neden olduğu anlaşılmıştır. Kuraklık, hücrelerde mitoz bölünme sayısını ve hücre turgor basıncını düşürür, bu da zayıf gelişime neden olur (Raza et al., 2020).

Kuraklık stresindeki bitkiler savunma olarak sekonder metabolitleri sentezleyerek, büyüme sürecinde daha kısa boylu, küçük ve daha az yaprak, daha az meyve verimi şeklinde uyum sağlamaya çalışır (Tablo 2) (Zafar et al., 2018). Osmo-regülatör süreçler, zar bütünlüğünü korur ve hücreye su akışının yanı sıra şekerler, amonyum bileşikleri, hidrofilik proteinleri ve prolin amino asidini sentezler (Crafts-Brandner et al., 2002; Lobell et al., 2007; Priya et al., 2019; Wang et al., 2016).

Kuraklık stresi, kuraklığın uzunluğuna ve şiddetine bağlı olarak değişen klorofil içeriğinin azalmasına neden olur. Kuraklık, tarımsal ekosistemlerde bitkisel ürün üretimi üzerinde olumsuz bir etkiye sahiptir ve meyveler, tahıllar ve yapraklar dahil olmak üzere ekonomik açıdan değerli bitkilerin büyüme ve gelişme hızını etkiler.

Kurak yıllarda, kahve gibi ticari ürünlerin üretimi sulama yapılmadan %80'e kadar azalmaktadır (DaMatta et al., 2006). Brezilya'nın Parana eyaletinde 2008/2009 hasat döneminde soya fasulyesi üretimi, 45 günlük bir kuraklık döneminde %80 oranında azalmıştır ve aynı bölgede yetişen şeker kamışı, mısır, buğday ve diğer ürünlerinde verim kaybına uğradığı tahmin edilmektedir (Franchini et al., 2009).

Tablo 2. Bazı Abiyotik stres faktörlerinin topraktaki besin elementi alımı açısından bitkiler üzerindeki etkisi(Zafar et al., 2018)

Stres	Etkilenen Süreç	Elementi Alımı Üzerine Etkisi
Kuraklık	Parçalanma yoluyla toprağın yapısının bozulması	Tüm besin elementlerinin azalması
Kuraklık ve ısı	Terleme kaynaklı su kaybı, toprak mikrobiyal faaliyet azalması	Mobil besin elementleri, başta Ca, Mg, Si ve nitratlar, sülfatlar ile başta P ve K olmak üzere ana besin elementleri ve tüm besin elementleri
Sıcaklık	Bitki fenolojisi ve redüktaz aktiviteleri	N, P, K

2.1.3. Tuzluluk

Dünya çapında yaklaşık 45 milyon hektar sulanan arazi tuz stresi altındadır ve 2050 yılına kadar ekilebilir arazilerin yarısından fazlası tuzdan etkilenebilir, bu da tuzluluğu gıda güvenliği için önemli bir sınırlayıcı faktör haline getirir (Munns and Tester, 2008). Tuz stresi, mahsulün büyümesini ve verimini çeşitli şekillerde etkiler. Tuz stresinin mahsul bitkileri üzerinde iki ana etkisi vardır; ozmotik stres ve iyon toksisitesi. Tuzluluk stresi altında toprak çözeltisinde daha fazla tuz olduğundan, bitki hücrelerindeki ozmotik basınç bitki hücrelerindeki ozmotik basıncı aşarak bitkilerin su ve K^+ ve Ca^{+2} gibi mineralleri alma kapasitelerini sınırlar. Tuzluluk stresinin bu birincil etkileri, hücre genişlemesi ve hücre duvarının işlevinin azalması gibi ikincil etkilerle sonuçlanır. Tuz stresi, biyomolekülleri (lipitler, proteinler ve nükleik asitler gibi) yok eden ve redoks homeostazını bozan ROS gelişimini artırır (Kundu et al., 2018)

Bitkiler, morfo-fizyolojik özelliklerin yanı sıra iyonik, biyokimyasal ve moleküler metabolizmalar dahil olmak üzere tuzlu ortamdaki değişiklikleri algılamak, tepki vermek ve bunlara uyum sağlamak için çeşitli mekanizmalar kullanır. Örneğin azalan yaprak bölgesi, yaprak kalınlığının artması, yaprak dökülmesi, kök ve sürgün dengesinin bozulması ve boğum arası uzunlukların azalmasıdır (Sabagh et al., 2020).

Dünya genelinde yaklaşık 800 milyon hektar ekilebilir alanın toprak tuzluluğundan etkilendiği değerlendirilmektedir. Tuzluluk, dünya çapında yaklaşık 45 milyon hektar sulanan arazi tuz baskısı altında olduğundan ve ekilebilir arazinin yarısından fazlası 2050 yılına kadar sürekli olarak tuzdan etkilenebileceğinden, gıda güvenliğini önemli ölçüde kısıtlayıcı bir unsura dönüşmektedir (Hussain et al., 2019; Zhang et al., 2016).

2.1.4 Ağır metal stresi

Madencilik, uyguladığımız tarım yöntemleri ve sanayileşme gibi antropojenik süreçlerin iklim üzerinde uzun vadeli olumsuz etkileri vardır. Toprak, su ve havadaki ağır metal konsantrasyonları bu etki sonucu olarak yükselir. Toprağın ağır metal kirlenmesi, çeşitli çevresel sorunlara neden olur ve hem bitkiler hem de hayvanlar üzerinde zararları vardır. Günümüzün yaygın sanayileşmesi, ağır metalleri biriktirerek toprak ve mahsul verimliliği üzerinde olumsuz olarak etkiler (Shahid et al., 2015). Çinko, bakır, molibden, manganez, kobalt ve nikel gibi ağır metaller bitkilerin yaşamlarında biyolojik süreçler ve gelişimleri için gereklidir (Salla et al., 2011). Bu ağır metallerin miktarı sınır değerleri aştığında, bitkilerde morfolojik ve metabolik bozukluklar görülür ve verimin düşmesine neden olur. Bu anormallikler ayrıca süperoksit anyon radikali (O^{2-}), hidrojen peroksit (H_2O_2) ve hidroksil radikali (OH^-) gibi ROS oluşumuna neden olur ve bu da ürün verimi azalır (Gill and Tuteja, 2010; Pierart et al., 2015; Pourrut et al., 2011).

2.2. ABİYOTİK STRES TOLERANSINDA BİTKİ HORMONLARININ GÖREVİ

Doğal ortamında yetişen bitkiler gibi kültüre alınanlar bitkilerde, büyüme ve gelişim dönemlerinde ürün verimliliğini etkileyen çeşitli abiyotik stres faktörleri ile karşılaşabilir (Erofeeva, 2021; Mokrani et al., 2020). Küresel çapta, iklimsel sapmaların sonuçlarından biri olarak bitkilerin maruz kaldığı abiyotik stresler faktörleri çok yaygınlaşmıştır. Özellikle tropikal ve subtropikal bölgelerin uç bölgelerinde yetişen bitkiler aşırı sıcaklıklar, tuzluluk, sel ve kuraklık, kirlilik ve ağır metal toksisitesi gibi abiyotik strese maruz kalmaktadır. Evrim sürecinde bitkiler, abiyotik faktörlerin neden olduğu olumsuz şartlarla karşı savunma mekanizmaları geliştirmiştir. Bu savaşıma ve adaptasyon mekanizmalarından biri olan bitki hormonları, stresler nedeniyle gelişen olumsuz durumlarda altında, ortama adaptasyon için bitkiler hormonal sinyaller ile tolerans mekanizmalarını çalıştırır (Roychoudhury and Banerjee, 2017).

Genel olarak, bitki büyümesi ve gelişim aşamaları farklı hormonlardan etkilenir. Abiyotik stres durumunda, hormonlar sinyal yolları aracılığıyla bitki tepkilerine öncülük etmektedir (Zhu, 2016). Klasik bitki hormonu olarak bilinen gibberellinler, oksinler, sitokininler ve etilenin, bitki savunmasında ve streslerin hafifletilmesinde temel büyüme sinyalleri gönderdiği bilinmektedir. Bitkiler, çeşitli hormonların birlikte çalışması ile abiyotik streslerle başa çıkar.

2.2.1. Giberellinler

Giberellinler (GA), bitkilerin büyüme dönemlerinde çok yönlü rolleri vardır. GA'nın bitkilerde biyosentezi, gelişimsel ve çevresel uyarılar'a göre gerçekleşir (Hedden, 2020). Etilen ve oksin gibi bazı klasik bitki hormonları, bitkilerde sentezlenen giberellik asit seviyesini etkiler (Yamaguchi, 2008). Bitkilerde abiyotik strese karşı GA'ların rolü bilinmekte ancak abiyotik stresin hafifletilmesi arasındaki ilişki tam olarak anlaşılammıştır (Upreti and Sharma, 2016). Yapılan çalışmalarda tuzluluk abiyotik stresi altındaki bitkilerdeki GA seviyeleri değişkenlik göstermekle beraber, tuzluluğun etkilerini kısmen hafiflettiği, arpa (Abdul-Baki et al., 1970), yulaf (Chauhan et al., 2019), zeytin (Shekafandeh et al., 2017), hint yağı (Rajput et al., 2015), şeker kamışı (Shomeili et al., 2011), keten tohumu (Nasri et al., 2017), kereviz (Aloni and Pressman, 1980), domates (Maggio et al., 2010)'te tespit edilmiştir.

Giberellinler, bitki dokularında tuzluluk stresinin olumsuz etkilerini azaltan bazı fizyolojik ve metabolik aktivitelerin gerçekleşmesini sağlar. NaCl kullanılarak tuzluluk stresine maruz bırakılan Pirinç bitkisinin kontrol grubunda bulunan fidelerinde büyüme baskılanmıştır. GA₃ uygulaması yapılan deney grubunda ise GA₃ seviyesine bağlı olarak büyüme normale yakın olarak devam etmiş, bununla birlikte topraktan fosfor ve kalsiyum alımı artmıştır (Starck and Kozińska, 1980; Wen et al., 2010).

2.2.2. Sitokininler

Sitokininler, hücre bölünmesini ve kloroplast biyogenezi, sürgün farklılaşması, vasküler farklılaşma, yaşlanmayı düzenleme ve pigment oluşumu gibi bitkilerin farklı gelişim süreçlerinde rol oynar. Bitkinin kök bölgesinde ve tohumlarda sentezlenir. Etki edeceği bölge olan sürgünlere taşınarak fizyolojik süreçlere katılır (Terceros et al., 2020).

Abiyotik stres faktörlerin sebep olduğu olumsuz etkilerden hafifletilmesinde sitokininlerin de görev aldığı anlaşılmıştır. Tohum çimlenmesinde abiyotik stres azalttığı, diğer klasik hormonlar olan oksinler ve ABA ile antagonistik veya sinerjistik olarak hareket ederek abiyotik strese karşı tepki verilmesinde etkin rol oynadığı anlaşılmıştır (Rhaman et al., 2020).

Bitkiler abiyotik stres altında iken sitokininlerin konsantrasyonunda değişim görülmektedir. Stres sonrası ise konsantrasyonu normal seviyelere döner. Yapılan çalışmalarda; pirinç (Reguera et al., 2013), buğday (Joshi et al., 2019), elma (Zhou et al., 2004), domates (Pillay and Beyl, 1990), Fransız fasulyesi (Upreti et al., 1997), soğan (Upreti and Murti, 2004) ve üzüm

(Satissha et al., 2005) gibi farklı bitkilerde abiyotik stres altında sitokinin konsantrasyonunda değişiklik olduğu gösterilmiştir.

2.2.3. Oksinler

İndol asetik asit (IAA) olarak da bilinen oksinler, Bitkilerde genel olarak kök büyümesi, tomurcuk oluşumu, vasküler doku farklılaşması, apikal baskınlık ve çiçeklenmeyi sağladığı düşünülmektedir (Sezgin and Kahya, 2018). Abiyotik stres altındaki bitkilerdeki IAA konsantrasyonu, oksin polar taşıyıcı genin ekspresyonu veya polar taşımadaki inhibisyonlarla değiştirilir (Korver et al., 2018).

Streste, IAA'nın oksidatif bozunması, ROS üretimi dahil olmak üzere gerçekleşir (Pasternak et al., 2005). Tuzluluk stresi altında, pirinçte (Prakash and Prathapasanen, 1990), domateste (Dunlap and Binzel, 1996) ve buğdayda (Sakhabutdinova et al., 2003) IAA seviyesi azalır.

Tuzluluk stresinde oksin uygulamasıyla buğdayın tohum çimlenmesindeki stresin baskılayıcı etkisi giderilmiştir (Afzal et al., 2005). Kırmızıbiberde IAA'nın uygulanması, sıcaklık stresinin etkilerini azaltmıştır (Upreti et al., 2012) Ayrıca Oksinler soğuk stresıyla mücadelede de etkilidir (Du et al., 2013). Araştırmalar, oksinin abiyotik stres koşulları altında çeşitli fizyolojik ve metabolik aktiviteleri ve gelişimsel genleri değiştirmede hayati önem taşıdığını ortaya koymuştur (Wei et al., 2019).

2.2.4. Etilen

Etilen, tohum çimlenmesi, kök oluşumu, çiçeklenme ve tozlaşma, dökülme ve yaşlanma ve meyve olgunlaşması gibi bitkilerin çeşitli fizyolojik işlemlerini ayarlayan gaz formunda fitohormondur (Dubois et al., 2018). Strese duyarlı bir hormon olarak da bilinir. Etilen, iki enzimin, yani ACC sentaz ve ACC oksidazın katılımıyla metiyoninin etilene dönüştürülmesi yoluyla biyosentezlenir (Yang and Hoffman, 1984).

Stres koşullarında, yaprak ve meyvelerin büyüme geriliğini ve yaşlanmasını artıran etilen konsantrasyonu artar ve böylece bitkilerden su kaybı azalır (Upreti and Sharma, 2016). Yapılan çalışmalarda; portakal (Ben-Yehoshua and Aloni, 1974), bakla (El-Beltagy and Hall, 1974), Fransız fasulyesi (Upreti et al., 1997) ve diğer mahsullerde stres koşulları altında etilenin arttığını ortaya koymuştur. Aşırı sulama kaynaklı hipoksi, ovalarda kültüre alınan bitkiler için yaygın bir strestir. Araştırmacılar; arpa (Larsen et al.,1986), soya fasulyesi (Bacanamwo and Purcell, 1999), bezelye (Gladish et al., 2006), mısır (He et al., 1994), buğday (Yamauchi et al., 2014) ve sünger kabağı (Vidoz et al., 2010)'nın su kaynaklı hipoksi durumunda kök gelişiminin

arttığını bulmuşlardır. Tuzluluk stresinde tolerans tepkileri büyük ölçüde bitki türüne bağlı olarak değişmektedir (Riyazuddin et al., 2020). Düşük sıcaklık stresinde, bitkiler etilen seviyelerini artırır, buna bağlı toleransı artar (Zhao et al., 2014).

3. SONUÇ

Abiyotik strese maruz kalan bitki hücrelerinde oksidatif strese neden olan reaktif oksijen türleri (ROS) aşırı birikmekte, bu birikim bitkilerin fizyo-biyokimyasal süreçlerinin normal işleyişini aksatarak büyüme ve gelişimi engellemektedir. Bitkiler, abiyotik streslerin neden olduğu olumsuz koşullara karşı büyüme düzenleyicileri (jasmonatlar, salisilatlar, brassinosteroidler (BR'ler), nitrik oksit (NO), poliaminler, glisin-betain, oligosakkaritler, strigolaktonlar (SL'ler) vb) sentezler. Bu büyüme düzenleyicilerin yanı sıra, prolin, glisin-betain, poliaminler ve çeşitli şekerler (örn. mannitol, sorbitol, galaktinol, vb.), abiyotik streslere bitki adaptasyonunda önemli role sahiptir.

Diğer canlıların aksine hareket yeteneğine sahip olmayan bitkiler buldukları ortamlarda aşırı soğuk, aşırı sıcak, su fazlalığı ve kıtlığı, tuzluluk, ağır metal stresi gibi nesillerinin devamını etkileyecek düzeylere ulaşabilen olumsuz şartlarda hayatta kalmalarının arkasındaki biyolojik süreçlerin anlaşılması, artan dünya nüfusu, ekolojik ve çeşitli nedenlerle kültüre alınan bitkilerin ekili alanlarının zarar görmesinin önlenmesi, insanlığın güvenli ve sürdürülebilir gıdaya erişiminde büyük bir önem arz etmektedir.

Kültüre aldığımız ve beslenme amacıyla kullandığımız bitkilerden birim alanda en fazla verim almak, fayda/maliyet anlamında sürdürülebilir gıda temini sağlamak için doğal koşullarında bitkilerin hayatta kalma mekanizmalarını anlamak önemlidir. Bu derleme ile bir araya getirilen abiyotik strese yanıt olarak bitkilerde sentezlenen Bitki büyüme düzenleyicilerin işleyiş mekanizmalarını araştıran çalışmalar bunun önemi bir kez daha ortaya koymaktadır.

4.KAYNAKLAR

- Abdul-Baki, A. A., Anderson, J. D. (1970). Viability and Leaching of Sugars from Germinating Barley 1. *Crop science*, 10(1), 31-34.
- Afzal, I., Basra, S. A., Iqbal, A. (2005). The effects of seed soaking with plant growth regulators on seedling vigor of wheat under salinity stress. *Journal of Stress Physiology Biochemistry*, 1(1), 6-15.
- Ahamed, K.-U., Nahar, K., Fujita, M., Hasanuzzaman, M. (2010). Variation in plant growth, tiller dynamics and yield components of wheat (*Triticum aestivum* L.) due to high temperature stress. *Advances in Agriculture Botany*, 2(3), 213-224.
- Aloni, B., Pressman, E. (1980). Interaction with salinity of GA₃-induced leaf elongation, petiole pithiness and bolting in celery. *Scientia horticulturae*, 13(2), 135-142.
- Bacanamwo, M., Purcell, L. C. (1999). Soybean root morphological and anatomical traits associated with acclimation to flooding. *Crop science*, 39(1), 143-149.
- Basbous-Serhal, I., Leymarie, J., Bailly, C. (2016). Fluctuation of Arabidopsis seed dormancy with relative humidity and temperature during dry storage. *Journal of Experimental Botany*, 67(1), 119-130.
- Ben-Yehoshua, S., Aloni, B. (1974). Effect of water stress on ethylene production by detached leaves of Valencia orange (*Citrus sinensis* Osbeck). *Plant physiology*, 53(6), 863-865.
- Canter, L. W. (2018). *Environmental impact of agricultural production activities*: CRC Press.
- Chauhan, A., AbuAmarah, B. A., Kumar, A., Verma, J., Ghramh, H. A., Khan, K. A., Ansari, M. J. (2019). Influence of gibberellic acid and different salt concentrations on germination percentage and physiological parameters of oat cultivars. *Saudi journal of biological sciences*, 26(6), 1298-1304.
- Chinnusamy, V., Zhu, J., Zhou, T., Zhu, J.-K. (2007). Small RNAs: big role in abiotic stress tolerance of plants. *Advances in molecular breeding toward drought and salt tolerant crops*, 223-260.
- Crafts-Brandner, S. J., Salvucci, M. E. (2002). Sensitivity of photosynthesis in a C₄ plant, maize, to heat stress. *Plant physiology*, 129(4), 1773-1780.
- Dai, A. (2011). Drought under global warming: a review. *Wiley Interdisciplinary Reviews: Climate Change*, 2(1), 45-65.
- DaMatta, F. M., Ramalho, J. D. C. (2006). Impacts of drought and temperature stress on coffee physiology and production: a review. *Brazilian Journal of Plant Physiology*, 18, 55-81.
- Du, H., Wu, N., Chang, Y., Li, X., Xiao, J., Xiong, L. (2013). Carotenoid deficiency impairs ABA and IAA biosynthesis and differentially affects drought and cold tolerance in rice. *Plant molecular biology*, 83, 475-488.
- Dubois, M., Van den Broeck, L., Inzé, D. (2018). The pivotal role of ethylene in plant growth. *Trends in plant science*, 23(4), 311-323.
- Dunlap, J. R., Binzel, M. L. (1996). NaCl reduces indole-3-acetic acid levels in the roots of tomato plants independent of stress-induced abscisic acid. *Plant physiology*, 112(1), 379-384.
- Easterling, W. E., Aggarwal, P. K., Batima, P., Brander, K. M., Erda, L., Howden, S. M., Schmidhuber, J. (2007). Food, fibre and forest products. *Climate change, 2007*, 273-313.
- El-Beltagy, A., Hall, M. (1974). Effect of water stress upon endogenous ethylene levels in *Vicia faba*. *New Phytologist*, 73(1), 47-60.
- Erofeeva, E. A. (2021). Plant hormesis and Shelford's tolerance law curve. *Journal of Forestry Research*, 32, 1789-1802.

- Franchini, J. C., Debiassi, H., Sacoman, A., Nepomuceno, A. L., Farias, J. R. B. (2009). *Manejo do solo para redução das perdas de produtividade pela seca*: Embrapa Soja Londrina.
- Gill, S. S., Tuteja, N. (2010). Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. *Plant Physiology and Biochemistry*, 48(12), 909-930.
- Gladish, D. K., Xu, J., Niki, T. (2006). Apoptosis-like programmed cell death occurs in procambium and ground meristem of pea (*Pisum sativum*) root tips exposed to sudden flooding. *Annals of botany*, 97(5), 895-902.
- Hasanuzzaman, M., Hossain, M. A., da Silva, J. A. T., Fujita, M. (2012). Plant response and tolerance to abiotic oxidative stress: antioxidant defense is a key factor. *Crop stress and its management: perspectives and strategies*, 261-315.
- Hasanuzzaman, M., Nahar, K., Fujita, M. (2013). Extreme temperature responses, oxidative stress and antioxidant defense in plants. *Abiotic stress-plant responses and applications in agriculture*, 13, 169-205.
- Hatfield, J. L., Boote, K. J., Kimball, B. A., Ziska, L., Izaurralde, R. C., Ort, D., Wolfe, D. (2011). Climate impacts on agriculture: implications for crop production. *Agronomy journal*, 103(2), 351-370.
- He, C.-J., Drew, M. C., Morgan, P. W. (1994). Induction of enzymes associated with lysigenous aerenchyma formation in roots of *Zea mays* during hypoxia or nitrogen starvation. *Plant physiology*, 105(3), 861-865.
- Hedden, P. (2020). The current status of research on gibberellin biosynthesis. *Plant and Cell Physiology*, 61(11), 1832-1849.
- Hossain, A., Pamanick, B., Venugopalan, V. K., Ibrahimova, U., Rahman, M. A., Siyal, A. L., Aftab, T. (2022). Chapter 1 - Emerging roles of plant growth regulators for plants adaptation to abiotic stress-induced oxidative stress. In T. Aftab M. Naeem (Eds.), *Emerging Plant Growth Regulators in Agriculture* (pp. 1-72): Academic Press.
- Hussain, H. A., Men, S., Hussain, S., Chen, Y., Ali, S., Zhang, S., Liao, C. (2019). Interactive effects of drought and heat stresses on morpho-physiological attributes, yield, nutrient uptake and oxidative status in maize hybrids. *Scientific Reports*, 9(1), 3890.
- Joshi, S., Choukimath, A., Isenegger, D., Panozzo, J., Spangenberg, G., Kant, S. (2019). Improved wheat growth and yield by delayed leaf senescence using developmentally regulated expression of a cytokinin biosynthesis gene. *Frontiers in plant science*, 10, 1285.
- Kalra, N., Chakraborty, D., Sharma, A., Rai, H., Jolly, M., Chander, S., Mittal, R. (2008). Effect of increasing temperature on yield of some winter crops in northwest India. *Current Science*, 82-88.
- Korver, R. A., Koevoets, I. T., Testerink, C. (2018). Out of shape during stress: a key role for auxin. *Trends in plant science*, 23(9), 783-793.
- Kundu, P., Gill, R., Ahlawat, S., Anjum, N. A., Sharma, K. K., Ansari, A. A., Tuteja, N. (2018). Targeting the redox regulatory mechanisms for abiotic stress tolerance in crops. In *Biochemical, physiological and molecular avenues for combating abiotic stress tolerance in plants* (pp. 151-220): Elsevier.
- Larsen, O., Nilsen, H.-G., Aarnes, H. (1986). Response of young barley plants to waterlogging, as related to concentration of ethylene and ethane. *Journal of plant physiology*, 122(4), 365-372.
- Lobell, D. B., Field, C. B. (2007). Global scale climate-crop yield relationships and the impacts of recent warming. *Environmental research letters*, 2(1), 014002.
- Maggio, A., Barbieri, G., Raimondi, G., De Pascale, S. (2010). Contrasting effects of GA 3 treatments on tomato plants exposed to increasing salinity. *Journal of Plant Growth Regulation*, 29, 63-72.

- Maheswari, M., Yadav, S., Shanker, A. K., Kumar, M. A., Venkateswarlu, B. (2012). Overview of plant stresses: Mechanisms, adaptations and research pursuit. *Crop stress and its management: perspectives and strategies*, 1-18.
- Mokrani, S., Nabti, E.-h., Cruz, C. (2020). Current advances in plant growth promoting bacteria alleviating salt stress for sustainable agriculture. *Applied Sciences*, 10(20), 7025.
- Munns, R., Tester, M. (2008). Mechanisms of salinity tolerance. *Annu. Rev. Plant Biol.*, 59, 651-681.
- Nasri, N., Maatallah, S., Saidi, I., Lachaâl, M. (2017). Influence of salinity on germination, seedling growth, ion content and acid phosphatase activities of *Linum usitatissimum* L. *JAPS: Journal of Animal Plant Sciences*, 27(2).
- Pasternak, T., Potters, G., Caubergs, R., Jansen, M. A. (2005). Complementary interactions between oxidative stress and auxins control plant growth responses at plant, organ, and cellular level. *Journal of Experimental Botany*, 56(418), 1991-2001.
- Pierart, A., Shahid, M., Sejalon-Delmas, N., Dumat, C. (2015). Antimony bioavailability: knowledge and research perspectives for sustainable agricultures. *Journal of hazardous materials*, 289, 219-234.
- Pillay, I., Beyl, C. (1990). Early responses of drought-resistant and-susceptible tomato plants subjected to water stress. *Journal of Plant Growth Regulation*, 9, 213-219.
- Pourrut, B., Jean, S., Silvestre, J., Pinelli, E. (2011). Lead-induced DNA damage in *Vicia faba* root cells: potential involvement of oxidative stress. *Mutation Research/Genetic Toxicology and Environmental Mutagenesis*, 726(2), 123-128.
- Prakash, L., Prathapasanan, G. (1990). NaCl- and gibberellic acid-induced changes in the content of auxin and the activities of cellulase and pectin lyase during leaf growth in rice (*Oryza sativa*). *Annals of botany*, 65(3), 251-257.
- Priya, M., Sharma, L., Kaur, R., Bindumadhava, H., Nair, R. M., Siddique, K., Nayyar, H. (2019). GABA (γ -aminobutyric acid), as a thermo-protectant, to improve the reproductive function of heat-stressed mungbean plants. *Scientific Reports*, 9(1), 7788.
- Raftery, A. E., Zimmer, A., Frierson, D. M., Startz, R., Liu, P. (2017). Less than 2 C warming by 2100 unlikely. *Nature climate change*, 7(9), 637-641.
- Rajput, N., Kumar, A., Chaudhry, A. (2015). Effects of NaCl stress on seed germination and early seedling growth of castor bean (*Ricinus communis* L.). *Int. J. Sci. Res*, 11, 104-107.
- Raza, A., Ashraf, F., Zou, X., Zhang, X., Tosif, H. (2020). Plant adaptation and tolerance to environmental stresses: mechanisms and perspectives. *Plant Ecophysiology and Adaptation under Climate Change: Mechanisms and Perspectives I: General Consequences and Plant Responses*, 117-145.
- Reguera, M., Peleg, Z., Abdel-Tawab, Y. M., Tumimbang, E. B., Delatorre, C. A., Blumwald, E. (2013). Stress-induced cytokinin synthesis increases drought tolerance through the coordinated regulation of carbon and nitrogen assimilation in rice. *Plant physiology*, 163(4), 1609-1622.
- Reis, S. P. d., Lima, A. M., De Souza, C. R. B. (2012). Recent molecular advances on downstream plant responses to abiotic stress. *International Journal of Molecular Sciences*, 13(7), 8628-8647.
- Rhaman, M. S., Imran, S., Rauf, F., Khatun, M., Baskin, C. C., Murata, Y., Hasanuzzaman, M. (2020). Seed priming with phytohormones: An effective approach for the mitigation of abiotic stress. *Plants*, 10(1), 37.
- Riyazuddin, R., Verma, R., Singh, K., Nisha, N., Keisham, M., Bhati, K. K., Gupta, R. (2020). Ethylene: A master regulator of salinity stress tolerance in plants. *Biomolecules*, 10(6), 959.

- Roychoudhury, A., Banerjee, A. (2017). Abscisic acid signaling and involvement of mitogen activated protein kinases and calcium-dependent protein kinases during plant abiotic stress. *Mechanism of plant hormone signaling under stress, 1*, 197-241.
- Sabagh, A. E., Hossain, A., Islam, M. S., Iqbal, M. A., Raza, A., Karademir, Ç., Singhal, R. K. (2020). Elevated CO₂ concentration improves heat-tolerant ability in crops. In *Abiotic stress in plants: IntechOpen*.
- Sakhabutdinova, A., Fatkhutdinova, D., Bezrukova, M., Shakirova, F. (2003). Salicylic acid prevents the damaging action of stress factors on wheat plants. *Bulg J Plant Physiol, 21*, 314-319.
- Salla, V., Hardaway, C. J., Sneddon, J. (2011). Preliminary investigation of *Spartina alterniflora* for phytoextraction of selected heavy metals in soils from Southwest Louisiana. *Microchemical Journal, 97*(2), 207-212.
- Satisha, J., Prakash, G., Murti, G., Upreti, K. (2005). Response of grape genotypes to water deficit: Root, shoot, growth and endogenous hormones. *Indian journal of plant physiology, 10*(3), 225.
- Sato, S., Kamiyama, M., Iwata, T., Makita, N., Furukawa, H., Ikeda, H. (2006). Moderate increase of mean daily temperature adversely affects fruit set of *Lycopersicon esculentum* by disrupting specific physiological processes in male reproductive development. *Annals of botany, 97*(5), 731-738.
- Sezgin, M., Kahya, M. (2018). Phytohormones. *Bitlis Eren University Journal of Science and Technology, 8*(1), 35-39.
- Shahid, M., Khalid, S., Abbas, G., Shahid, N., Nadeem, M., Sabir, M., Dumat, C. (2015). Heavy metal stress and crop productivity. *Crop production and global environmental issues, 1*-25.
- Shao, H., Wang, H., Tang, X. (2015). NAC transcription factors in plant multiple abiotic stress responses: progress and prospects. *Frontiers in plant science, 6*, 902.
- Shekafandeh, A., Sirooenejad, S., Alsmoushtaghi, E. (2017). Influence of gibberellin on increasing of sodium chloride tolerance via some morpho-physiological changes in two olive cultivars. *Agriculturae Conspectus Scientificus, 82*(4), 367-373.
- Shomeili, M., Nabipour, M., Meskarbashee, M., Memari, H. R. (2011). Effects of gibberellic acid on sugarcane plants exposed to salinity under a hydroponic system. *African Journal of Plant Science, 5*(10), 609-616.
- Starck, Z., Kozińska, M. (1980). Effect of phytohormones on absorption and distribution of ions in salt-stressed bean plants. *Acta Societatis Botanicorum Poloniae, 49*(1-2), 111-125.
- Terceros, G. C., Resentini, F., Cucinotta, M., Manrique, S., Colombo, L., Mendes, M. A. (2020). The importance of cytokinins during reproductive development in *Arabidopsis* and beyond. *International Journal of Molecular Sciences, 21*(21), 8161.
- Tigchelaar, M., Battisti, D. S., Naylor, R. L., Ray, D. K. (2018). Future warming increases probability of globally synchronized maize production shocks. *Proceedings of the National Academy of Sciences, 115*(26), 6644-6649.
- Tubiello, F. N., Soussana, J.-F., Howden, S. M. (2007). Crop and pasture response to climate change. *Proceedings of the National Academy of Sciences, 104*(50), 19686-19690.
- Upreti, K., Murti, G. (2004). Effects of brassinosteroids on growth, nodulation, phytohormone content and nitrogenase activity in French bean under water stress. *Biologia plantarum, 48*, 407-411.
- Upreti, K., Murti, G., Bhatt, R. (1997). Response of French bean cultivars to water deficits: changes in endogenous hormones, proline and chlorophyll. *Biologia plantarum, 40*, 381-388.

- Upreti, K., Sharma, M. (2016). Role of plant growth regulators in abiotic stress tolerance. *Abiotic stress physiology of horticultural crops*, 19-46.
- Upreti, K., Srinivasa Rao, N., Jayaram, H. (2012). Floral abscission in capsicum under high temperature: role of endogenous hormones and polyamines. *Indian J Plant Physiol*, 17, 207-214.
- Vidoz, M. L., Loreti, E., Mensuali, A., Alpi, A., Perata, P. (2010). Hormonal interplay during adventitious root formation in flooded tomato plants. *The Plant Journal*, 63(4), 551-562.
- Wada, H., Murata, N. (2007). The essential role of phosphatidylglycerol in photosynthesis. *Photosynthesis Research*, 92, 205-215.
- Wang, F., Guo, Z., Li, H., Wang, M., Onac, E., Zhou, J., Zhou, Y. (2016). Phytochrome A and B function antagonistically to regulate cold tolerance via abscisic acid-dependent jasmonate signaling. *Plant physiology*, 170(1), 459-471.
- Waqas, M. A., Khan, I., Akhter, M. J., Noor, M. A., Ashraf, U. (2017). Exogenous application of plant growth regulators (PGRs) induces chilling tolerance in short-duration hybrid maize. *Environmental Science and Pollution Research*, 24, 11459-11471.
- Warland, J., McDonald, M., McKeown, A. (2006). Annual yields of five crops in the family Brassicaceae in southern Ontario in relation to weather and climate. *Can. J. Plant Sci*, 86, 1209-1215.
- Wei, K., Ruan, L., Wang, L., Cheng, H. (2019). Auxin-induced adventitious root formation in nodal cuttings of *Camellia sinensis*. *International Journal of Molecular Sciences*, 20(19), 4817.
- Wen, F.-p., Zhang, Z.-h., Bai, T., Xu, Q., Pan, Y.-h. (2010). Proteomics reveals the effects of gibberellic acid (GA3) on salt-stressed rice (*Oryza sativa* L.) shoots. *Plant Science*, 178(2), 170-175.
- Yamaguchi, S. (2008). Gibberellin metabolism and its regulation. *Annu. Rev. Plant Biol.*, 59, 225-251.
- Yamauchi, T., Watanabe, K., Fukazawa, A., Mori, H., Abe, F., Kawaguchi, K., Nakazono, M. (2014). Ethylene and reactive oxygen species are involved in root aerenchyma formation and adaptation of wheat seedlings to oxygen-deficient conditions. *Journal of Experimental Botany*, 65(1), 261-273.
- Yang, S. F., Hoffman, N. E. (1984). Ethylene biosynthesis and its regulation in higher plants. *Annual review of plant physiology*, 35(1), 155-189.
- Yang, X., Chen, X., Ge, Q., Li, B., Tong, Y., Zhang, A., Lu, C. (2006). Tolerance of photosynthesis to photoinhibition, high temperature and drought stress in flag leaves of wheat: A comparison between a hybridization line and its parents grown under field conditions. *Plant Science*, 171(3), 389-397.
- Zafar, S. A., Noor, M. A., Waqas, M. A., Wang, X., Shaheen, T., Raza, M., Rahman, M. (2018). Temperature extremes in cotton production and mitigation strategies. *Past, present and future trends in cotton breeding*, 4, 65-91.
- Zhang, X., Hirsch, C. N., Sekhon, R. S., De Leon, N., Kaeppler, S. M. (2016). Evidence for maternal control of seed size in maize from phenotypic and transcriptional analysis. *Journal of Experimental Botany*, 67(6), 1907-1917.

- Zhao, M., Liu, W., Xia, X., Wang, T., Zhang, W. H. (2014). Cold acclimation-induced freezing tolerance of *Medicago truncatula* seedlings is negatively regulated by ethylene. *Physiologia plantarum*, 152(1), 115-129.
- Zhou, R., Cutler, A. J., Ambrose, S. J., Galka, M. M., Nelson, K. M., Squires, T. M., Taylor, D. C. (2004). A new abscisic acid catabolic pathway. *Plant physiology*, 134(1), 361-369.
- Zhu, J.-K. (2016). Abiotic stress signaling and responses in plants. *Cell*, 167(2), 313-324.
- Zörb, C., Geilfus, C. M., Dietz, K. J. (2019). Salinity and crop yield. *Plant biology*, 21, 31-38.

BITKİ STREOİD HORMONU: BRASSİNOSTEROİDLER

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ÖZET

Bitki yapısında sentezlenen, hücreler ve dokularda büyüme, gelişme ile yaşamsal faaliyetleri düzenleyen, organik veya inorganik maddelere bitki büyüme düzenleyicileri (BBD) ya da fitohormonlar denilmektedir. Bu düzenleyici maddeler bitkilerin ilgili bölgelerinde sentezlenerek büyüme, gelişme ve diğer fizyolojik olayları tek başına ya da karşılıklı olarak etkileyebilen, meydana geldikleri dokuda etkin olabildikleri gibi taşıma sistemi ile bitkinin ilgili bölgesine taşınabilen ve bu etkinliğini burada da gösterebilen maddelerdir. Fitohormonlar büyümeyi düzenleyici, gelişmeyi teşvik edici ve baskılayıcı (engelleyici) olmak üzere üç gruba ayrılmaktadır. Büyümeyi teşvik eden hormonlar grubundan olan ve klasik beşli olarak adlandırılan Oksin, Sitokin, Absisik Asit, Giberellinler ve Etilen'e ek olarak altıncı grup olan Brassinosteroidler, bitkiler tarafından endojenik olarak sentezlenebilen steroid yapısındaki altıncı grup bitki hormon grubudur. Steroid yapıdaki hormonlar, hayvanların embriyonik gelişimi ile yetişkin homeostasisi açısından çok önemli olduğu kadar, bitkilerde hormonların yapısında görev almaktadırlar. Bitkiler bu amaçla bol miktarda steroid ve sterol üretmektedir. Brassinosteroidler (BR) büyümeyi teşvik eden bitki steroidleridir. Bazı polen ekstraktlarının büyümeyi teşvik edici özellikleri BR'lerin araştırılmasına yön vermiştir. Yapılan çalışmalarda, *Brassica napus* (kolza) polenlerinden elde ettikleri ekstraktın fasulye internodlarında uzamaya sebep olduğunu gözlemlemiş ve yaklaşık 60 farklı bitkinin polenlerinden elde edilen ekstraktların test edilmesi sonucu, bitkilerde büyümeyi teşvik ettikleri anlaşılmıştır. Bu özelliği nedeniyle Brassinosteroid'lerin bitki hormonlarının yeni bir sınıfı olarak kabul edilmiştir. Bu derleme ile yapılan çalışmalara ait güncel literatür bir araya getirilmiştir.

Anahtar Kelimeler: Brassinosteroidler, Bitki Büyüme Düzenleyiciler, Fitohormonlar

PLANT STEROID HORMONE: BRASSINOSTEROIDS

ABSTRACT

Organic or inorganic substances synthesized in the plant structure, regulating growth, development and vital activities in cells and tissues are called plant growth regulators (PGR) or phytohormones. These regulatory substances are that can be synthesized in the relevant parts of the plants and affect growth, development and other physiological events alone or mutually, can be effective in the tissue where they occur, or can be carried to the relevant region of the plant by the transport system and can show this activity here as well. Phytohormones are divided into three groups: growth-regulating, development-promoting and suppressive (inhibitory). Brassinosteroids, which are the sixth group in addition to Auxin, Cytokine, Abscisic Acid, Gibberellins and Ethylene, which are from the growth promoting hormones group and called the classical quintet, are the sixth group of plant hormones in the steroid structure that can be synthesized endogenously by plants. Hormones in steroid structure are very important for the embryonic development of animals and adult homeostasis, as well as taking part in the structure of hormones in plants. Plants produce a large amount of steroids and sterols for this purpose. Brassinosteroids (BR) are plant steroids that promote growth. The growth-promoting properties of some pollen extracts have guided the search for BRs. In the studies, it was observed that the extracts obtained from *Brassica napus* (rapeseed) pollen caused elongation in bean internodes, and as a result of testing the extracts obtained from the pollen of about 60 different plants, it was understood that they stimulated growth in plants. Because of this feature, Brassinosteroids have been accepted as a new class of plant hormones. In this review, the current literature of the studies has been brought together.

Keywords: Brassinosteroids, Plant Growth Regulators, Phytohormones

1. GİRİŞ

Bitki yapısında sentezlenen, hücreler ve dokularda büyüme, gelişme ile yaşamsal faaliyetleri düzenleyen, organik veya inorganik maddelere bitki büyüme düzenleyicileri (BBD) diğer bir ifade ile fitohormonlar denilmektedir. Bu düzenleyici maddeler bitkilerin ilgili bölgelerinde sentezlenerek; büyüme, gelişme ve diğer fizyolojik olayları tek başına ya da karşılıklı olarak etkileyebilen, meydana geldikleri dokuda etkin olabildikleri gibi taşıma sistemi ile bitkinin ilgili bölgesine taşınabilen ve bu etkinliğini burada da gösterebilen maddelerdir (Kumlay ve Eryiğit 2011, Sezgin ve Kahya 2018).

Fitohormonlar büyüme düzenleyici, gelişmeyi teşvik edici ve baskılayıcı (engelleyici) olmak üzere üç gruba ayrılmaktadır. Büyümeyi teşvik eden hormonlar grubundan olan ve klasik beşli olarak adlandırılan Oksin, Sitokin, Absisik Asit, Giberellinler ve Etilen'e ek olarak altıncı grup olan Brassinosteroidler, bitkiler tarafından endojenik olarak sentezlenebilen steroid yapısında altıncı grup bitki hormon grubudur. Steroid yapıdaki hormonlar, hayvanların embriyonik gelişimi ile yetişkin homeostasisi açısından çok önemli olduğu kadar (Evans 1988), bitkilerde hormonların yapısında görev almaktadırlar. Bitkiler bu amaçla bol miktarda steroid ve sterol üretmektedir (Geuns 1978, Jones and Roddick 1988).

Brassinosteroidler (BR) büyüme teşvik eden bitki steroidleridir (Müssig 2005). Bazı polen ekstraktlarının büyüme teşvik edici özellikleri BR'lerin araştırılmasına yönelik çalışmaları hızlandırmıştır. Yapılan öncü çalışmalardan biri Mitchell et.al (1970) tarafından *Brassica napus* (kolza) polenlerinden elde ettikleri ekstraktın fasulye internodlarında uzamaya sebep olduğunu gözlemlemiştir. Yaklaşık 60 farklı bitkinin polenlerinden elde edilen ekstraktların test edilmesi sonucu, büyüme teşvik ettikleri belirlenmiştir. Araştırmacılar çalışmalarda kullanılan aktif bileşiğin *Brassica* cinsi bitkilerden elde edilmesi nedeniyle bu bileşiklere *brassin*'ler olarak isimlendirmişlerdir.

Brassin'lerin kimyasal yapılarını belirlemek için Grove et al. (1979) tarafından yapılan çalışmalarda; 40 kg polenden 4 mg kristal elde etmişler ve elde ettikleri bileşiği brassinolid (BL) olarak isimlendirilmiştir. Brassinolid eldesi sonrası yapılan çalışmalarda bu bileşiğin bitki büyümesi ve gelişiminde rol aldığı anlaşılmıştır. Bu özelliği nedeniyle brassinosteroidlerin bitki hormonlarının yeni bir sınıfı olarak kabul edilmiştir (Bajguz 2000, Bajguz and Tretyn 2003, Clouse and Sasse 1998, Li and Chory 1999, Michelini et.al. 2004, Müssig and Altmann 1999, Rao et.al. 2002, Vardhini and Rao 2002). Ayrıca 1982 yılında büyüme teşvik edici özelliği anlaşılan ve yapısal olarak steroidal madde olan kastasteron (CS) keşfedilmiştir (Yokota et.al. 1982).

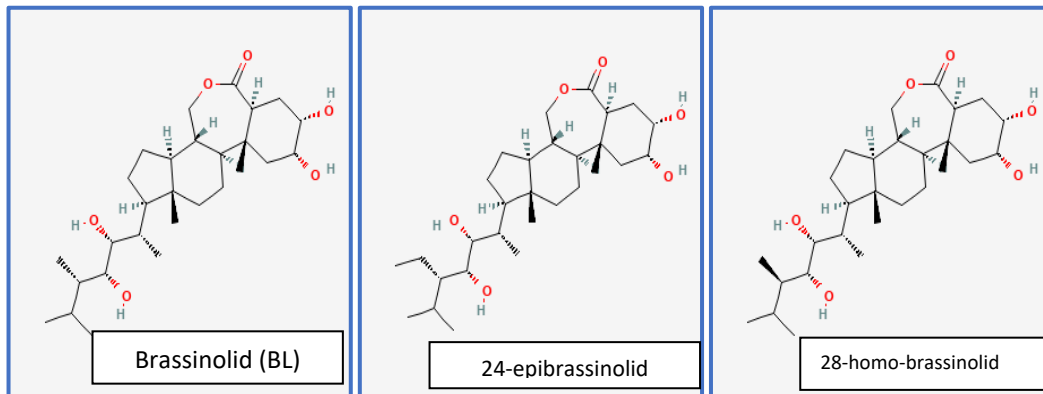
2. KURAMSAL TEMELLER

2.1 Brassinosteroid Türleri

Grove et al. (1979) kolzadan brassinolidi [(22R, 23R, 24S)-2 α , 3 α , 22,23-tetrahidroksi-24-metil- β -homo-7-oksa-5 α -kolestan-6-on)] izole etmişlerdir. brassinosteroidler kolestanın hidroksile edilmiş türevleridir. Brassinosteroidlerin yapısal çeşitleri; C17 yan zincirinin A ve B halkası üzerine farklı grupları ile elde edilmektedir. Farklı brassinosteroidler, yan zincir uzunluğuna (zincirdeki C sayılarına) göre, C27, C28 ve C29 brassinosteroidleri olarak sınıflandırılmaktadır (Bajguz 2007).

C27, C28 ve C29 steroidlerini içeren brassinosteroidler, benzer yan zincir ile 5 α -kolestan yapısına sahiptir (Sakurai, 1999). C27 brassinosteroidleri, C24 pozisyonunda olduğu gibi alkil grubu bulunmamakta ve kolesterolden üretilmektedir (Surgun v.d. 2012).

C28 brassinosteroidleri, C24 durumunda bir metilen, α -metil veya β -metil gruplarına sahip olup 24-metilenekolesterol, kampesterol ya da 24-epikampesteroldan türevlenebilmektedir. C29 brassinosteroidleri, C24'de etil veya α -etil grubundan oluşmakta ve isofukosterol veya sitosterolden türevlenmiştir (Yokota 1997). C28 türü brassinosteroid bileşikleri, bitkilerde en yaygın bulunan formudur (Sakurai, 1999). Doğadaki brassinosteroidler ardışık sayılarla numaralandırılmıştır. BR1, kısaltması brassinolid temel alınarak BR2, BR3, BR4...BRn olarak isimlendirilmiştir. Tüm brassinosteroidler, her zaman biyolojik olarak aktif değildir. Brassinolid (BL), 24-epibrassinolid (24-epiBL) ve 28-homobrassinolid (28-homoBL) çalışmalarda genel olarak kullanılan aktif brassinosteroidlerdir (Rao et al. 2002) (Şekil 1).



Şekil 1 Aktif brassinosteroidler

2.2. Yapısında Brassinosteroid Bulunan Bitkiler

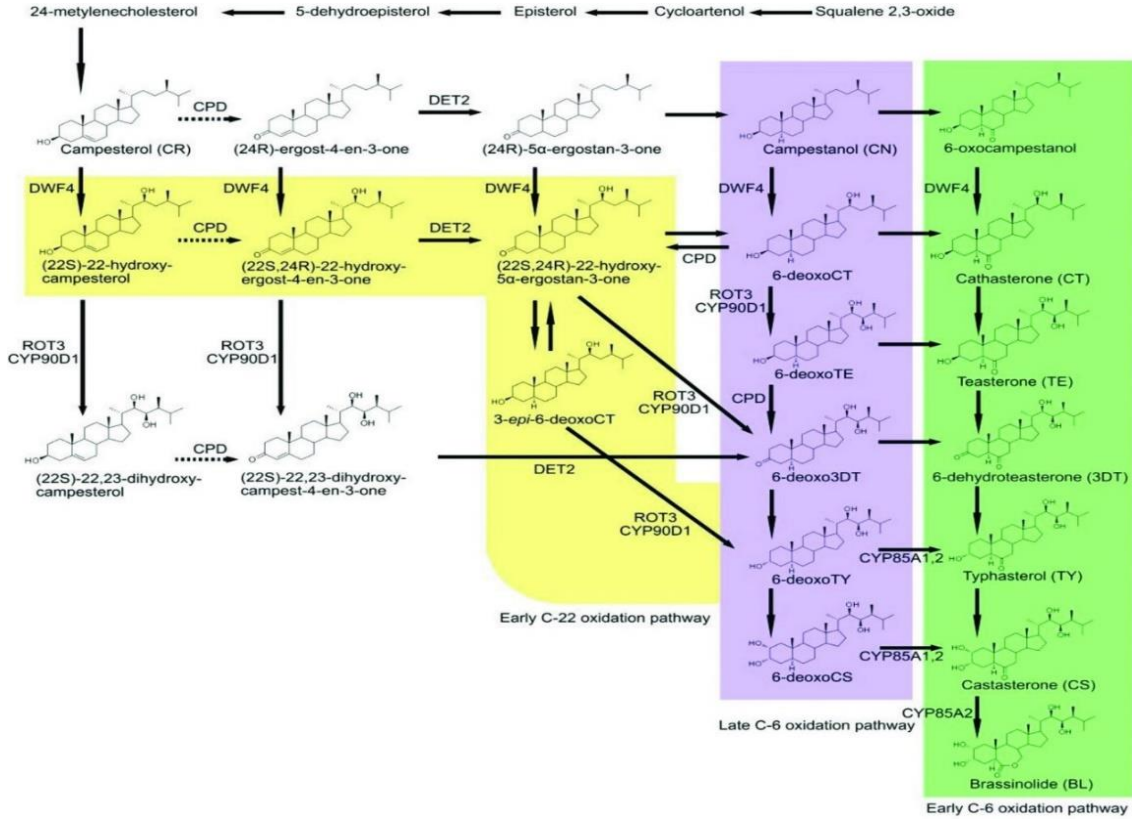
Brassinosteroidler; açık tohumluların (gymnospermler) 3 familyasında, kapalı tohumluların (angiospermler) ise; monokotillerde 15, dikotillerde ise 16 olmak üzere toplam 31 familyasında

bulunmaktadır. Ayrıca alg ve eğreltilerde de buldukları belirlenmiştir. Bitkinin tüm yapılarında biyosentezi yapılabilen brassinosteroidler genellikle tohum, polen, yaprak, gövde, kök, çiçek gibi bölümlerde yoğun olarak bulunabilmektedir (Ankudo 2004). Endojen brassinosteroid seviyeleri bitki dokularına göre farklılık gösterebilmektedir. Brassinosteroidler en yüksek seviyede polen ve tohum yapısında bulunurken sürgün, anter, çiçek tomurcukları ve meyveler ile kambiyal bölgelerde farklı seviyelerde bulunabilmektedir (Zullo and Adam 2002). Bitki dokularında endojen brassinosteroid düzeylerinin tespit edilmesi için yapılan çalışmalar da en yüksek konsantrasyon, 10⁻¹ nmol/g yaş ağırlık olarak *Brassica napus* ve *Vicia faba* polenlerinden elde edilen brassinolide aittir. En az seviyede ise, 10⁻⁷ nmol/g yaş ağırlık olarak Çin lahanası (*Brassica campestris* var. *pekinensis*)'nin olgunlaşmamış tohum ve sürgünlerinden elde edilen homokastasteron'a aittir (Clouse 2003). Bitkilerde brassinolidlerin temel kaynağı olgunlaşmamış polen ile tohumlarda 1-10 ng/g düzeyde bulunmaktadır. En az ise yapraklarda, 0.01-0,1 ng/g seviyelerinde bulunmaktadır. *Arabidopsis thaliana*'nın olgun tohumlarında yapılan çalışmada; 3.9x10⁻³ nmol/g brassinolid (BL), 9.5x10⁻⁴ nmol/g kastasteron, 3x10⁻³ nmol/g tifasterol, 3.5x10⁻³ nmol/g 6-deoksokastasteron, 2.1x10⁻³ nmol/g 6-deoksotifasterol, 1.2x10⁻³ nmol/g 6-deokso teasteron belirlenmiştir (Ankudo 2004).

2.3. Bitkilerde Brassinosteroid'lerin Sentezi

Brassinosteroidlerin biyosentetik yollarının erken C-6 ve geç C-6 oksidasyon yolları olmak üzere iki farklı yolla olduğu düşünülmektedir (Fujioka et al.1998). DWF4'ün sentez adımlarında birden fazla biyosentetik ara madde üzerinde etki gösterebileceği bulgusuna dayanarak erken bir C-22 hidroksilasyon yolu oluşturmak için kampesterolde farklılaşmaktadır (Şekil 2, sarı gölgeli alan) (Choe et al 2001; Fujioka and Yokota 2003).

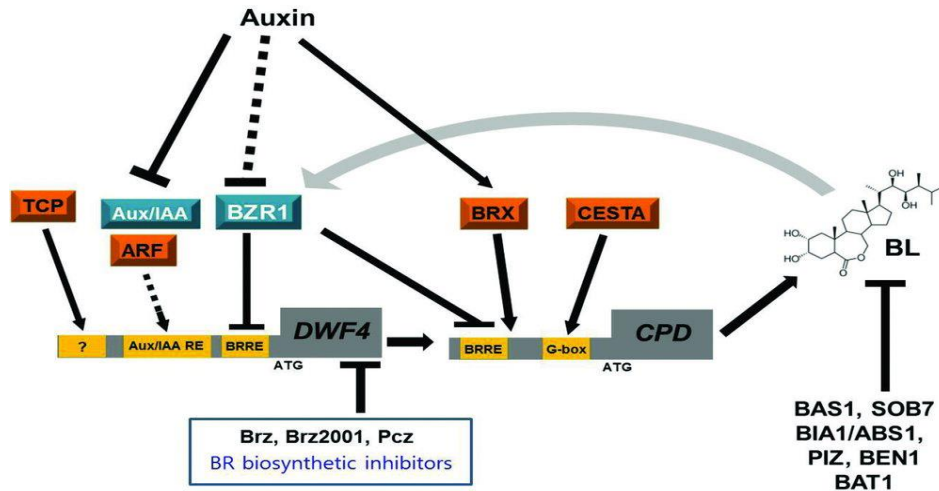
Ortamda bulunan kampesterol (CR), erken C-22 oksidasyon yolunu izleyerek (Şekil-2'de gösterilen sarı renkli alan) DWF4'ün etkisiyle C-22'yi hidroksilatlar. Burada erken ve geç C-6 oksidasyon yollu olmak üzere iki farklı yol izler. Erken C-6 oksidasyon yolu, C-22 oksidasyonundan (Şekil-2'de gösterilen yeşil renkli alan) önce C-6 oksidasyonuna maruz kalır. Geç C-6 oksidasyon yolu, C-22'yi C-6 oksidasyonundan (Şekil-2'de gösterilen mor renkli alan) önce hidroksile eder (Şekil 2).



Şekil 2 Brassinosteroidlerin sentezlenmesi

2.4. Brassinosteroidlerin Sentez İnhibitörleri

Arabidopsis mutanları cüce fenotipleri (Choe 2004), *Zea mays* (mısır) ve *Sorghum* bitkilerinde (Fernandez et al. 2009) biyosentez inhibitörlerinin rolünü araştırmak için yapılan çalışmalarda Triazol tipi bir bileşik olan Brz, güçlü bir BR biyosentez inhibitörü olduğu anlaşılmıştır (Şekil 3) (Asami et al. 2000).



Şekil 3 Brassinosteroid inhibitörlerinin sentezlenmesi

Bir steroid C-22 hidroksilaz olan DWF4'ün Brz'yi sentezlediği ve BR biyosentez inhibitörü olan Brz2001'i karakterize edilmiştir (Sekimata et al. 2001). Brz ve Brz2001'in güçlü özgüllüğüne rağmen, bu bileşiklerin nispeten yüksek maliyeti, tarımsal ve büyük ölçekli saha çalışmalarında uygulamalarını sınırlamıştır. Alternatif olarak, Propiconazol (Pcz) olarak adlandırılan başka bir triazol türevi ve ticari olarak temin edilebilen bileşiğin hem *Arabidopsis* hem de mısır için geçerli olduğu bulunmuştur (Hartwig et al. 2012).

2.5 Brassinosteroidlerin Bitkilerde Taşınımı

Brassinosteroidlerin bitki sisteminde taşınımı ile ilgili Savaldi et al. (2006) tarafından yapılan araştırmada; 24-epiBL'in ekzojen uygulamasında taşınım yönün kökten gövdeye doğru olduğu anlaşılmıştır. Salatalık, domates ve buğday bitkisi köklerine radyoaktif (^{14}C) ile işaretlenmiş 24-epiBL uygulamasında radyoaktivitenin gövde bölgesine taşındığı bulunmuştur. Brassinosteroid sentezlemeyen *Arabidopsis* mutantlarının, Brassinolid içeren agar bulunan in vitro ortamda yabancı tip fenotipe dönmeleri sağlanmış ve yabancı tip (wild type) *Arabidopsis thaliana* bitkilerinin yaprak sapları köklerinin brassinolide bağlı olarak uzamıştır.

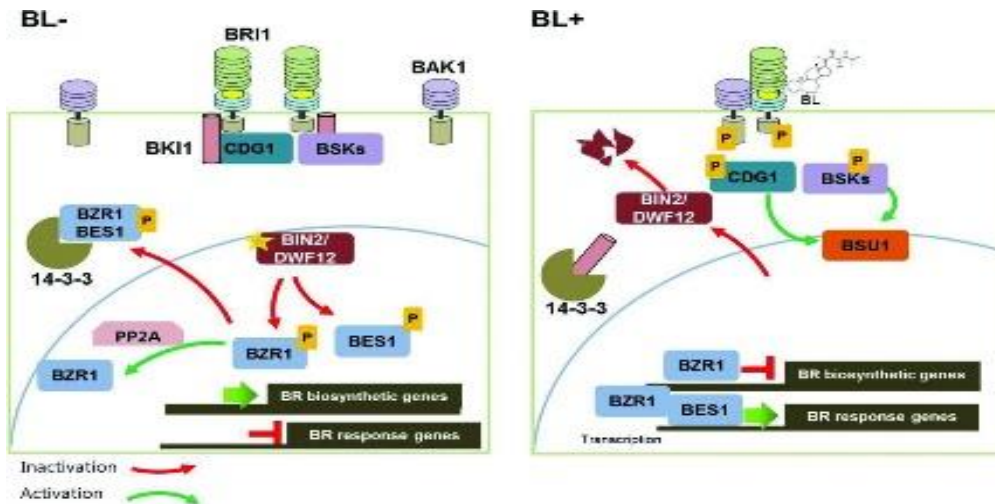
^{14}C -24-epiBL uygulamaları salatalık yapraklarının yüzeyinde yapıldığında, yaprak tarafından hızlıca absorbe edildiği, ancak yaprak haricinde yavaş taşındığı saptanmıştır. Uygulanan ^{14}C -24-epiBL'den %6'sı genç yapraklara taşınmıştır. Bu çalışma; ekzojen brassinosteroid uygulamalarının köklerden gövde ve yaprağa taşındığı, bitkinin kalan organlarına taşınmadığı sonucunu desteklemiştir. Köklerle alınan 24-epiBL'in gövde yapısına ksilem içinde hareket ettiği düşünülmektedir. Ksilem içinde madde taşınımı tek yönlü olduğundan, yapraklara ekzojen uygulanan 24-epiBL'nin yapraktan diğer yapraklara sadece floem ile taşındığı düşünülmektedir. Ekzojen uygulamaları 24-epiBL'in kökten gövdeye taşındığı düşünülmesine rağmen endojen brassinosteroidlerin kökten gövdeye taşınımının farklı olduğu anlaşılmıştır.

Brassinosteroidler ile metabolitlerin dokular içinde dağılımına bakıldığında; farklı organlarda, metabolitlerin miktarları farklı olsa da tüm bitki dokularında var olduğu tespit edilmiştir. *Arabidopsis*, bezelye ve domates'te yapılan çalışmalarda, erken iletilen bileşikler kökte daha fazla bulunurken, kastasteron gibi geç iletilenlerin gövdede, köke göre daha fazla bulunduğu saptanmıştır. Brassinosteroidlerin sentezinde, enzimlerin dokularda eksprese edildiği, fakat seviyelerinin dokudan dokuya değişmektedir (Savaldi et al. 2006).

2.6 Brassinosteroidlerin Sinyal İletişimi

BR sinyali, biyoaktif brassinolidenin, bir plazma zarı lokalize reseptör kinazın, BRI1'in bir ada alanına bağlanmasıyla başlar (Şekil 4). BRI1 ve yardımcı reseptörü BRI1-Associated-Kinase1 (BAK1) arasındaki oto ve transfosforilasyon olayları, plazma zarı lokalize inhibitörü BKI'nin BRI1'den ayrılmasına neden olur (Karlova vd. 2006; Oh et al. 2009; Wang et al. 2008). BR-Sinyal Kinazları (BSK) ve yapısal diferansiyel büyüme-1 (CDG1), BR sinyalini iletir ve bir protein fosfatazi, BRI1 baskılayıcı 1'i (BSU1) aktive eder (Tang et al.2008; Kim et al. 2009; Kim et al. 2011). BSK'ler ve CDG1, transmembran alanlara sahip olmamasına rağmen, bunlar palmitoillenir ve plazma zarlarında sabitlenir (Kim et al. 2011).

BSU1, BR sinyalini, BIN2'yi (Brassinosteroid duyarsız 2) negatif olarak düzenleyen bir bileşenin Tyr200 kalıntısını defosforile eder (Mora et al. 2004). Bir proteazom inhibitörü olan MG132 ile BIN2'nin birikmesine neden olur ve proteazom tarafından parçalanır (Peng et al. 2008). Bununla birlikte, BR sinyali aktif olmadığında, BZR1 ve BES1 fosforile edilir ve 14-3-3 proteinleri tarafından tutulur ve çekirdeğin dışında kalır (Gampala et al. 2007; Ryu et al. 2007). Alternatif olarak, çekirdeğin içindeki fosforile edilmiş BZR1, hedef genlerinin promotör DNA'sına verimsiz bir şekilde bağlanır (He et al. 2002). Fosforlanmış BZR1'in yeniden aktivasyonuna, PP2A tipi protein fosfatazlar yoluyla fosforilasyon aracılık eder (Tang et al. 2011).



Şekil 4 Hücre yüzeyinde brassinosteroidin algılanması ve sinyal iletimi

2.7. Brassinosteroidin Sentez ve Sinyal Genleri

Brassinosteroidlerin bitki gelişimindeki rolünü anlamak için *Arabidopsis* bitkisinin brassinosteroid sentezlemeyen (BR-deficient) ve brassinosteroid yanıt vermeyen (BR-insensitive) mutantları ile yapılan moleküler genetik çalışmalar ile olmuştur (Divi et al. 2010).

Brassinosteroid sentezlemesi yapamayan mutantlar; biyosentetik enzimleri kodlamasını yapan genlerin mutasyondur. Hormon uygulaması ile yabancı tip fenotipe dönüşmektedir. Hormon uygulamasına olumlu yanıt vermeyen mutantlar ise; aynı fenotip özellik gösteren ancak hormon uygulaması ile geri döndürülemeyen mutantlardır. Brassinosteroid sentezlemeyen ve hormon yanıtı vermeyen mutantlarda; hücre boyutu ile hücreler arası boşlukların azalması, koyu yeşil renk, cücelik, rozet yapısı, çiçeklenmede zamanında gecikme ve indirgenmiş fertilité gibi fenotipik değişiklikler gözlenmiştir (Divi and Krishna 2009).

1970'lerde brassinosteroidlerin bitki büyüme ve gelişmesindeki fizyolojik etkilerinde üzerinde çalışmalar devam ederken, 1990'lı yıllarda brassinosteroid sentezlemeyen *det2* ve *cpd* mutantlarının elde edilme çalışmaları brassinosteroidlerin bitki gelişiminde önemini gösteren ilk genetik kanıt olmuştur. DET2 ve CPD proteinlerinin moleküler yapılarını anlaşılması ile DET2 proteinin steroid 5 α -redüktaz ve CPD proteinin steroid hidroksilaz ile sekans ve fonksiyonel olarak benzerlikleri steroid metabolizmasında proteinlerin fonksiyonu göstermiştir. *Det2* ve *cpd* mutantlarının doz seviyesine göre ekzojen uygulamaları yabancı tip mutantların fenotipinde brassinosteroid sentezinin DET2 ve CPD'nin rollerini göstermiştir (Clouse 1996, Dhaubhadel et al. 1999, Krishna 2003). Farklı bitkilerde yapılan çalışmalarda brassinosteroidin sinyali ve sentezinde sorumlu olan genler Çizelge 1'de gösterilmiştir (Divi and Krishna 2009).

Çizelge1. Fonksiyonlarında modifikasyon yapılmış brassinosteroid sentez ve sinyal gen özet tablosu (Divi and Krishna 2009).

	Gen ismi	Genin tanımı	Genetik modifikasyon	Bitki ismi	Gözlenen sonuç
BR Sentezi	<i>DWF4</i>	<i>A. thaliana</i> sitokrom P450 monooksijenaz	Ektopik yüksek ekspresyon (ectopic overexpression)	<i>Arabidopsis</i>	Tohum veriminde artış
	<i>ZmDWF4</i>	<i>DWF4</i> 'ün mısır bitkisindeki benzeri (ortholog)	Ektopik yüksek ekspresyon	Mısır	Tohum, dal sayısı ve çiçek durumu sapının boyunda artış
	<i>CYP</i>	<i>C-22 hidroksilaz</i>	Gövde, kök ve yapraklarda yüksek ekspresyon	Çeltik	Fotosentez etkinliğinde ve tane veriminde artış
	<i>GhDET2</i>	<i>DET2</i> 'nin (steroid 5 α -redüktaz) pamuktaki benzeri	Tohum kabuğuna spesifik ekspresyon	Pamuk	Lif verimi ve kalitesinde artış
	<i>OsDWARF4</i>	<i>DWF4</i> 'ün çeltikteki benzeri	Genin ekspresyonunun engellenmesi (gene knockout)	Çeltik	Yarı cüce, dik yapraklar, sık dikim koşulları altında biyokütle ve tane veriminde artış, küçük tohumlar

Çizelge 1. Fonksiyonlarında modifikasyon yapılmış Brassinosteroid sentez ve sinyal gen özet tablosu (Divi & Krishna, 2009)(Devamı).

	Gen ismi	Genin tanımı	Genetik modifikasyon	Bitki ismi	Gözlenen sonuç
BR sinyali	<i>OsBR11</i>	BRI1'in çeltikteki benzeri (BR-reseptörü)	Eş-baskılama (Co-suppression)	Çeltik	Dik yapraklar, verim potansiyelinde artış
	<i>AtBAK1</i>	BR-eş reseptörü	Ektopik yüksek ekspresyon	Çeltik	Yarı cüce bitkiler
	<i>UZU</i> (<i>HvBR11</i>)	BRI1'in arpadaki benzeri (BR reseptörü)	Tek nükleotid değişimi (BR-yanıt vermeyen mutant)	Arpa	Yarı cüce, verimde artış ve yatmaya dayanıklılık
	<i>OsGSK1</i>	BIN2'in çeltikteki benzeri (GSK3/SHA GGY-protein kinaz benzeri, BR sinyalizasyonunda negatif regülatör)	Genin ekspresyonunun engellenmesi	Çeltik	Abiyotik stres toleransında artış
Kabul edilen steroid regülasyonu	<i>AtHSD</i>	11-β-Hidroksisterol dehidrogenaz	Ektopik yüksek ekspresyon	<i>Arabidopsis</i>	Büyümede, verimde ve tuz toleransında artış, BR'in aktive ettiği genlerin sürekli ekspresyonu

2.8. Brassinosteroidlerin Bitkilerde Abiyotik Stres'e Karşı Etkisi

Bitkilerde abiyotik stres; morfolojik, fizyolojik ve moleküler değişimlere neden olmaktadır. Bitkinin abiyotik stres faktörlerine karşı dayanımları açısından brassinosteroidlerin olumlu katkısı çalışmalar ile anlaşılmıştır (Divi et al. 2010) Tuz stresinde yetiştirilen buğday yapraklarına 24-epiBL endojenik olarak spreyleme yöntemi ile uygulanmış, 24-epiBL'in büyüme ve besin elementlerini alımına etkisi araştırılmıştır. Uygulama sonrası, tuz stresi altında besin maddelerinin alımına anlamlı bir etkisi görülmemiştir. Biyokütle ile büyümeyi üzerinde olumlu etkisi olduğu anlaşılmıştır (Shahbaz and Ashraf 2007).

Kuraklık stresindeki domates bitkilerine 24-epiBL uygulaması, H₂O₂ içeriği ve lipid peroksidasyonunu azaltmıştır. Ancak prolin, protein içeriği ile antioksidatif enzim aktivitelerinde artışa neden olmuştur (Behnamnia et al. 2009). Dhaubhadel et al. (1999) tarafından, 24-epiBL'nin bitkilerin abiyotik stres koşulları altındaki etkisini anlamak amacıyla, domates ve *Brassica napus* fidelerinde yapılan araştırmada 24-epiBL uygulamaları deney gruplarının, kontrol gruplarına nazaran letal sıcaklığa toleranslı olduğu anlaşılmıştır.

Sıcaklık stresi altında *Brassica napus* fidelerinde, 24-epiBL uygulamaları, uygulama yapılmayan fidelere göre ısı şoku proteinleri birikiminin daha fazla olmasının, 24-epiBL'in stres proteinleri olan HSP'lerin ekspresyonunu indüklemesi olabileceği gösterilmiştir (Dhaubhadel et al. 1999). Soğuk stresine karşı, kabak fidelerine ekzojen uygulaması yapılan 28-homoBL, fidelerde büyüme ve fotosentez üzerinde kontrol grubuna göre anlamlı olarak etki göstermiştir (Fariduddin et al. 2011). Brassinosteroidlerin, birden fazla abiyotik strese karşı etkilerini anlamak için yapılan araştırmada; 24-epiBL uygulaması, *Arabidopsis thaliana* ve *Brassica napus*'da kuraklık ve soğuk stresi toleransını arttırmış, tuz stresinin sebep olduğu tohum çimlenmesi inhibisyonunu engellemiştir. 24-epiBL'in bitkilerin çoklu abiyotik stres durumlarına karşı toleransı arttırdığı, markör genlerinin analizi anlaşılmıştır (Kagale et al. 2007). Xia et al., (2009)'nın yaptığı çalışmada; bitkilerde brassinosteroidlerin abiyotik stres toleransını araştırmak amacıyla *Cucumis sativus* bitkisinde endojen uygulanan brassinosteroidin fotooksidatif tolerans, soğuk stresi ve salatalık mozaik virüsün olumsuz etkilerine karşı, pozitif yönde korelasyon olduğunu göstermişlerdir.

Sorghum vulgare bitkilerinin ozmotik stres altındaki fidelerine 28-homoBL ve 24-epiBL uygulanmıştır. Araştırma sonunda; çözülebilir protein ile prolin içeriği ile bağlantılı tohum çimlenme yüzdesi ve fide gelişimlerinde olumlu yönde anlamlı etkiler gözlenmiştir (Vidya and Rao 2003).

2.9. Bitkilerde Ağır Metal Stresine Karşı Brassinosteroidlerin Etkileri

Chlorella vulgaris'de 24-epiBL uygulamasının; bakır, kurşun, kadmiyum ve çinko stresinde büyüme ve hücrelerdeki ağır metal birikimine olan etkilerinin araştırıldığı çalışmada ağır metal ile kontamine olan bitkilerde anti-stres etki gösterdiği sonucuna ulaşılmıştır (Bajguz 2000).

Brassica juncea bitkisinin 60 günlük fidelerine kadmiyum stresi uygulanmıştır. Stres altındaki fidelerde 28-homoBL'in gelişim, fotosentez ve antioksidatif enzim seviyelerindeki değişimleri araştırılmıştır. Araştırma sonucunda; kök ve toprak üstü organlarda enzim seviyeleri artmış,

kadmiyumun bitkide neden olduđu olumsuz toksik etkinin iyileştirildiđi belirtilmiştir (Hayat et al. 2007).

Maş fasulyesi (*Vigna radiata* L.)'nin farklı miktardaki alüminyum konsantrasyonları ile hazırlanan ortamda stres halindeki fidelerine 24-epiBL ve 28-homoBL birlikte ya da ayrı ayrı uygulanmıştır. Uygulanan epiBL ve homoBL fideler normal gelişim gösterirken, epiBL ve homoBL'nin birlikte uygulaması yapılan bitkilerde antioksidan enzim ve prolin yükselmiştir (Ali et al. 2008).

Raphanus sativus L.'nin kadmiyum stresi altında yetiştirilen fidelerine 24-epiBL uygulaması yapılmıştır. Uygulama sonucunda; Kadmiyum bitki büyüme aktivitelerinde düşmeye neden olurken, aynı bitkinin tohumlarına yapılan 24-epiBL uygulamasının bitki gelişiminde, toksik etkiyi azaltıcı etkisi gözlenmiş ve 24-epiBL'in iyileştirici etkisi anlaşılmıştır (Anuradha and Rao 2009).

Fasulye (*Phaseolus vulgaris*) bitkisinde tuzluluk stresi için; NaCl ile CdCl₂ uygulanmış ve 24-epiBL'nin etkisi araştırılmıştır. Araştırma sonunda; Kontrol grubunda, Bitki gelişimine, pigment içeriğine ve meyve veriminde önemli oranda azalma tespit edilmiştir. 24-epiBL uygulaması yapılan grupta ise toksik etki detoksifiye edildiđi ve parametrelerde olumlu ve istatistiki açıdan anlamlı gelişme görülmüştür (Rady 2011).

Domatesin iki farklı kültivarına kadmiyumun farklı konsantrasyonları (0, 3, 6, 9, 12 mg/kg) ile 10-8 M 28-homoBL/24-epiBL uygulanmıştır. Kontrol grubu bitkilerde konsantrasyona bazı enzim aktiviteleri her iki kültivarda önemli oranda azalmıştır. HomoBL/epiBL uygulamalarının yapıldığı deney grubunda; antioksidan enzim aktivitelerinde ve prolin içeriğinde anlamlı seviyede artış meydana gelmiştir (Hasan et al. 2011)

Maş fasulyesi (*Vigna radiata*)'nin 6 günlük fidelerine 7 gün boyunca 0.5, 1.0 ve 2.0 mM bor uygulaması yapılmıştır. Uygulama sonrası bitkilere spreyc yöntemi ile 10-8 M 28-homoBL uygulaması yapılmıştır. 21. günün sonunda büyüme ve biyokimyasal parametreleri araştırılmıştır. Kontrol grubunda; bor uygulaması büyümeyi, su içeriğini ve fotosentetik aktiviteleri doz miktarına bađlı olarak azaltmıştır. Lipit peroksidasyonu, elektrolit sızıntısı, prolin birikimini ve antioksidan enzim aktivitelerinin bor miktarı ile doğru orantılı olarak arttığı bulunmuştur. Bor stresindeki bitkilere yapılan 28-homoBL uygulaması sonucu; büyüme, su içeriđi, fotosentetik aktivite, katalaz, peroksidaz, süperoksit dismutaz ile prolin miktarının artış tespit edilmiştir. Araştırma sonucu; brassinosteroidlerin anti-stres etkisi sayesinde borun oluşturduđu iyonik stresin etkilerini azalttığı anlaşılmıştır (Yusuf et al. 2011)

3. SONUÇ

Brassinosteroidler, bitki büyüme düzenleyici olarak; bitkilerde birçok gelişme sürecini düzenlemenin yanı sıra abiyotik stres durumunda bitkilerin büyüme, savunma dengesindeki rolleri ile tarım ve doğal ekosistemlerde sürdürülebilirlik açısından önemli bir yere sahiptir.

BR'ler bu fonksiyonlarını yerine getirirken birçok bitki hormonu ile interaksiyon içinde olmaktadır. BR sinyal yolu, BR biyosentezi ve metabolizması hakkında bilgilerimiz her geçen gün artmakla beraber, ilgili genlerin aktif hale geçmesi ve hücre içi iletimi ile BRI1'in kinaz aktivitesini nasıl aktive ettiği belirsizliğini korumaktadır. Brassinosteroid sinyalleşmesinde yeni yolların keşfi ve bunların diğer sinyal yolları ile, bitkilerde brassinosteroid fonksiyonlarının kapsamlı ve sistematik etkisi tam olarak anlaşılacaktır. Brassinosteroid sinyal olaylarının tam olarak aydınlatılması ve bunların diğer sinyal yollarıyla entegrasyonu, brassinosteroidin özellikle tarımda ucuz ve sürdürülebilir gıda üretimine katkı sağlayacaktır.

4. KAYNAKLAR

- Ali, B., Hasan, S., Hayat, S., Hayat, Q., Yadav, S., Fariduddin, Q., & Ahmad, A. (2008). A role for brassinosteroids in the amelioration of aluminium stress through antioxidant system in mung bean (*Vigna radiata* L. Wilczek). *Environmental and Experimental Botany*, 62(2), 153-159.
- Ankudo, T. (2004). Immunomodulation of brassinosteroid functions in seeds of *Arabidopsis thaliana* (L.). Halle (Saale), Univ., Diss., 2004,
- Anuradha, S., & Rao, S. S. R. (2009). Effect of 24-epibrassinolide on the photosynthetic activity of radish plants under cadmium stress. *Photosynthetica*, 47, 317-320.
- Asami, T., Min, Y. K., Nagata, N., Yamagishi, K., Takatsuto, S., Fujioka, S., Yoshida, S. (2000). Characterization of brassinazole, a triazole-type brassinosteroid biosynthesis inhibitor. *Plant physiology*, 123(1), 93-100.
- Bajguz, A. (2000). Blockade of heavy metals accumulation in *Chlorella vulgaris* cells by 24-epibrassinolide. *Plant Physiology and Biochemistry*, 38(10), 797-801.
- Bajguz, A., Tretyn, A. (2003). The chemical characteristic and distribution of brassinosteroids in plants. *Phytochemistry*, 62(7), 1027-1046.
- Bajguz, A. (2007). Metabolism of brassinosteroids in plants. *Plant Physiology and Biochemistry*, 45(2), 95-107.
- Behnamnia, M., Kalantari, K., & Ziaie, J. (2009). The effects of brassinosteroid on the induction of biochemical changes in *Lycopersicon esculentum* under drought stress. *Turkish Journal of Botany*, 33(6), 417-428.
- Clouse, S. D. (1996). Molecular genetic studies confirm the role of brassinosteroids in plant growth and development. *The Plant Journal*, 10(1), 1-8.
- Clouse, S. D., & Sasse, J. M. (1998). Brassinosteroids: essential regulators of plant growth and development. *Annual review of plant biology*, 49(1), 427-451.
- Clouse, S. D. (2003). Recent advances in brassinosteroid research: From molecular mechanisms to practical applications. *Journal of Plant Growth Regulation*, 22, 273-275.
- Choe, S., Fujioka, S., Noguchi, T., Takatsuto, S., Yoshida, S., Feldmann, K. A. (2001). Overexpression of DWARF4 in the brassinosteroid biosynthetic pathway results in increased vegetative growth and seed yield in *Arabidopsis*. *The Plant Journal*, 26(6), 573-582.
- Choe, S. (2004). *Plant Hormones: Biosynthesis, Signal Transduction, Action*.
- Dhaubhadel, S., Chaudhary, S., Dobinson, K. F., Krishna, P. (1999). Treatment with 24-epibrassinolide, a brassinosteroid, increases the basic thermotolerance of *Brassica napus* and tomato seedlings. *Plant molecular biology*, 40(2), 333.
- Divi, U. K., & Krishna, P. (2009). Brassinosteroid: a biotechnological target for enhancing crop yield and stress tolerance. *New biotechnology*, 26(3-4), 131-136.
- Divi, U. K., Rahman, T., & Krishna, P. (2010). Brassinosteroid-mediated stress tolerance in *Arabidopsis* shows interactions with abscisic acid, ethylene and salicylic acid pathways. *BMC plant biology*, 10, 1-14.
- Evans, R. M. (1988). The steroid and thyroid hormone receptor superfamily. *Science*, 240(4854), 889-895.
- Fariduddin, Q., Yusuf, M., Chalkoo, S., Hayat, S., & Ahmad, A. (2011). 28-homobrassinolide improves growth and photosynthesis in *Cucumis sativus* L. through an enhanced antioxidant system in the presence of chilling stress. *Photosynthetica*, 49, 55-64.
- Fernandez, M. G. S., Becraft, P. W., Yin, Y., & Lübberstedt, T. (2009). From dwarves to giants Plant height manipulation for biomass yield. *Trends in plant science*, 14(8), 454-461.
- Fujioka, S., Noguchi, T., Yokota, T., Takatsuto, S., & Yoshida, S. (1998). Brassinosteroids in *Arabidopsis thaliana*. *Phytochemistry*, 48(4), 595-599.

- Fujioka, S., Yokota, T. (2003). Biosynthesis and metabolism of brassinosteroids. Annual review of plant biology, 54(1), 137-164.
- Gampala, S. S., Kim, T. W., He, J. X., Tang, W., Deng, Z., Bai, M. Y., Wang, Z. Y. (2007). An essential role for 14-3-3 proteins in brassinosteroid signal transduction in Arabidopsis. Developmental cell, 13(2), 177-189.
- Geuns, J. M. (1978). Steroid hormones and plant growth and development. *Phytochemistry*, 17(1), 1-14.
- Grove, M. D., Spencer, G. F., Rohwedder, W. K., Mandava, N., Worley, J. F., Warthen, J. D., Cook, J. C. (1979). Brassinolide, a plant growth-promoting steroid isolated from Brassica napus pollen. *Nature*, 281(5728), 216-217. doi:10.1038/281216a0
- Hasan, S. A., Hayat, S., & Ahmad, A. (2011). Brassinosteroids protect photosynthetic machinery against the cadmium induced oxidative stress in two tomato cultivars. *Chemosphere*, 84(10), 1446-1451.
- Hartwig, T., Corvalan, C., Best, N. B., Budka, J. S., Zhu, J. Y., Choe, S., Schulz, B. (2012). Propiconazole is a specific and accessible brassinosteroid (BR) biosynthesis inhibitor for Arabidopsis and maize. PloS one, 7(5).
- Hayat, S., Ali, B., Hasan, S. A., & Ahmad, A. (2007). Brassinosteroid enhanced the level of antioxidants under cadmium stress in Brassica juncea. *Environmental and Experimental Botany*, 60(1), 33-41.
- He, J. X., Gendron, J. M., Yang, Y., Li, J., Wang, Z. Y. (2002). The GSK3-like kinase BIN2 phosphorylates and destabilizes BZR1, a positive regulator of the brassinosteroid signaling pathway in Arabidopsis. Proceedings of the National Academy of Sciences, 99(15), 10185-10190.
- Jones, J. L., Roddick, J. G. (1988). Steroidal estrogens and androgens in relation to reproductive development in higher plants. *Journal of plant physiology*, 133(4), 510-518.
- Kagale, S., Divi, U. K., Krochko, J. E., Keller, W. A., Krishna, P. (2007). Brassinosteroid confers tolerance in Arabidopsis thaliana and Brassica napus to a range of abiotic stresses. *Planta*, 225, 353-364.
- Karlova, R., Boeren, S., Russinova, E., Aker, J., Vervoort, J., & de Vries, S. (2006). The Arabidopsis somatic embryogenesis receptor-like kinase1 protein complex includes brassinosteroid-insensitive1. *The Plant Cell*, 18(3), 626-638.
- Kim, T. W., Guan, S., Sun, Y., Deng, Z., Tang, W., Shang, J. X., Wang, Z. Y. (2009). Brassinosteroid signal transduction from cell-surface receptor kinases to nuclear transcription factors. *Nature cell biology*, 11(10), 1254-1260.
- Kim, T. W., Guan, S., Burlingame, A. L., Wang, Z. Y. (2011). The CDG1 kinase mediates brassinosteroid signal transduction from BRI1 receptor kinase to BSU1 phosphatase and GSK3-like kinase BIN2. *Molecular cell* 43(4), 561-571.
- Krishna, P. (2003). Brassinosteroid-mediated stress responses. *Journal of Plant Growth Regulation*, 22, 289-297.
- Kumlay, A. M., Eryiğit, T. (2011). Bitkilerde Büyüme ve Gelişmeyi Düzenleyici Maddeler: Bitki Hormonları. I. doi:https://dergipark.org.tr/tr/pub/jist /issue/ 7925/ 104223
- Li, J., Chory, J. (1999). Brassinosteroid actions in plants. *Journal of experimental botany*, 50(332), 275-282.
- Michelini, F. M., Ramírez, J. A., Berra, A., Galagovsky, L. R., & Alché, L. E. (2004). In vitro and in vivo antiherpetic activity of three new synthetic brassinosteroid analogues. *Steroids*, 69(11-12), 713-720.
- Mitchell, J., Mandava, N., Worley, J., Plimmer, J., & Smith, M. (1970). Brassins a new family of plant hormones from rape pollen. *Nature*, 225, 1065-1066.

- Mora-García, S., Vert, G., Yin, Y., Caño-Delgado, A., Cheong, H., Chory, J. (2004). Nuclear protein phosphatases with Kelch-repeat domains modulate the response to brassinosteroids in Arabidopsis. *Genes & development*, 18(4), 448-460.
- Müssig, C., Altmann, T. (1999). Physiology and molecular mode of action of brassinosteroids. *Plant Physiology and Biochemistry*, 37(5), 363-372.
- Müssig, C. (2005). Brassinosteroid-promoted growth. *Plant biology*, 7(02), 110-117.
- Oh, M. H., Wang, X., Kota, U., Goshe, M. B., Clouse, S. D., & Huber, S. C. (2009). Tyrosine phosphorylation of the BRI1 receptor kinase emerges as a component of brassinosteroid signaling in Arabidopsis. *Proceedings of the National Academy of Sciences*, 106(2), 658-663.
- Peng, P., Yan, Z., Zhu, Y., Li, J. (2008). Regulation of the Arabidopsis GSK3-like kinase BRASSINOSTEROID-INSENSITIVE 2 through proteasome-mediated protein degradation. *Molecular Plant*, 1(2), 338-346.
- Rady, M. M. (2011). Effect of 24-epibrassinolide on growth, yield, antioxidant system and cadmium content of bean (*Phaseolus vulgaris* L.) plants under salinity and cadmium stress. *Scientia horticultrae*, 129(2), 232-237.
- Rao, S. S. R., Vardhini, B. V., Sujatha, E., & Anuradha, S. (2002). Brassinosteroids—a new class of phytohormones. *Current Science*, 1239-1245.
- Ryu, H., Kim, K., Cho, H., Park, J., Choe, S., Hwang, I. (2007). Nucleocytoplasmic shuttling of BZR1 mediated by phosphorylation is essential in Arabidopsis brassinosteroid signaling. *The Plant Cell*, 19(9), 2749-2762.
- Sakurai, A. (1999). Brassinosteroid biosynthesis. *Plant Physiology and Biochemistry*, 37(5), 351-361.
- Savaldi-Goldstein, S., & Chory, J. (2006). Brassinosteroids. *Plant physiology*, 4.
- Sekimata, K., Kimura, T., Kaneko, I., Nakano, T., Yoneyama, K., Takeuchi, Y., ... & Asami, T. (2001). A specific brassinosteroid biosynthesis inhibitor, Brz2001: evaluation of its effects on Arabidopsis, cress, tobacco, and rice. *Planta*, 213, 716-721.
- Sezgin, M., Kahya, M. (2018). Phytohormones. *Bitlis Eren University Journal of Science and Technology*, 8, 35-39. doi:https://dergipark.org.tr/tr/pub/beuscitech /issue/36605/386 726
- Shahbaz, M., Ashraf, M. (2007). Influence of exogenous application of brassinosteroid on growth and mineral nutrients of wheat (*Triticum aestivum* L.) under saline conditions. *Pakistan Journal of Botany*, 39(2), 513.
- Surgun, Y. , Yilmaz, E. , Çöl, B., Bürün, B. (2012). Altinci Grup Bitki Hormonu: Brassinosteroidler Sixth Class Of Plant Hormones: Brassinosteroids . Celal Bayar University Journal of Science , 8 (1) , 27-46 . Retrieved from https:// dergipark .org.tr /tr/pub/ cbayarfb/ issue/4053/53404
- Tang, W., Kim, T. W., Osés-Prieto, J. A., Sun, Y., Deng, Z., Zhu, S., Wang, Z. Y. (2008). BSKs mediate signal transduction from the receptor kinase BRI1 in Arabidopsis. *Science*, 321(5888), 557-560.
- Tang, W., Yuan, M., Wang, R., Yang, Y., Wang, C., Osés-Prieto, J. A., Wang, Z. Y. (2011). PP2A activates brassinosteroid-responsive gene expression and plant growth by dephosphorylating BZR1. *Nature cell biology*, 13(2), 124-131.
- Vardhini, B. V., Rao, S. S. R. (2002). Acceleration of ripening of tomato pericarp discs by brassinosteroids. *Phytochemistry*, 61(7), 843-847.
- Vidya Vardhini, B., Seeta Ram Rao, S. (2003). Amelioration of osmotic stress by brassinosteroids on seed germination and seedling growth of three varieties of sorghum. *Plant Growth Regulation*, 41, 25-31.

- Wang, X., Kota, U., He, K., Blackburn, K., Li, J., Goshe, M. B., Clouse, S. D. (2008). Sequential transphosphorylation of the BRI1/BAK1 receptor kinase complex impacts early events in brassinosteroid signaling. *Developmental cell*, 15(2), 220-235.
- Xia, X.-J., Wang, Y.-J., Zhou, Y.-H., Tao, Y., Mao, W.-H., Shi, K., Yu, J.-Q. (2009). Reactive oxygen species are involved in brassinosteroid-induced stress tolerance in cucumber. *Plant physiology*, 150(2), 801-814.
- Yokota, T. (1997). The structure, biosynthesis and function of brassinosteroids. *Trends in plant science*, 2(4), 137-143.
- Yokota, T., Arima, M., & Takahashi, N. (1982). Castasterone, a new phytosterol with plant-hormone potency, from chestnut insect gall. *Tetrahedron Letters*, 23(12), 1275-1278.
- Yusuf, M., Fariduddin, Q., Ahmad, A. (2011). 28-Homobrassinolide mitigates boron induced toxicity through enhanced antioxidant system in *Vigna radiata* plants. *Chemosphere*, 85(10), 1574-1584.
- Zullo, M. A. T., & Adam, G. (2002). Brassinosteroid phytohormones: structure, bioactivity and applications. *Brazilian Journal of Plant Physiology*, 14, 143-181.

BLOK ZİNCİRİ VE IPFS DESTEKLİ IOT VERİ YÖNETİMİ

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ÖZET

Endüstriyel alanda teknolojinin kullanımı ve beraberinde internet teknolojilerinin desteğinin alınması üretim süreçlerinde iş yapış şeklini değiştirmiştir. Nesnelerin interneti'nin (IoT) bir çok alanda uygulanmaya başlanması, Endüstri 4.0'ın genel kabulünün artmasını sağlamıştır. Endüstriyel üretim, beraberinde her an her yerde kontrolün ve veri akışının düzenli sağlanması ihtiyacını ortaya çıkarmış ve üretimde IoT kullanımını desteklemiştir. Endüstriyel IoT (IIoT), üretim sürecinin takibi ve verimliliğinin devamı için gerekli temel taşlarından biridir. IIoT, ürettiği veri aracılığıyla veri temelli operasyonel süreç mekanizmalarının altyapısını oluşturmaktadır. Mevcut uygulamalar değerlendirildiğinde IIoT verilerinin kayda değer büyük bir kısmının güvenlik ve gizlilik gibi çekincelerden dolayı atıl bir şekilde bekletilmektedir. Klasik veri yönetim sistemlerinin değişimi için ademi merkezîyetçilikten uzak ve üçüncü taraf güvenine ihtiyaç duymayan yeni yaklaşımların benimsenmesi gerekmektedir. Blok zinciri teknolojisi, ademi merkezîyetçilik, değişmezlik, izlenebilirlik özellikleri nedeniyle yeni çözümün bir parçası olmaya adaydır. Blok zinciri teknolojisi, blok hacimlerinin sınırlı oluşu ve mutabakat protokollerinin ölçeklenmesi ile ilgili problemleri olduğundan dolayı büyük veri alışverişi ile ilgili olarak yetersiz kalmaktadır. Ancak merkezi olmayan depolama çözümlerinden Gezegeçenler Arası Dosya Sistemi (IPFS), blok zincirinde yetersiz kalan yönlerinin tamamlayıcısı olarak değerlendirilmektedir. Bu amaçla, blok zinciri ve IPFS teknolojisinin bir arada kullanıldığı merkezi olmayan bir IIoT veri yönetim modeli önermektedir. Yapılan çalışmada, önerilen modelin mimarisi ve kullanılan teknolojiler hakkında bilgi verilmiş ardından uygulaması gerçekleştirilmiştir. Gerçekleştirilen uygulamanın sonuçları önerilen modelin gerçek hayatta kullanılabilir olduğunu göstermiştir.

Anahtar kelimeler: Blok zinciri, IPFS, veri yönetimi, nesnelerin interneti, Endüstri 4.0

Giriş

Dördüncü Sanayi Devrimi olarak da bilinen Endüstri 4.0, dijital teknolojilerin ve otomasyonun entegrasyonunu vurgulayan imalat ve üretimde bir paradigma değişikliğidir. Endüstri 4.0'ı mümkün kılan en önemli teknolojilerden biri, fiziksel cihazların, araçların, binaların ve sensörler, yazılımlar ve bu nesnelerin toplanıp değiş tokuş edilmesini sağlayan bağlantılarla gömülü diğer nesnelerin ağını ifade eden Nesnelerin İnterneti'dir (IoT) (Wang ve Onori, 2015).

IoT, Endüstri 4.0'ın akıllı fabrikalarının belkemiğini oluşturduğundan, Endüstri 4.0 ile IoT arasındaki ilişki ayrılmaz bir bütündür. IoT, bir fabrikadaki makinelerin, cihazların ve diğer nesnelerin birbirleriyle ve merkezi sistemlerle iletişim kurmasını sağlayarak üretim süreçlerini optimize etmek, arıza süresini azaltmak ve ürün kalitesini iyileştirmek için kullanılacak gerçek zamanlı veriler sağlar (Ordieres-Meré, Villalba-Díez ve Zheng, 2019).

IoT sensörleri, makine performansı, çevre koşulları ve envanter seviyeleri gibi üretim sürecinin çeşitli yönleri hakkında veri toplamak için kullanılabilir. Bu veriler daha sonra kalıpları ve anormallikleri belirlemek için gelişmiş analitik ve makine öğrenimi algoritmaları kullanılarak analiz edilebilir ve üreticilerin süreçlerini optimize etmelerine ve potansiyel sorunları ortaya çıkmadan önce tahmin etmelerine olanak tanır (Lee, Bagheri ve Kao, 2015).

Verimliliği ve üretkenliği artırmanın yanı sıra IoT, üreticiler için yeni iş modelleri ve gelir akışları da sağlar. Örneğin, IoT verileri, müşterilere katma değerli teklifler olarak satılabilecek önceden tahmin edilmiş bakım hizmetleri veya uzaktan izleme çözümleri gibi yeni hizmetler ve ürünler geliştirmek için kullanılabilir (Mohamed ve Al-Jaroodi, 2019).

Genel olarak, IoT'nin Endüstri 4.0'a entegrasyonu, imalat ve üretimde büyük bir değişimi temsil ederek üreticilerin yeni verimlilik, üretkenlik ve yenilik seviyelerine ulaşmak için veri ve otomasyondan yararlanmasını sağlıyor (Frické, 2009).

Blockchain, bankalar veya hükümetler gibi araçlara ihtiyaç duymadan güvenli ve şeffaf veri işlemlerini mümkün kılan dağıtılmış bir defter teknolojisidir (Wood, 2014). Verilerin ve işlemlerin bütünlüğünü sağlayan kurcalamaya dayanıklı ve merkezi olmayan bir sistem sağlar. Öte yandan, Nesnelerin İnterneti (IoT), bu nesnelerin veri toplamasını ve değiş tokuş etmesini sağlayan sensörler, yazılımlar ve bağlantılarla gömülü fiziksel cihazlar, araçlar, binalar ve diğer nesnelere ağını ifade eder (Brogan, Baskaran ve Ramachandran, 2018).

Blok zinciri ve IoT entegrasyonu, özellikle güvenlik, gizlilik ve şeffaflık açısından sayısız fayda sağlayabilir. IoT cihazları, blockchain teknolojisini kullanarak verileri güvenli bir şekilde paylaşabilir ve araçlara ihtiyaç duymadan birbirleriyle iletişim kurabilir, bu da veri ihlalleri ve

siber saldırı riskini azaltabilir (Dorri, Kanhere ve Jurdak, 2017). Bu, hasta verilerinin gizli ve güvenli tutulması gereken sağlık hizmetleri gibi sektörlerde özellikle önemli olabilmektedir.

Blok zinciri, tüm işlemlerin ve veri alışverişlerinin değişmez bir kaydını oluşturarak IoT ağında güven ve hesap verebilirlik oluşturmaya da yardımcı olabilir (Atlam ve Wills, 2019). Bu, malların menşei ve hareketinin blockchain teknolojisi kullanılarak izlenebildiği ve doğrulanabildiği tedarik zinciri yönetiminde faydalı olabilir.

Ayrıca blok zinciri, IoT ekosisteminde yeni iş modelleri ve gelir akışları sağlayabilir. Örneğin, IoT cihazları, blockchain tabanlı akıllı sözleşmeler kullanarak insan müdahalesine ihtiyaç duymadan sözleşmeleri ve işlemleri otomatik olarak yürütebilir, bu da maliyetleri azaltabilir ve verimliliği artırabilir (Pranto, Noman, Mahmud ve Haque, 2021).

Blok zinciri ve IoT'yi entegre etmenin potansiyel faydalarına rağmen, ele alınması gereken zorluklar da var. Bunlar, özellikle IoT cihazlarının ve işlemlerinin sayısı arttıkça, birlikte çalışabilirlik standartlarına olan ihtiyacı ve blockchain teknolojisinin ölçeklenebilirliğini içerir (Huh, Cho ve Kim, 2017).

Genel olarak, blockchain ve IoT entegrasyonu, veri işlemlerinde güvenliği, gizliliği ve şeffaflığı artırarak bir dizi endüstriyi ve uygulamayı dönüştürme potansiyeline sahip, heyecan verici bir araştırma ve geliştirme alanını temsil eder.

Dağıtılmış Defter Teknolojisi (DLT), bir bilgisayar ağında güvenli ve şeffaf veri işlemlerini mümkün kılan merkezi olmayan bir sistemdir. Popüler DLT yapıları arasında, her ikisi de veri işlemleri için kurcalamaya dayanıklı ve merkezi olmayan bir sistem sağlamak üzere tasarlanmış blok zincir ve yönlendirilmiş döngüsel olmayan hat (DAG - Directed Acyclic Graph) bulunur (Wang, Yu, Chen ve Xiang, 2023).

Blockchain, veri işlemlerini kaydetmek ve doğrulamak için bir blok zinciri kullanan bir DLT yapısıdır. Her blok, bir işlem listesi ve onu önceki bloğa bağlayan, güvenli ve şeffaf bir veri işlemleri zinciri oluşturan bir kriptografik hash içerir. Blockchain teknolojisi, kripto para birimi, tedarik zinciri yönetimi ve dijital kimlik doğrulama gibi uygulamalarda yaygın olarak kullanılmaktadır (Pervez, Muneeb, Irfan ve Haq, 2018).

DAG, veri işlemlerini kaydetmek ve doğrulamak için farklı bir yaklaşım kullanan başka bir DLT yapısıdır. DAG yapıları, bir blok zinciri kullanmak yerine, her işlemin yönlendirilmiş döngüsel olmayan bir grafikte önceki işlemlere bağlandığı grafik tabanlı bir yaklaşım kullanır. İşlemler paralel olarak işlenebildiği için bu daha esnek ve ölçeklenebilir bir sistem oluşturur ve daha yüksek verim ve daha hızlı işlem süreleri sağlar. DAG yapıları IoT, tedarik zinciri

yönetimi ve merkezi olmayan sosyal ağlar gibi uygulamalarda kullanılmaktadır (Zhao, Yu, 2019).

Hem blockchain hem de DAG'ın avantajları ve sınırlamaları vardır ve DLT yapısının seçimi, uygulamanın özel gereksinimlerine bağlı olacaktır. Blockchain, sağlam güvenliği ve şeffaflığıyla bilinir, ancak ölçeklenebilirlik sorunları ve yüksek enerji tüketimi sorunları yaşayabilir. DAG yapıları daha ölçeklenebilir ve enerji açısından verimlidir, ancak güvenlik ve işlem kesinliği açısından sınırlamaları olabilir (Li, Huang ve Zhang, 2022).

Genel olarak, DLT yapısının seçimi, uygulamanın özel ihtiyaçlarına ve hedeflerine bağlı olacaktır ve bu alanda daha fazla araştırma ve geliştirme, DLT teknolojisindeki yeniliği ve ilerlemeyi yönlendirmeye devam edecektir.

Son yıllarda, Blok zinciri teknolojisi, üretim süreçlerinde Endüstri 4.0 ile birlikte kullanılmaya başlanmış ve teknoloji geliştiricileri tarafından benimsenmiştir. Üretim süreçlerinin, veri ve veri yönetimi alternatif olarak dağıtık defter teknolojileri ile desteklenebilmektedir. Enerji dağıtımı ve ticareti, bilgi yönetimi, endüstriyel üretim ve tedarik zinciri DLT için en çok araştırılan ve avantajlı oldukları düşünülen alanlardır. Blok zinciri teknolojileri veri güvenliği ve otonom çalışmasında avantajlara sahip olsa dahi işlem hızı ve ölçeklendirmesi açısından kısıtlara sahiptir (Wang, Wang Shen, Jia ve Shao, 2021).

DAG tabanlı projeler, blok zinciri teknolojisine alternatif olarak işlem ölçeklendirme problemlerinin üstesinden gelebilmek amacıyla alternatif DLT yöntemleri önermişlerdir. Önerilen alternatif DLT olarak DAG tabanlı çalışan IOTA projesi verilebilir. IOTA projesi, teorik olarak, büyüyen bir yapıda artan ölçeklendirme kapasitesi sunmaktadır. Artan kapasite ile yüksek veri aktarımı ve düşük işlem ücreti sağlamaktadır (Gangwani, Perez-pons, Bhardwaj ve Upadhyay, 2021).

DLT, her ne kadar veri kaydı tutma için belli bir kapasitesi olsa dahi büyük ölçekte veri için uygun değildir. DLT, veri depolama ve yönetimi için destekleyici ve tamamlayıcı olarak IPFS kullanılmaktadır. IPFS, eşler arası dosya depolama imkânı getiren, merkezi olmayan depolama çözümüdür. IPFS üzerinde saklanan her dosyanın hash bilgisi alınmakta ve dosya üzerinde değişiklik gerçekleşmesi durumunda hash bilgisi de değişmektedir (Ali, Dolui ve Antonelli, 2017).

MİMARİ

Bu çalışmada önerilen mimari temel olarak üç bölümden oluşmaktadır. İlk bölüm verinin üretildiği IIoT tarafıdır. Endüstriyel üretimin yapıldığı alanlarda bulunan IoT cihazları, veri

ürettikten sonra bu verileri IPFS üzerinde kayıt için gönderilmesi amacıyla veri toplayan ara bir katman ile iletişim halindedir. IoT cihazları, veri toplama katmanına verileri gönderir.

İkinci bölüm, depolama ve yayınlama bölümüdür. Bu bölüm IPFS ve IOTA'yı kapsamaktadır. Veri toplama katmanında bulunan cihazlar verileri IPFS üzerinde kayıt altına alırlar. IPFS üzerinde kayıt altına alınan her veri özet bilgisi (Hash) üretmektedir. Bu hash ile veriye geri erişim sağlanabilmekte ve verinin değiştirilmediğinin bir nişanesidir. Elde edilen hash bilgileri, verinin ilgili kişiler tarafından direkt olarak eriminin sağlanması amacıyla yayınlanması gerekmektedir. Hash bilgisinin, yayın alanı olarak DLT kullanılmaktadır. DLT içinde, bu probleme uygun olarak en umut vaat eden protokol DAG'dır. DAG içerisinde IOTA projesi bulunmaktadır. Hash bilgileri, IOTA üzerinde yayına alınır. Böylelikle veriye erişim sağlanmış olur.

Üçüncü bölümde, veri tüketimi bulunmaktadır. IIoT tarafından üretilen, IPFS ile kayda alınan ardından IOTA ile erişime açılan veriler, tüketilmek için kndileri ile ilgili verilere erişimi sağlayabilmektedir. Erişim sağlanan veriler ihtiyaca ve gizliliğe göre veri erişim parolasına ihtiyaç duyabilmektedir.

SONUÇLAR

Sonuç olarak bu makale, yenilikçi bir IIoT veri depolama ve paylaşma yaklaşımı önererek Endüstri 4.0 ve akıllı üretim alanına zamanında ve önemli bir katkı sunmaktadır. Veri entegrasyonuna ve farklı kaynaklardan paylaşma yönelik artan ihtiyaçlar, böyle bir yaklaşımın önemini vurgulamaktadır. Önerilen yaklaşım, IIoT tarafından üretilen büyük miktardaki verileri işleme konusunda karşılaştıkları zorluklara kapsamlı bir çözüm sunmaktadır. Blockchain, IOTA Tangle ve IPFS teknolojilerinin entegrasyonu, yüksek ölçeklenebilirlik, düşük maliyet, kurcalamaya karşı dirençli veri paylaşımı ve büyük hacimli veri depolama sağlar. Kavram kanıtı uygulaması ve deney sonuçları, önerilen yaklaşımın fizibilitesini ve potansiyelini göstererek, onu akıllı üretim için veriye dayalı stratejileri desteklemek için değerli bir varlık haline getiriyor. Önerilen yaklaşımın semantik modelleme ve makine öğrenimi ile birleşimi, daha gelişmiş veri işleme çözümleri sağlamak için yeteneklerini daha da geliştirebilir ve Endüstri 4.0'ın gelişimini hızlandırabilmektedir. Genel olarak, bu makale, önerilen yaklaşımın faydaları, zorlukları ve potansiyel uygulamaları hakkında kapsamlı bir genel bakış sunarak, onu akıllı üretim ve Endüstri 4.0 alanındaki araştırmacılar ve uygulayıcılar için değerli bir referans haline getiriyor. Önerilen yaklaşım, üreticilerin süreçlerini optimize etmelerine, üretkenliği artırmalarına ve daha iyi müşteri memnuniyeti elde etmelerine olanak tanıyarak verilerin depolanma, paylaşılma ve analiz edilme biçiminde devrim yaratma potansiyeline sahiptir.

Kaynakça

- Ali, M. S., Dolui, K., & Antonelli, F. (2017, October). IoT data privacy via blockchains and IPFS. In *Proceedings of the seventh international conference on the internet of things* (pp. 1-7).
- Atlam, H. F., & Wills, G. B. (2019). Technical aspects of blockchain and IoT. In *Advances in computers* (Vol. 115, pp. 1-39). Elsevier.
- Brogan, J., Baskaran, I., & Ramachandran, N. (2018). Authenticating health activity data using distributed ledger technologies. *Computational and structural biotechnology journal*, 16, 257-266.
- Dorri, A., Kanhere, S. S., & Jurdak, R. (2017, April). Towards an optimized blockchain for IoT. In *Proceedings of the second international conference on Internet-of-Things design and implementation* (pp. 173-178).
- Frické, M. (2009). The knowledge pyramid: a critique of the DIKW hierarchy. *Journal of information science*, 35(2), 131-142.
- Gangwani, P., Perez-Pons, A., Bhardwaj, T., Upadhyay, H., Joshi, S., & Lagos, L. (2021). Securing environmental IoT data using masked authentication messaging protocol in a DAG-based blockchain: IOTA tangle. *Future Internet*, 13(12), 312.
- Huh, S., Cho, S., & Kim, S. (2017, February). Managing IoT devices using blockchain platform. In *2017 19th international conference on advanced communication technology (ICACT)* (pp. 464-467). IEEE.
- Lee, J., Bagheri, B., & Kao, H. A. (2015). A cyber-physical systems architecture for industry 4.0-based manufacturing systems. *Manufacturing letters*, 3, 18-23.
- Li, L., Huang, D., & Zhang, C. (2022). An Efficient DAG Blockchain Architecture for IoT. *IEEE Internet of Things Journal*, 10(2), 1286-1296.
- Mohamed, N., & Al-Jaroodi, J. (2019, January). Applying blockchain in industry 4.0 applications. In *2019 IEEE 9th annual computing and communication workshop and conference (CCWC)* (pp. 0852-0858). IEEE.
- Ordieres-Meré, J., Villalba-Diez, J., & Zheng, X. (2019). Challenges and opportunities for publishing IIoT data in manufacturing as a service business. *Procedia Manufacturing*, 39, 185-193.
- Pervez, H., Muneeb, M., Irfan, M. U., & Haq, I. U. (2018, December). A comparative analysis of DAG-based blockchain architectures. In *2018 12th International conference on open source systems and technologies (ICOSST)* (pp. 27-34). IEEE.
- Pranto, T. H., Noman, A. A., Mahmud, A., & Haque, A. B. (2021). Blockchain and smart contract for IoT enabled smart agriculture. *PeerJ Computer Science*, 7, e407.
- Wang, L., Törngren, M., & Onori, M. (2015). Current status and advancement of cyber-physical systems in manufacturing. *Journal of Manufacturing Systems*, 37, 517-527.
- Wang, Q., Yu, J., Chen, S., & Xiang, Y. (2023). Sok: Dag-based blockchain systems. *ACM Computing Surveys*, 55(12), 1-38.
- Wang, T., Wang, Q., Shen, Z., Jia, Z., & Shao, Z. (2021). Understanding characteristics and system implications of dag-based blockchain in iot environments. *IEEE Internet of Things Journal*, 9(16), 14478-14489.
- Wood, G. (2014). Ethereum: A secure decentralised generalised transaction ledger. *Ethereum project yellow paper*, 151(2014), 1-32.
- Zhao, L., & Yu, J. (2019, August). Evaluating DAG-based blockchains for IoT. In *2019 18th IEEE international conference on trust, security and privacy in computing and communications/13th IEEE international conference on big data science And engineering (TrustCom/BigDataSE)* (pp. 507-513). IEEE.

**PEER BULLYING/VICTIMIZATION IN ADOLESCENTS AND INVESTIGATION
OF AFFECTING FACTORS**

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ABSTRACT

Purpose: This study was conducted to determine peer bullying and the state of being victim of bullying in adolescents and investigate the affecting factors. **Method:** Sample of the study was composed of 542 students in 14-18 age group studying at a state high school in Karaman province in 2022-2023 academic year. In the study “Personal Information Form” was used to assess descriptive characteristics of the students and “Peer Bullying Determination Scale Adolescent Form” was used to determine their levels of victimization and practicing bullying.

Findings: It was determined that 60.5% of the students were females, 39.1% were attending the 11th grade, level of education of mothers of 39.7% was primary education and that of fathers of 35.1% was high school, mothers of 67.5% were unemployed, fathers of 88.7% were employed, 86.2% had a group of friends, 38.2% had an academic grade point average of 70-84. The total victimization score average of students of was 83.30 ± 27.47 , and their total score average of being a bully was 73.23 ± 26.31 . A statistically significant relationship was determined between the students’ total victimization score and their grade, father’s level of education, and having a group of friends ($p < 0.05$). No statistically significant relationship was found between the total victimization scores of students and their sex, mother’s level of education, mother-father employment status, academic status, and academic grade point average ($p > 0.05$). A statistically significant relationship was determined between the students’ state of being a bully and their grade, sex, economic status, and state of having a group of friends ($p < 0.05$). No statistically significant relationship was found between the total score of students’ being a bully and mother-father level of education, mother-father employment status, and academic grade point average ($p > 0.05$). **Result:** Total victimization score was higher among those in the first grade, with father having an undergraduate degree, with no group of friends. Total being a bully score was higher among those in the eleventh grade, males, those with expenses exceeding income, and those with groups of friends. It is recommended that monitoring and follow-up is conducted towards these risk groups by nurses in the scope of school health, effective intervention programs to reduce the state of victimization and bullying behaviour in adolescents.

Keywords: adolescent, peer bullying, victim

1. INTRODUCTION

The world is based on balance and harmony. The problem of aggressive behaviour and inability to control behaviour arises in human beings who cannot achieve this harmony (Yelboğa & Koçak, 2019b). Incompatibilities in the school environment have been the subject of many international studies under the name of school bullying (Slee & Skrzypiec, 2016). The subject of peer bullying has been included in many school studies on adolescents (Cross et al., 2018; Karmaliani et al., 2020; Singla et al., 2021). Bullying is a special form of aggressive behaviour. Bullying, as a subset of violent or aggressive behaviour, is a behaviour that intentionally causes psychological or physical harm to another individual (Tedeschi & Felson, 1994). In our age, bullying causes negative changes in the health of young people and is recognised as an important public health problem. The changes experienced by the person associated with bullying and the resulting physiological changes have prompted public health authorities to address the subject of bullying. Victims of bullying feel that they cannot easily defend themselves against a bully due to an imbalance of physical or social power (Gaffney et al., 2019). Studies report that young people face health problems such as depression, anxiety and insomnia as a result of bullying behaviour (Copeland et al., 2015; Holt et al., 2015).

When the studies on the subject are evaluated, it is stated that one out of every 5 adolescents in the United States is exposed to bullying at school (CDC, 2019). In a study conducted in China, it was reported that 20.83 per cent of students were exposed to bullying (Wang et al., 2012). In a study comparing Korean students living in Korea and Germany, 21.0% of Korean children living in Germany were bullied and 18.1% bullied their peers; 33.7% of Korean children living in Korea were bullied and 35.8% were involved in bullying (Bae, 2016). In a prevalence study conducted in Turkey, it was reported that 34.2% of students were victims of bullying and 13.9% bullied someone (Kilicaslan et al., 2022). In another study, it was reported that 47.0% of the students were victims and 31.42% were bullies (Gür et al., 2020). In addition, a meta-analysis study conducted in Turkey shows that an adolescent has been exposed to peer bullying at least twice during the academic year and has been bullied twice (Talu & Gümüş, 2022). Age, gender, personal characteristics, family characteristics (authoritarian-parental attitude), socio-economic status, psychological characteristics, behavioural characteristics, ethnic and racial characteristics are the factors that affect being a bully and a victim (Çelenk & Yıldızlar, 2019; Yelboğa & Koçak, 2019a).

Bullying incidents affect children physically, socially and psychologically and have been increasing recently as an important public health problem. For this reason, it is important to

continue studies on peer bullying in the field of public health, to better understand bullying and to develop appropriate intervention programmes for healthy generations. Therefore, this study was conducted to determine the status of peer bullying and victimisation in adolescents and to examine the factors affecting them.

Study questions;

1. What are the identifying characteristics of adolescents?
2. What is the mean score of adolescents being bully and victim?
3. Do the mean scores of being a bully and victim change according to the identifying characteristics of adolescents?

2. METHOD

Study design and setting

This is a descriptive study. This study was conducted in a state high school in Karaman province.

Study sampling

In the school where the study was conducted, 574 students were studying. Sample size was calculated with G-power 3.1.9.2 programme (Faul et al., 2007). The sample size of the study was calculated as 542 students with an effect size of 0.1552422 at 95% power and 95% confidence interval, taking into account the total average score of being a bully (247.49 ± 35.10) in the study of Mercan and Yıldırım Sarı (2018). The students in the sample were selected by random sampling method. The inclusion criteria of the study were the students studying in the 9th, 10th, 11th, 12th grades, and the exclusion criteria were the students being absent during the study.

Data Collection Tools

Two data collection tools were used in this study; "Personal Information Form" and "Peer Bullying Determination Scale Adolescent Form"

Personal Information Form: This form includes 15 questions (age, grade, gender, parents' education level, parents' occupation, family type, income level, number of siblings, number of friends) about the descriptive characteristics of the students who participated in the study determined by the researcher. The questions in the Personal Information Form were prepared based on the literature (Gür et al., 2020; Mercan & Sarı, 2018).

Peer Bullying Determination Scale Adolescent Form

Peer Bullying Determination Scale Adolescent Form was developed by Pişkin and Ayas (2015) to determine the levels of bullying and being bullied. The scale consisted of two scales, one

called "bully scale" and the other called "victim scale", which included a total of 53 items consisting of the same items asked in different ways. Cronbach α internal consistency reliability coefficient is 0.93 for the total victimisation scale and 0.92 for the total bullying scale. There are six factors in the scale. These factors are physical bully and victim, verbal bully and victim, isolation bully and victim, rumour spreading bully and victim, property damage bully and victim, sexual bully and victim. The scale is 5-point Likert type. The lowest score that can be obtained from the bully and victim dimensions of the scale is 53 and the highest score is 265. The higher the scores, the higher the status of being a bully and victim (Ayas & Pişkin, 2015). The data were collected by the researcher in the classroom environment between 27.02.2023 and 03.03.2023. The data were collected within the time periods determined by the school administration so as not to disrupt the course programme of the students.

Data Analysis

SPSS package programme was used in the analysis of the study data. Descriptive statistics were evaluated with number, percentage, mean and standard deviation. The conformity of the data to normal distribution was evaluated by using Kolmogorov Smirnov test and Q-Q plot graphs. Mann Whitney U and Kruskal-Wallis analyses were used because the data did not fit the normal distribution. $p < 0.05$ was considered statistically significant.

Ethical Approval

In order to conduct the study, permission was obtained from Konya Selcuk University Faculty of Nursing, Non-Interventional Clinical Research Ethics Committee (Date:29.12.2022 Issue: 2022/70). In order to collect the study data, the researcher obtained permission from Karaman Provincial Directorate of National Education and Karaman Province Governorship (Date: 20.01.2023 Issue: 450059). Written consent was obtained from the families and adolescents with an informed consent form.

3. RESULTS

It was found that 60.5% of the students were female, 39.1% were in the 11th grade, 39.7% had a primary school mother, 35.1% had a high school father, 67.5% had a non-working mother, 88.7% had a working father, 86.2% had a group of friends, and 38.2% had an academic grade point average of 70-84 (Table 1).

When the status of being a victim according to the descriptive characteristics of the students was analysed, it was found that there was a statistically significant difference between the total score of being a victim and the class, father's education level and having a group of friends ($p < 0.05$). 11. Those who were in the classroom, whose fathers were undergraduate graduates,

and who did not have a group of friends had higher total victimisation scores. There was no statistically significant difference ($p>0.05$) between the students' total score of victimisation and gender, mother's education status, parents' employment status, academic status and academic grade point average (Table 1).

When the status of being a bully according to the descriptive characteristics of the students was analysed, it was found that there was a statistically significant difference between the class, gender, economic status and having a group of friends ($p<0.05$). 11th graders, males, those whose income is higher than expenses and those who have a group of friends have higher total score of being a bully. There was no statistically significant difference ($p>0.05$) between the total score of being a bully and parental education level, parental employment status and academic grade point average (Table 1).

Table 1. Distribution of students' descriptive characteristics and mean scores of being victim and bully according to their descriptive characteristics

Features	n (%)	Total points for victimisation	Test and p value	Total points for being a bully	Test and p value
Grade					
9	96 (17.7)	82.71±26.44	KW=19.401 p=<0.001	70.09±25.39	KW=17.272 p=<0.001
10	175 (32.3)	85.32±29.13		73.58±24.70	
11	212 (39.1)	85.54±27.90		76.73±29.12	
12	59 (10.9)	70.23±17.63		64.63±18.62	
Gender					
Female	328 (60.5)	81.93±25.73	z=-0.732	67.50±20.59	z=-6.712
Male	214 (39.5)	85.37±29.87	p=0.464	82.02±31.31	p=<0.001
Mother's education level					
Literate	17 (3.1)	83.88±30.56	KW=3.910 P=0.418	77.70±35.27	KW=3.106 P=0.540
Primary School	215(39.7)	84.46±28.39		72.88±27.35	
Secondary School	141 (26.0)	79.95±26.27		70.51±21.46	
High school	129 (23.8)	85.14±27.96		74.93±26.97	
University	35 (6.5)	81.40±23.66		77.22±30.28	
Father's education level					
Literate	13 (2.4)	81.46±36.33	KW=9.883 p=0.042	80.30±40.26	KW=6.624 P=0.157
Primary School	142(26.2)	82.07±24.86		72.04±23.98	
Secondary School	119(22.0)	80.55±27.05		71.25±26.56	
High school	190(35.1)	83.11±27.30		73.60±27.81	
Bachelor's Degree	68(12.5)	91.48±31.21		76.33±23.50	
Mother's employment status					
Unemployed	366(67.5)	83.69±27.49	z=-0.723	73.71±26.56	z=-0.927
Employed	171(31.5)	82.27±27.61	p=0.469	72.05±25.78	p=0.354

Father's employment status					
Unemployed	51(9.4)	86.09±27.76	z=-0.928	77.50±30.42	z=-1.056
Employed	481(88.7)	82.99±27.48	p=0.353	72.71±25.88	p=0.291
Economic situation					
Income less than expenditure	72 (13.3)	87.75±29.81	KW=3.288	69.50±26.25	KW=9.346
Income equals expenditure	333 (61.4)	81.82±27.03	p=0.193	72.30±25.59	p=0.009
Income more than expenditure	137 (25.3)	84.54±27.12		77.38±27.73	
Academic grade point average					
85 and above	125(23.1)	77.87±21.24	KW=4.156	66.79±16.56	KW=6.910
70-84	207(38.2)	85.13±27.75	p=0.245	74.50±26.25	p=0.075
60-70	136 (25.1)	83.62±25.92		73.72±26.95	
45-60	74 (13.7)	86.79±36.65		79.91±35.73	
Having a group of friends					
Yes	467(86.2)	81.52±25.44	z=-2.851	73.68±25.67	z=-2.382
No	75 (13.8)	94.33±35.98	p=0.004	70.41±30.05	p=0.017

The mean total score of the students' victimisation was 83.30±27.47. When the sub-dimensions of the victimisation scale of the students were examined, it was found that the physical (25.46±9.92), verbal (14.36±6.09) and sexual bullying scores (13.69±6.09) of the students were higher than the other sub-dimensions. The students' total mean score of being a bully was 73.23±26.31. When the sub-dimensions of the bullying scale of the students were analysed, it was found that the physical (23.29±10.17), sexual (12.30±5.09) and verbal bullying scores (12.75±5.97) were higher than the other bullying types (Table 2).

Table 2. Mean scores of total and sub-dimensions of bully and victimisation of students

	Mean (standard deviation)	Minimum-maximum
Total score for victimisation	83.30±27.47	53-213
Physical bullying	25.46±9.92	14-62
Verbal bullying	14.36±6.09	8-36
Exclusion	9.32±4.86	6-30
Creating and spreading rumours	7.20±3.53	5-25
Damaging their belongings	11.98±4.30	9-34
Sexual bullying	13.69±6.09	10-46
Total score for being a bully	73.23±26.31	52-219
Physical bullying	23.29±10.17	14-70
Verbal bullying	12.75±5.97	8-36
Exclusion	7.79±3.48	6-30
Creating and spreading rumours	5.81±2.35	5-25
Damaging their belongings	12.19±4.70	10-43
Sexual bullying	12.30±5.09	10-42

4. DISCUSSION

Bullying is an important public health problem. The increasing continuation of peer bullying, which leads to negative changes in the health of young people, in the school environment we trust, creates disharmony at school and disrupts the healthy school environment. For this reason, this study was conducted to determine the status of peer bullying and victimisation in adolescents aged 14-18 years and to examine the factors affecting them.

In this study, the total mean score of victimisation is 83.30 ± 27.47 . The mean total score of being a bully is 73.23 ± 26.31 . In the study of Mercan and Sarı (2018), the mean score of being a victim was reported as 231.25 ± 46.3 , and the mean score of being a bully was reported as 247.49 ± 35.1 . In another study, the mean victim score was 65.25 ± 15.86 and the mean bully score was 74.61 ± 23.22 (Kılıç and Uzun 2020). In this study, physical, verbal and sexual bullying scores in the sub-dimensions of the victimisation scale were found to be higher than the other sub-dimensions. In the sub-dimensions of the bullying scale, physical, sexual and verbal bullying were found to be higher than the other subtypes. In the study conducted by Mercan and Sarı (2018), the scores of physical bullying, property damage and sexual bullying in the sub-dimensions of victimisation and bullying scale were found to be higher than other sub-dimensions (Mercan & Sarı, 2018). In another study, physical bullying was found to be higher in the sub-dimensions of victimisation and bullying compared to other sub-types (Çelenk & Yıldızlar, 2019). It is thought that this difference in the results of the study may be due to the province, school type and sample characteristics.

In this study, boys' total score of being a bully was found to be higher than that of girls. However, in this study, no significant difference was found between victimisation and gender. In the study conducted by Çelenk and Yıldızlar (2019), it was reported that the total score of being victim and bully did not show a significant difference according to gender. In another study conducted on high school students, it was stated that gender was a determinant in both being a victim and a bully (Mohseny et al., 2019). In some studies, similar to this study, it was stated that the mean scores of boys being bullies were higher (Gkatsa et al., 2015; Yelboğa & Koçak, 2019b).

In this study, the mean scores of 11th grade students being both victim and bully are higher than other grade types. The fact that the 10th and 11th grade mean scores were higher than the 9th grade scores indicates that the bully and victim status increases with increasing age. The 12th grade average score is low in terms of being both victim and bully. The 12th graders' low average scores in both types can be attributed to their anxiety about the future, exam stress,

established friendships, and age-appropriate physical and mental maturation. In a study, similar to the findings of this research, the mean scores of 10th and 11th grade bullying were higher than 9th grade (Burnukara & Uçanok, 2012). In the study conducted by Çelenk and Yıldız (2019), 9th grade victim and bully mean scores were found to be higher than other class types. In this study, no significant difference was found between the mother's education level and the mean score of victimisation. However, in terms of father's education level, the mean victimisation score of adolescents with high school and university graduate parents was found to be higher than the other education levels. This difference may be associated with the fact that the adolescent spends less time with the parent, the parent therefore tends to increase the control over the child and the adolescent's burnout at this point. In a study, it was stated that as family-related burnout increases, being a victim of relational and verbal bullying increases (Yöndem & Totan, 2007). In a study different from this study, it was stated that there was no significant relationship between parents' education level and bullying behaviours (Yelboğa & Koçak, 2019b). Unlike the findings of this study, in the study conducted by Mercan and Sarı (2018), a significant difference was found between the mother's education level and the mean scores of being a victim (Mercan & Sarı, 2018).

In this study, it was determined that the mean victim score of those who did not have a group of friends was higher than those who had a group of friends, and the mean bully score of those who had a group of friends was higher than those who did not. In a study, it was determined that as the number of friends increases, the bullying status of the person increases, and in the same direction, the victimisation experienced as a result of being a victim increases with the increase in bullying behaviours and the number of friends.(Yılmaz & Çağlayan, 2018). In another study, similar to this study, adolescents with friendship problems were found to have a high risk of being victimised.(Ehrhardt et al., 2022). The victimisation experienced by a person who feels lonely and does not feel belonging to any group and the situation experienced by a person who has a group of friends who bullies and tries to be at the forefront can be associated with anxiety.

In this study, no significant difference was found between economic status and the mean score of victimisation. However, when the economic status variable was analysed, it was found that the mean bullying score of the student group whose income was higher than the expenses was higher than the other income groups. There are study findings in the literature that support this study (Gkatsa et al., 2015). In our study, the number of people with middle income is higher and the number of people with income more than expenditure is lower than this group. Based

on this, it is predicted that the group that thinks that they have the financial power may be applying bullying behaviour to the victims who remain timid by attracting more people to them. In addition, contrary to the findings of this study, some studies have reported that students with low socioeconomic status are more involved in bullying (Dietrich & Ferguson, 2020; Tippett & Wolke, 2014).

5. CONCLUSION

As a result, those who were in the eleventh grade, whose fathers were undergraduate graduates, and who did not have a group of friends had higher total victimisation scores. Those who are in the eleventh grade, males, those whose income is higher than expenses and those who have a group of friends have higher total scores of being a bully. It is recommended that screening and follow-ups for peer bullying should be carried out by nurses within the scope of school health for these risk groups, and effective intervention programmes should be implemented to reduce victim status and bullying behaviour in adolescents in line with the literature.

6. REFERENCES

- Ayas, T., & Pişkin, M. (2015). Akran zorbalığı belirleme ölçeği ergen formu. *Akademik Bakış Uluslararası Hakemli Sosyal Bilimler Dergisi*(50), 316-324.
- Bae, H.-o. (2016). Bullying involvement of Korean children in Germany and in Korea. *School psychology international*, 37(1), 3-17.
- Burnukara, P., & Uçanok, Z. (2012). İlk ve orta ergenlikte akran zorbalığı: Gerçekleştiği yerler ve bas etme yolları. *Türk Psikoloji Yazıları*, 15(29), 68.
- CDC. (2019). *CDC. Preventing youth violence fact sheet, 2019 (erişim13.01.2023)*. Available from: www.cdc.gov/injury.
- Copeland, W. E., Bulik, C. M., Zucker, N., Wolke, D., Lereya, S. T., & Costello, E. J. (2015). Does childhood bullying predict eating disorder symptoms? A prospective, longitudinal analysis. *International journal of eating disorders*, 48(8), 1141-1149.
- Cross, D., Lester, L., Pearce, N., Barnes, A., & Beatty, S. (2018). A group randomized controlled trial evaluating parent involvement in whole-school actions to reduce bullying. *The Journal of Educational Research*, 111(3), 255-267.
- Çelenk, T. E. A., & Yıldızlar, O. (2019). Lise öğrencilerinde akran zorbalığı ve mağduriyetinin incelenmesi. *Sağlık ve Yaşam Bilimleri Dergisi*, 1(2), 24-31.
- Dietrich, L., & Ferguson, R. F. (2020). Why stigmatized adolescents bully more: the role of self-esteem and academic-status insecurity. *International Journal of Adolescence and Youth*, 25(1), 305-318.
- Ehrhardt, A. D., Hoffman, A. J., & Schacter, H. L. (2022). On shaky grounds: Peer victimization predicts friendship instability across the ninth grade school year. *Journal of Adolescence*, 94(7), 1041-1046.
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, 39(2), 175-191.
- Gaffney, H., Farrington, D. P., & Ttofi, M. M. (2019). Examining the effectiveness of school-bullying intervention programs globally: A meta-analysis. *International Journal of Bullying Prevention*, 1(1), 14-31.
- Gkatsa, T., Magklara, K., Bellos, S., Damigos, D., Mavreas, V., & Skapinakis, P. (2015). Sociodemographic associations of school-related bullying and its impact on psychosomatic health in adolescents. *Archives of Hellenic Medicine/Arheia Ellenikes Iatrikes*, 32(2).
- Gür, N., Eray, Ş., Makinecioğlu, I., Siğirli, D., & Vural, A. P. (2020). Akran zorbalığı ile aile duygu dışı vurumu ve psikopatoloji arasındaki ilişki. *Anadolu Psikiyatri Dergisi*, 21(1), 77-86.
- Holt, M. K., Vivolo-Kantor, A. M., Polanin, J. R., Holland, K. M., DeGue, S., Matjasko, J. L., Wolfe, M., & Reid, G. (2015). Bullying and suicidal ideation and behaviors: A meta-analysis. *Pediatrics*, 135(2), e496-e509.
- Hong, J. S., Espelage, D. L., & Rose, C. A. (2019). Bullying, peer victimization, and child and adolescent health: An introduction to the special issue. In (Vol. 28, pp. 2329-2334): Springer.
- Karmaliani, R., McFarlane, J., Khuwaja, H. M. A., Somani, Y., Bhamani, S. S., Saeed Ali, T., Asad, N., Chirwa, E. D., & Jewkes, R. (2020). Right To Play's intervention to reduce peer violence among children in public schools in Pakistan: a cluster-randomized controlled trial. *Global health action*, 13(1), 1836604.
- Kilicaslan, F., Beyazgul, B., Kuzan, R., Karadag, D., Koruk, F., & Koruk, I. (2022). The prevalence of peer bullying and psychiatric symptoms among high school students in southeast Turkey. *Nordic journal of psychiatry*, 1-8.
- Mercan, H., & Sari, H. Y. (2018). Lise öğrencilerinde akran zorbalığı ve sosyodemografik değişkenlerle ilişkisi. *Florence Nightingale Journal of Nursing*, 26(1), 21-29.
- Mohseny, M., Zamani, Z., Basti, S. A., Sohrabi, M.-R., Najafi, A., Zebardast, J., & Tajdini, F. (2019). Bullying and victimization among students bears relationship with gender and emotional and behavioral problems. *Iranian journal of psychiatry*, 14(3), 211.
- Singla, D. R., Shinde, S., Patton, G., & Patel, V. (2021). The mediating effect of school climate on adolescent mental health: Findings from a randomized controlled trial of a school-wide intervention. *Journal of Adolescent Health*, 69(1), 90-99.

- Slee, P. T., & Skrzypiec, G. (2016). *Well-Being, Positive Peer Relations and Bullying in School Settings* (I. Boniwell, Ed.). Springer Nature.
- Talu, E., & Gümüş, G. (2022). Türkiye’de akran zorbalığının ergenler arasında yaygınlığının incelenmesi: bir meta analiz çalışması. *Trakya Eğitim Dergisi*, 12(3), 1673-1682.
- Tedeschi, J. T., & Felson, R. B. (1994). *Violence, aggression, and coercive actions*. American Psychological Association.
- Tippett, N., & Wolke, D. (2014). Socioeconomic status and bullying: A meta-analysis. *American journal of public health*, 104(6), e48-e59.
- Wang, H., Zhou, X., Lu, C., Wu, J., Deng, X., Hong, L., Gao, X., & He, Y. (2012). Adolescent bullying involvement and psychosocial aspects of family and school life: A cross-sectional study from Guangdong Province in China. *PLoS One*, 7(7), e38619.
- Yelboğa, N., & Koçak, O. (2019a). Ergenlerde akran zorbalığını yordayan bazı faktörlerin zorba ve mağdur bireyler açısından değerlendirilmesi. *OPUS International Journal of Society Researches*, 13(19), 2286-2320.
- Yelboğa, N., & Koçak, O. (2019b). Lise öğrencilerini akran zorbalığına iten nedenlerin değerlendirilmesi ve Artvin örneği. *İstanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi*, 18(35), 771-802.
- Yılmaz, T., & Çağlayan, İ. D. (2018). Ergenlerde akran zorbalığının ebeveynlik çeşitleri ve yaşanılan yer açısından karşılaştırılması. *Nesne Psikoloji Dergisi*, 6(12), 82-102.
- Yöndem, Z. D., & Totan, T. (2007). Ergenlerde zorbalığın anne baba ve akran ilişkileri açısından incelenmesi. *Ege Eğitim Dergisi*, 8(2), 53-68.

UNDERSTANDING THE ROLE OF COVENANT ORIENTATION IN KNOWLEDGE SHARING: A STUDY OF INDONESIAN SMALL AND MEDIUM ENTERPRISES

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Abstract

Organizational culture, both small and large organizations, is an important thing in an organization because it can affect everyone's behaviour. The organizational culture built in this study is a clan organizational culture. Organizational culture is formed by the owner and followed by employees and everyone in the organization. The purpose of this research is to find out whether there is a relationship between clan culture and company SME performance. This research is analyzed using Structural Equation Modeling (SEM) analysis tools. This study uses primary data and secondary data. Secondary data is obtained from data from the cooperative service of small and medium enterprises and the Bandung city trade industry. On the other hand, primary data is obtained from distributing questionnaires to SME entrepreneurs. This research was conducted in West Java (Bandung Regency, North Bandung, South Bandung, East Bandung and Bandung City) by distributing questionnaires randomly with simple random sampling. About 500 questionnaires were distributed, and 241 were received. The object of research was small and medium business actors engaged in the culinary business. The SME players' educational background, the majority of whom are graduates, are between 30 and 40 years old. The company ages of these SME actors range from 1 year to 10 years. The results showed that clan culture did not directly affect SMEs' performance but was moderated by covenantal knowledge sharing. Clan culture does not directly affect the performance of SMEs but is moderated by covenantal knowledge sharing. Covenantal knowledge sharing is a process of disseminating knowledge to everyone, whether employees, consumers, or suppliers, underpinned by a confident attitude, closeness, voluntary attitude, patience, comfort and humility.

Kata kunci : Clan Culture, Covenantal knowledge sharing, SME's Performance

BACKGROUND

Organizational culture, both small and large organizations, is an important thing in an organization because it can affect everyone's behaviour. Organizational culture is not formed quickly but formed over a long time. People usually form organizational culture within the organization. Organizational culture is formed by the owner and followed by employees and everyone in the organization. It is in line with what was conveyed by Lok and Crawford (2004), which states that organizational culture can influence everyone in the organization in regulating behaviour and performing tasks and managing resources to achieve. Organizational culture can also be considered a resource because it provides information for members of the organization to create, acquire, share, and manage knowledge. (Jones et al., 2006).

In developing SME, organizational culture is needed to support small and medium enterprises' development and growth. Every organization has a unique culture that distinguishes one organization from another. SME is an organization that has a different organizational culture from large companies. The organizational culture built in this study is a clan organizational culture. Clan culture can be built in partnership and kinship. This family-like culture is the culture prevailing in Indonesia so far. A partnership is a culture where everyone can build a relationship, be it an employee, a supplier or a customer.

Partnerships must be well built to benefit all parties both as owners of SMEs and as users of SMEs. It aligns with Sadigli's (2017) opinion, which states that clan culture is similar to a family-like culture whose main focus is on the organization's goals and values. Clan cultures tend to be more internally focused, smaller, and have a higher degree of specialization. (Jacobs et al, 2013). Clan culture consists of a warm and friendly workplace where people can freely share knowledge. The form of clan organizational culture emphasizes organic values that are internally focused. Tseng (2010) argues that clan culture emphasizes the long-term benefits of developing human resources with high unity or cohesion and morals but wise and conservative.

Clan culture is characterized by cohesiveness, participation, trust, cooperation, teamwork, and a sense of unity, commitment and morale. Sadiglih (2017) states that clans' cultural characteristics in the workplace tend to positively impact performance. Meanwhile, Tseng (2010) states that clan culture highlights the long-term benefits of developing human resources with high cohesion and morale, though it is prudent and conservative related to company performance. Clan culture represents a welcoming place to work where people can share. This condition shows a family atmosphere. The leader of the organization is considered

a mentor and possibly even a figure from the organization. In this culture, a high level of loyalty or commitment is needed. Clan culture is one of the dimensions expressed by Cameron and Quinn (1999), who develop an organizational culture framework built on a theoretical model known as competitive value framework. Martin (2005) asserts that diverse organizational cultures, lack of trust, lack of time, ineffective communication and poor knowledge can hinder knowledge sharing. Knowledge sharing is the act of making knowledge available to others in the organization.

Research results by Supeno and Laksmana (2015); Castro (2016); S Sadighi (2017); Maelah (2018) shows that clan culture has a significant effect on organizational performance. While the results of research by Zhu (2012), Kayab (2013) show that clan culture has no significant effect on organizational performance. Based on the previous elaboration, we can observe a research gap between organizational culture and organizational performance. The authors try to add a new construct that can support organizational culture on small and medium enterprises' performance. The new construct in this research is covenantal knowledge sharing. Covenantal knowledge sharing is different from other knowledge sharing because it is formed from an organizational culture with a clan culture and serving leadership. Covenantal knowledge sharing is a process of disseminating knowledge to everyone, whether employees, consumers, or suppliers, underpinned by a confident attitude, closeness, voluntary attitude, patience, comfort and humility.

Covenantal knowledge sharing is shared with everyone where all those people are considered partners. In line with the opinion of Lee and Al-Hawamdeh (2002) that knowledge sharing can occur in one direction or two ways, vertically (between superiors and subordinates) or horizontally, which occurs to people outside the organization such as customers, suppliers, partners. Strategic alliances, collaborators and regulators. SME owners must be able to conduct covenantal knowledge sharing to improve the performance of SMEs.

Covenantal knowledge sharing as a mediated variable is in line with the research results by Song et al. (2015) and Li et al. (2019), which show that knowledge sharing is a mediated variable. Covenantal knowledge sharing must be done correctly to be of great advantage to the continuity of a business. SME owners have the potential to conduct covenantal knowledge sharing. It needs to be a concern considering that conventional SMEs with local contexts are also unique, so a knowledge-sharing process is needed to enhance SMEs' performance. SME owners only keep their tacit knowledge without performing knowledge sharing. So that there is a loss of knowledge in the organization because knowledge sharing is not implemented.

Mcdermott and O'Dell (2001) showed that doing knowledge sharing can add value to the company. Members of the company will share their knowledge and accept other people's ideas because they believe in its core values. Each individual will participate in the community to share or exchange knowledge if the personal benefits outweigh the disadvantages (Chang, 2011). Yang (2004) states that knowledge sharing is disseminating information and knowledge through all departments and or organizations. Van Den Hooff and Ridder (2004) states that knowledge sharing is the process of exchanging knowledge and creating new knowledge together. Thus, we can see that this knowledge sharing must occur within the organization to create new knowledge.

The process of implementing knowledge sharing refers to social interaction activities that involve the exchange of employee knowledge, experience and skills through all departments or organizations (Kim and Lee, 2012). Relevant knowledge sharing has the potential to reduce costs and optimize processes, while deficiencies in doing knowledge sharing can endanger the organization and even make the process of activities in the organization ineffective (Rutten et al., 2016). Knowledge sharing can increase employee creativity, create new knowledge, complement individual shortcomings, and maximize knowledge's benefits through better individual and organizational performance. SME owners must create a family-friendly work atmosphere, which allows everyone to do knowledge sharing well. SME owners have a significant role in doing knowledge sharing. Knowledge sharing must be done correctly to be of great benefit to the continuity of a business. Every organization must be able to utilize knowledge effectively depending on people who can create knowledge sharing and use that knowledge. Increasing knowledge is only possible when that person can do the knowledge sharing they have and can help increase others' knowledge.

Knowledge sharing is the act of making knowledge available to others in the organization. Akhavan et al. (2012) stated that knowledge sharing in an organization could be viewed as a behaviour used by each individual voluntarily to provide knowledge and experience to organization members. In conducting covenantal knowledge sharing, a serving leadership is needed. Serving leadership is sensitive to all organizational stakeholders' needs and desires, including those who have no direct influence on the organization (Graham, 1991). Serving leadership emphasize trust, respect, and empowerment (Russell, 2001). Servicing leadership is based on the premise that in order to bring out the best in their followers, leaders rely on communication to understand the abilities, needs, wants, goals, and potential of that individual (Liden et al., 2008). Serving leadership can provide influence and motivation that can produce

a shared vision dedicated to helping others, building a loving community, and creating freedom and resources for followers (Boerner and Gebert, 2012).

Kaul (2014) states that serving leadership is created based on respect and compassion, where power and authority are used to provide benefits to the entire organization. The characteristic of serving leadership is humility, and a leader cares about followers by receiving recognition for follower achievements rather than receiving awards for their success. Servant leadership begins with an attitude of wanting to serve everyone's needs. A leader must set a good example so that their followers can follow him without feeling a burden and compulsion. Leaders are followed not because they are feared for their power but because they respect and respect them because they show a good example of both words and behaviour. A leader's presence is needed, and many are looking for a leader figure who is needed for the organization. Servant leadership must seek to transform their followers into individuals who grow better, wiser, freer, more autonomous, and more likely to serve. The essence of serving leadership is someone who must surrender individualist desires for the collective good (Joseph and Winston, 2003).

In SMEs, leadership is needed where the leader must serve every need of his followers. Serving leadership can demonstrate their moral responsibility for the organization's success and its stakeholders' success, especially employees and customers. Small and medium enterprises are one type of business that has great potential and opportunities for economic growth in Indonesia. West Java is one of the regions where SMEs are growing and developing rapidly. SMEs have a prominent role in propelling the West Java economy. The organizational culture that belongs to the West Java region is very supportive of economic growth, especially in SMEs' growth. The culture of creativity, kinship, friendliness, innovation owned by the people of West Java is very helpful in the growth of SMEs. SMEs' current challenges, especially in facing industry 4.0, are the numerous overseas products that offer lower prices with better quality. It can cause a shortage of demand for the domestic market. Based on this, the SME owner must manage the company culture entirely to face the existing challenges.

LITERATURE REVIEW

Organizational Culture

The concept of organizational culture originates from research in the field of organizational behaviour characterized by qualitative methods (Balthazard et al., 2006). Organizational researchers tend to focus separately on cultural elements such as symbols, myths, or stories that appear to be important in analytical studies. Organizational culture is one

of the most popular concepts in management and organizational theory. Organizational culture is the belief of top management, who can create, maintain, and change an organization's culture. Organizational culture shapes their perceptions and behaviour, and one way is by building a context for social interaction within the organization (De Long and Fahey, 2000).

Rayees Farooq (2018) says that organizational culture is a set of shared beliefs, values and assumptions that direct how people behave in an organization. Based on the above opinion, organizational culture is very important in an organization that can regulate and become a reference or standard for everyone in the organization, both as a leader and employee. The organizational culture of SMEs is different compared to other organizational cultures. The organizational culture that will be developed in this study is the clan culture. This model, which was first described by Quinn and Rohrbaugh (1983), is based on an empirical analysis of individual values that impact organizational performance. Cameron and Quinn's organizational culture framework is based on a theoretical model known as the Competing Values Framework. This model shows whether an organization focuses internally and externally, predominantly or not. It also states whether an organization strives for flexibility and independence or constancy and regulation. CVF is an idea that allows imagining various management theories such as internal processes, open systems, rational goals and human relations (Sadighi, 2017). The cultural viewpoint of CVF provides four types of cultural orientation, namely group (clan) culture, developmental/adhocratic culture, rational culture and hierarchical culture.

Knowledge Sharing

Knowledge sharing has been described as an essential component of knowledge management practice (Alavi and Leidner, 2001; Earl, 2001; Hendriks, 1999; Hickins, 1999; Sohail and Daud, 2009). Knowledge sharing is the act of making knowledge available to others in the organization (Ipe, 2003). Wang et al., (2006) said that knowledge sharing could improve work and help a team develop strong knowledge. Knowledge sharing as part of knowledge production occurs in the form of discussion, working together to solve problems (Bakker, 2006).

Knowledge sharing provides all skills and knowledge for individuals to work or achieve goals more efficiently (Le, 2006). Knowledge sharing explicitly includes almost all forms of knowledge sharing, which institutionalized in organizations. The practice of explicit knowledge sharing appears to be more common in the workplace because explicit knowledge can be easily captured, codified and transmitted. Knowledge sharing can assist in creating shared models and the development of transactive memory, thereby enabling better

coordination among team members (Srivastava, 2006). Huysman and Wulf (2006) stated two things that motivate people to do knowledge sharing: first, people do knowledge sharing because they expect recognition and appreciation for their work (knowledge), promotion opportunities, or a sense of responsibility. Second, they expect something in return, such as other people will also share the knowledge that might be of use to them. Knowledge sharing is perceived as a knowledge transaction process in which knowledge buyers and sellers must reciprocally benefit from the exchange. Mutual benefits, reputation benefits, and trust are considered incentives for knowledge sharing (Hsu & Lin, 2008). McAdam et al, (2012) say that knowledge sharing refers to activities through various transfer forms starting from one person, group, or organization to another.

Wang and Wang (2012) said that knowledge sharing is more focused on knowledge gathering and diffusion and contributes to exchanging knowledge-based applications and creations in organizations. Knowledge sharing is an activity, experience, skill information, and expertise which exchanged, shared, and transferred between organizational members (Kim, Lee, Paek, & Lee, 2013). Eze et al., (2013) said that knowledge sharing refers to how team members share ideas related to tasks, information, and improvements to one another. Knowledge sharing in an organization is an act of transmitting organizational knowledge among employees to take action and engage in innovation (Islam et al., 2015). Lin (2015) says that knowledge sharing refers to collective beliefs or behavioral routines related to exchanging employees' knowledge, experiences, and skills across departments or organizations.

Knowledge sharing refers to the communication of all types of knowledge, namely explicit knowledge and tacit knowledge, through an attitude of socialization, interaction, and training. Knowledge sharing occurs between two individuals, one who has the knowledge and the other who acquires knowledge. This process includes sharing information, ideas, suggestions, and experiences related to an organization. (Obeidat et al., 2017). From the above statement, it can conclude that knowledge sharing is important in an organization's growth and development. Knowledge sharing in an organization must be managed properly to provide positive benefits for an organization. Knowledge sharing in SMEs is very important and is usually done informally. Knowledge sharing is one of the main ways to increase organizational employees' knowledge, which leads to increased organizational performance (Tuan, 2016). The results show that knowledge sharing that occurs in organizations can improve performance (Oyemomi, 2018). Kim et al., (2018) results of their research show that knowledge sharing is a mediated variable.

Organizational Performance

Venkantraman and Ramanujam (1986) view the performance of a company as having a multidimensional nature. Firm performance reflects the achievement of goals in terms of labor, capital, marketing, and fiscal issues (Marcoulides & Heck, 1993). Zhang & Zhu (2012) said that organizational performance is the achievement of specific goals, usually consisting of several indicators to measure the organization's efficiency and effectiveness to understand whether its operating processes conform with the goals set.

HYPOTHESIS

Suppiah and Sandhu (2011) stated a relationship between clan organizational culture and knowledge sharing. Wiewiora et al., (2014) asserted that a clan culture in the organization could increase trust in conducting knowledge sharing in the organization. From the literature review conducted and empirical evidence that supports the relationship between the two variables, the hypothesis for the above statement is:

Hypothesis 1 : Clan culture has impact on covenantal knowledge sharing.

Wang and Noe, (2010) showed that knowledge sharing has many positive effects such as sales and revenue growth, company innovation ability, team performance, faster completion of new product development, and reduced production costs. Qammach (2016) states that knowledge sharing can positively affect innovation performance and that organizations must prioritize knowledge sharing. From the literature review conducted and empirical evidence that supports the relationship between the two variables, the hypothesis for the above statement is:

Hypothesis 2 : Covenantal knowledge sharing has impact on the performance of SMEs.

Organizations strive to improve company performance, and organizational culture is recognized as one of the important drivers of company performance (Uzkurt, Kumar, Kimzan, & Eminoğlu, 2013). Kaya (2012) states that clan organizations' cultural dimensions are positively related to financial performance. Jacobs et al. (2013) stated that clan culture is more dominant in influencing performance. Sadighi's research results (2017a) show that organizational culture influences the performance of SMEs. From the literature review conducted and empirical evidence that supports the relationship between the two variables, the hypothesis for the above statement is:

Hypothesis 3: Clan culture has impact on the performance of SMEs.

METHODS

The primary data is obtained from distributing questionnaires to SME entrepreneurs. This research was conducted in West Java (Bandung Regency, North Bandung, South Bandung,

East Bandung, and Bandung City). The distribution of questionnaires was carried out randomly with simple random sampling. The research object was micro and medium business actors engaged in the culinary business. The educational background of the SME owner is mostly bachelors. This research is analyzed using Structural Equation Modeling (SEM) analysis tools.

RESULTS

This research is analyzed using Structural Equation Modeling (SEM) analysis tools. The selection of analysis tools is based on the fact that SEM can simultaneously test several dependent and independent variables with direct and indirect relationships (Ferdinand, 2005). The explanation of the output with this method is divided into three parts: the fit instrument model test, the goodness of fit criteria, and the output of the hypothesis test.

Validity and Reliability

The first thing to do is assess whether the research model built meets the instrument testing criteria, namely the measurement construct, to assess the unidimensionality and construct reliability. Unidimensionality is a basis for calculating reliability which is intended when indicators of a construct are accepted. The approach used to assess the model's unidimensionality is to measure composite reliability (Cronbach, 1951) and average variance extracted (AVE) for each construct. Reliability is a construct measurement through consistent internal indicators. High-reliability results provide confidence that each variable's indicators have consistency with their measurements (Vaske, Beaman, & Sponarski, 2017).

The accepted level of reliability (CR) must be ≥ 0.70 , and the reliability is ≤ 0.70 to be accepted in the research. The approach used to assess the model's unidimensionality is to measure composite reliability (Cronbach, 1951) and average variance extracted (AVE) for each construct. Reliability is a construct measurement through consistent internal indicators. High-reliability results provide confidence that each variable's indicators have consistency with their measurements (Vaske, Beaman, & Sponarski, 2017).

The level of reliability (CR) accepted must be ≥ 0.70 , and reliability \leq of 0.70 can be accepted for research that is still exploratory (Kaplan and Sacuzzo, 2001). However, reliability cannot guarantee validity. Validity can measure the extent to which an indicator describes the accuracy in measuring what the study wants to measure. Another measure of validity is the variance extracted as a complement to the AVE size with a cut off value \geq of 0.50 (Gerbing & Anderson, 1988; Fornell & Larcker, 1981), explaining that the AVE value must be greater than 0.5 and if the AVE value <0.4 then the construct is still accepted. If the value of composite reliability

(CR) is > 0.7 , then the convergent validity is still accepted. Due to the loading factor value > 0.5 but still < 0.6 , it results in a relatively small AVE value. The SEM AMOS output is as follows:

Tabel 1. Validity and Reliability Test

Variable	Indicator	Loading Factor	Standar Loading2	1-Std. Loading	CR	AVE			
Clan Culture	BC1	0.676	0.457	0.543	0.858	0.355			
	BC2	0.598	0.358	0.642					
	BC3	0.631	0.398	0.602					
	BC5	0.595	0.354	0.646					
	BC6	0.541	0.293	0.707					
	BC7	0.586	0.343	0.657					
	BC8	0.621	0.386	0.614					
	BC9	0.567	0.321	0.679					
	BC11	0.56	0.314	0.686					
	BC12	0.576	0.332	0.668					
	BC13	0.587	0.345	0.655					
	Covenantal Knowledge Sharing	CKS1	0.602	0.362			0.638	0.856	0.316
		CKS2	0.506	0.256			0.744		
CKS3		0.535	0.286	0.714					
CKS4		0.543	0.295	0.705					
CKS5		0.548	0.300	0.700					
CKS6		0.61	0.372	0.628					
CKS7		0.645	0.416	0.584					
CKS8		0.52	0.270	0.730					
CKS9		0.549	0.301	0.699					
CKS10		0.653	0.426	0.574					
CKS11		0.565	0.565	0.681					
CKS12		0.513	0.513	0.737					
CKS13		0.487	0.487	0.763					
SME Performance	KU1	0.653	0.426	0.574	0.789	0.429			
	KU2	0.612	0.375	0.625					
	KU3	0.656	0.430	0.570					
	KU4	0.75	0.563	0.438					
	KU5	0.592	0.350	0.650					

Values with a loading factor <0.5 are eliminated from the model, namely BC4, BC10, CKS12. Estimated parameter test results explicate that the model has passed the reliability and validity instrument testing. The validity value measured using construct reliability (CR) were ≥ 0.70 (Kaplan and Sacuzzo, 2001) and AVE <0.40 (Fornell & Lacker, 1981).

Outlier Normality Assumption Test

Outliers are observational data with different characteristics and appear in extreme forms (Hair et al., 1995). Outlier data appears in univariate and multivariate forms. Testing univariate outliers can be done by looking at the standard score (Z-Score) conversion data which has an average value of 0 and a standard deviation of 1. The model is said to have univariate outliers if the minimum and maximum values are \pm four or \pm five (Ferdinand, 2014). The following is the univariate outlier test data using construct reliability (CR) which is ≥ 0.70 (Kaplan and Sacuzzo, 2001) and AVE <0.40 (Fornell & Lacker, 1981).

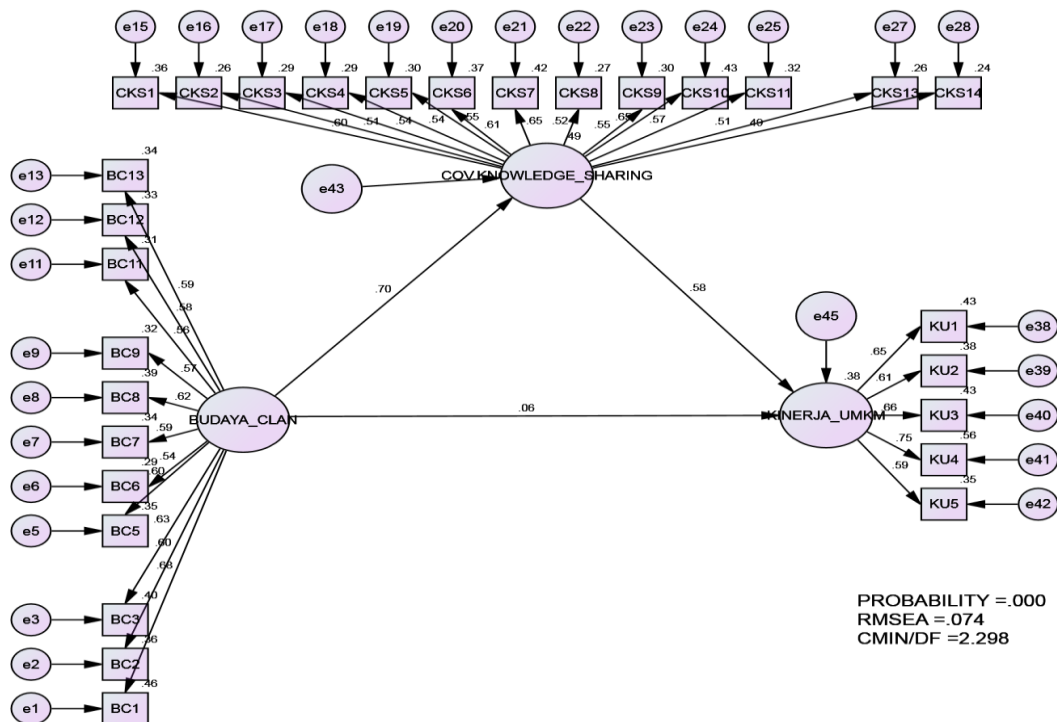


Figure 1. Model Evaluation

The image shows the model construct of the research. However, a construct cannot be considered good if it does not meet the goodness of fit criteria. The goodness of fit measures the suitability of the actual or observed input (covariance or correlation matrix) with the proposed model's predictions. The basic goodness of fit is the primary measurement indicator model, namely Chi-square (X^2) and Degrees of freedom. Absolute fit measurement estimate the overall fit model (both structural models and joint measurement models), which consisting of chi-square (X^2), the goodness of fit indices (GFI), and root mean square error of approximation (RMSE). Incremental fit indices are a measure used to compare the proposed model with other models specified by researchers. It consists of the adjusted goodness of fit index (AGFI), norm fit index (NFI), comparative fit index (CFI), incremental fit index (IFI), relative fit index (RFI), and the Tucker Lewis Index (TLI). Parsimonious fit indices provide adjustments to fit measurements to be compared between models with a different number of coefficients. It consisting of Akaike's Information Criterion (AIC), Consistent Akaike Information Index (CAII), Expected Cross Validation Index (ECVI), Parsimonious Normal Fit Index (PNFI), and Parsimonious Goodness of Fit Index (PGFI).

In empirical research practice, a researcher does not have to suffice all the goodness of fit criteria. The use of 3 to 4 goodness of fit criteria is considered sufficient to assess the feasibility of a model with the condition that each of the goodness of fit groups, namely absolute fit indices, incremental fit indices, and parsimonious fit indices, are represented (Hair *et al.*, 2014). Based on chi-square (X^2), the goodness of fit indices (GFI), and root mean square error of approximation (RMSE), incremental fit indices are a measure to compare the proposed model with other models specified by the researcher. It consists of adjusted goodness of fit index (AGFI), norm fit index (NFI), comparative fit index (CFI), incremental fit index (IFI), and relative fit index (RFI), and the Tucker Lewis Index (TLI). Parsimonious fit indices perform adjustments to fit measurements to be comparable between models with different number of coefficients, which consists of Akaike's Information Criterion (AIC), Consistent Akaike Information Index (CAII), Expected Cross Validation Index (ECVI), Parsimonious Normal Fit Index (PNFI) and Parsimonious Goodness of Fit Index (PGFI). Based on data processing in the model, the following results were obtained:

Table 2. Goodness of Fit Evaluation

Criteria	Cut-off value	Result	Classification
Chisquare	Expected Low	859.332	Fit
RMSEA	$\leq 0,09$ (Hatcher, 1994)	.074	Fit
CMIN/DF	≤ 2 (Byrne, 1998) ≤ 5 (Wheaton, 1977)	2.298	Fit
TLI (Tucker Lewis Index)	≥ 0.90 (Arbuckle, 1997) $\geq 0,95$ (Hair et al, 1995)	.757	Marginal Fit
IFI	$\geq 0,80$ (Browne and Cudeck, 1993; Garson, 2006)	.796	Marginal Fit
CFI	$\geq 0,80$ (Browne & Cudeck, 1993; Garson, 2006)	.791	Marginal Fit
PRATIO	The higher the better, the utility of PRATIO shows a limited parsimonious fit 0-1	.860	Fit
	The higher the better, the utility of PRATIO shows a limited parsimonious fit	> 0.7 (Folnell & Larcker, 1981)	Fit

Hypothesis Test Output Analysis

The first hypothesis in this study is that clan culture affects covenantal knowledge sharing. Based on the results of the AMOS analysis, it shows that there is an influence of clan culture on social capital where the value of $T = .672$ $P = 0.00 < 0.05$, so H_0 is rejected and H_a is accepted, meaning that there is a positive influence between clan culture and covenantal knowledge sharing. It conforms to S. Wang and Noe (2010), which show that knowledge sharing positively affects sales and revenue growth, company innovation ability, team performance, new product development effectiveness, and reduction of production costs.

The second hypothesis in this study is that covenantal knowledge sharing affects the performance of SMEs. Based on the results of the AMOS analysis, it shows that there is an effect of covenantal knowledge sharing on the performance of SMEs where the value of $T =$

.711 and $P = .000 < 0.05$ then H_0 is rejected and H_a is accepted, meaning that there is a positive influence between covenantal knowledge sharing and the performance of SMEs. The result of the path coefficient of .546 positive shows that there is a unidirectional relationship, meaning that every time there is an increase in covenantal knowledge sharing activities, the performance of SMEs increases. Qammach, (2016) states that knowledge sharing can positively affect innovation performance and that organizations must prioritize knowledge sharing.

The third hypothesis in this study is that clan culture affects performance of SMEs. Based on the results of the AMOS analysis, it shows that the influence of clan culture on the performance of SMEs shows that the value of $T = -1.44$ and $P = .586 > 0.05$ then H_0 is accepted and H_a is rejected, meaning that there is a value that is not significant between clan culture and the performance of SMEs. The result of the path coefficient -.018 means that there is no unidirectional relationship. Clan culture does not directly affect the performance of SMEs but is moderated by covenantal knowledge sharing. It conforms to Kayab's (2013) research outcomes, pointing that clan culture has no significant effect on organizational performance.

CONCLUSIONS

The relationship between clan culture and covenantal knowledge sharing is unidirectional, meaning that every time there is an increase in the implementation of clan culture, covenantal knowledge sharing activities also increase. The dimensions of the clan culture here are kinship, teamwork, a friendly and comfortable working atmosphere. The dimensions used by covenantal knowledge sharing in this study are self-confidence, volunteerism, honesty, and humility. Covenantal knowledge sharing has a significant effect on the performance of SMEs.

REFERENCES

- Abhishek Srivastava, Kathryn M Bartol, & Edwin a Locke. (2006). Empowering Leadership in Management Teams: Effects on Knowledge Sharing, Efficacy, and Performance. *Academy of Management Journal*, 49(6), 1239.
- Akhavan, P., Ghojavand, S., & Abdali, R. (2012). Knowledge sharing and its impact on knowledge creation. *Journal of Information and Knowledge Management*, 11(2). <https://doi.org/10.1142/S0219649212500128>
- Bakker, M. (2006). Is trust really social capital? Knowledge sharing in product development projects. *Learning Organization*, 13(6), 594–605. <https://doi.org/10.1108/09696470610705479>
- Balthazard, P. A., Cooke, R. A., & Potter, R. E. (2006). Dysfunctional culture, dysfunctional organization: Capturing the behavioral norms that form organizational culture and drive performance. *Journal of Managerial Psychology*, 21(8), 709–732. <https://doi.org/10.1108/02683940610713253>
- Barney, J. A. Y. B. (1986). Organizational Culture: Can It Be a Source of Sustained Competitive Advantage ?, 11(3), 22–23.
- Chanhoosong, Kwangseo Ryan Park, S. W. K. (2015). Servant Leadership and Team Performance the mediating role of knowledge sharing climate. *SOCIAL BEHAVIOR AND PERSONALITY*, 43(10), 1749–1760.
- Cronbach, L. . (1951). Coefficient Alpha and the Internal Structure of Tests. *Psychometrika*, 16(3), 297–333.
- De Long, D. W., & Fahey, L. (2000). Diagnosing cultural barriers to knowledge management. *Academy of Management Executive*, 14(4), 113–127.
- Gerbing, D. W., & Anderson, J. C. (1988). An Updated Paradigm for Scale Development Incorporating Unidimensionality and Its Assessment. *Journal of Marketing Research*, 25(2), 186. <https://doi.org/10.2307/3172650>
- Hsin Hsin Chang, S.-S. C. N. (2011). Social capital and individual motivations on knowledge sharing: Participant involvement as a moderator. *Information & Management*, 48(1), 9–18. <https://doi.org/10.1016/j.im.2010.11.001>
- Hsu, C. L., & Lin, J. C. C. (2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information and Management*, 45(1), 65–74. <https://doi.org/10.1016/j.im.2007.11.001>
- Huysman, M., & Wulf, V. (2006). IT to support knowledge sharing in communities, towards a social capital analysis. *Journal of Information Technology*, 21(1), 40–51. <https://doi.org/10.1057/palgrave.jit.2000053>
- Ipe, M. (2003). Knowledge Sharing in Organizations: A Conceptual Framework. *Human Resource Development Review*, 2(4), 337–359. <https://doi.org/10.1177/1534484303257985>
- Islam, M. Z., Jasimuddin, S. M., & Hasan, I. (2015). Organizational culture, structure, technology infrastructure and knowledge sharing. *Vine*, 45(1), 67–88. <https://doi.org/10.1108/vine-05-2014-0037>
- Jacobs, R., Mannion, R., Davies, H. T. O., Harrison, S., & Konteh, F. (2013). Social Science & Medicine The relationship between organizational culture and performance in acute hospitals. *Social Science & Medicine*, 76, 115–125. <https://doi.org/10.1016/j.socscimed.2012.10.014>
- Jones, M. C., Cline, M., & Ryan, S. (2006). Exploring knowledge sharing in ERP implementation: An organizational culture framework. *Decision Support Systems*, 41(2), 411–434. <https://doi.org/10.1016/j.dss.2004.06.017>

- Kim, T., & Lee, G. (2012). A modified and extended Triandis model for the enablers-process-outcomes relationship in hotel employees' knowledge sharing. *Service Industries Journal*, 32(13), 2059–2090. <https://doi.org/10.1080/02642069.2011.574276>
- Kim, T. T., Lee, G., Paek, S., & Lee, S. (2013). Social capital, knowledge sharing and organizational performance: What structural relationship do they have in hotels? *International Journal of Contemporary Hospitality Management*, 25(5), 683–704. <https://doi.org/10.1108/IJCHM-Jan-2012-0010>
- Lee, C. K., & Al-Hawamdeh, S. (2002). Factors impacting knowledge sharing. *Journal of Information and Knowledge Management*, 1(1), 49–56. <https://doi.org/10.1142/S021964920200016>
- Lee, J. C., Shiue, Y. C., & Chen, C. Y. (2016). Examining the impacts of organizational culture and top management support of knowledge sharing on the success of software process improvement. *Computers in Human Behavior*, 54, 462–474. <https://doi.org/10.1016/j.chb.2015.08.030>
- Li, Y., Song, Y., Wang, J., & Li, C. (2019). Intellectual capital, knowledge sharing, and innovation performance: Evidence from the Chinese Construction Industry. *Sustainability (Switzerland)*, 11(9). <https://doi.org/10.3390/su11092713>
- Lok, P., & Crawford, J. (2004). The effect of organisational culture and leadership style on job satisfaction and organisational commitment: A cross-national comparison. *Journal of Management Development*, 23(4), 321–338. <https://doi.org/10.1108/02621710410529785>
- Mcdermott, R., & O'Dell, C. (2001). Overcoming cultural barriers to sharing knowledge. *Journal of Knowledge Management*, 5(1), 76–85. <https://doi.org/10.1108/13673270110384428>
- Nahapiet, J. (1998). Social Capital Intellectual Capital and the organizational advantage., 23(2), 242–266.
- Le, P. B., & Lei, H. (2017). How transformational leadership supports knowledge sharing: evidence from Chinese manufacturing and service firms. *Chinese Management Studies*.
- Roskin, R. (1986). Corporate Culture Revolution : *Journal of Managerial Psychology*, 2–10.
- Rutten, W., Blaas - Franken, J., & Martin, H. (2016). The impact of (low) trust on knowledge sharing. *Journal of Knowledge Management*, 20(2), 199–214. <https://doi.org/10.1108/JKM-10-2015-0391>
- Sadighi, S. (2017). Anglia Ruskin University Organizational Culture and Performance : Research on SMEs at Tele-Healthcare Industry , United Kingdom Saeed Sadighi A Thesis in fulfilment of the Requirements of Anglia Ruskin University For the degree of Doctor of Philosophy Sub.
- Salih YesilAhmet Kaya. (2012). The Effect of Organizational Culture on Firm Financial Performance : Evidence from a Developing Country. *Procedia - Social and Behavioral Sciences*, 81, 428–437. <https://doi.org/10.1016/j.sbspro.2013.06.455>
- Shehu, A. M., & Mahmood, R. (2014). The Relationship between Market Orientation and Business Performance of Nigerian SMEs: The Role of Organizational Culture. *International Journal of Business and Social Science*, 5(9), 159–168.
- Suppiah, V., & Sandhu, M. S. (2011). Organisational culture's influence on tacit knowledge-sharing behaviour. *Journal of Knowledge Management*, 15(3), 462–477. <https://doi.org/10.1108/13673271111137439>
- Tseng, S.-M. (2010). The correlation between organizational culture and knowledge conversion on corporate performance, 14(2), 269–284. <https://doi.org/10.1108/13673271011032409>
- Uzkurt, C., Kumar, R., Kimzan, H. S., & Eminoğlu, G. (2013). Role of innovation in the relationship between organizational culture and firm performance: A study of the

- banking sector in Turkey. *European Journal of Innovation Management*, 16(1), 92–117. <https://doi.org/10.1108/14601061311292878>
- Van Den Hooff, B., & Ridder, J. A. (2004). Knowledge sharing in context: The influence of organizational commitment, communication climate and CMC use on knowledge sharing. *Journal of Knowledge Management*, 8(6), 117–130. <https://doi.org/10.1108/13673270410567675>
- Vaske, J. J., Beaman, J., & Sponarski, C. C. (2017). Rethinking Internal Consistency in Cronbach's Alpha. *Leisure Sciences*, 39(2), 163–173. <https://doi.org/10.1080/01490400.2015.1127189>
- Wang, S., & Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Human Resource Management Review*, 20(2), 115–131. <https://doi.org/10.1016/j.hrmr.2009.10.001>
- Wiewiora, A., Murphy, G., Trigunarsyah, B., & Brown, K. (2014). Interactions between organizational culture, trustworthiness, and mechanisms for inter-project knowledge sharing. *Project Management Journal*, 45(2), 48–65. <https://doi.org/10.1002/pmj.21407>
- Yang, J. Te. (2004). Job-related knowledge sharing: Comparative case studies. *Journal of Knowledge Management*, 8(3), 118–126. <https://doi.org/10.1108/13673270410541088>
- Yousef Obeidat, B., Bahjat Abdallah, A., Osama Aqqad, N., Akhoershiedah, A. H. O. M., & Maqableh, M. (2017). The Effect of Intellectual Capital on Organizational Performance: The Mediating Role of Knowledge Sharing. *Communications and Network*, 09(01), 1–27. <https://doi.org/10.4236/cn.2017.91001>
- Zhang, Z., & Zhu, X. (2012). Empirical analysis of the relationship between organizational culture and organizational performance. *Proceedings of the 2012 National Conference on Information Technology and Computer Science, CITCS 2012*, (Citcs), 763–766. <https://doi.org/10.2991/citcs.2012.14>

**DYNAMIC MODELLING AND CONTROL OF TWO LINK FLEXIBLE ARM
ROBOTIC MANIPULATOR**

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Abstract

Robots are used in various fields now-a-days. The major application of robots is in industries. Increased rate of production within stipulated period of time along with high quality of products are the prime requirements of the industry. This is achieved by increasing the speed of operation. This increase in operation speed of robots causes problems of vibrations of *links* which are the major cause of positional inaccuracies at the end-effector. Furthermore, less power consumption is another area of concern. This may be achieved by decreasing the inertia of robots. But this results in lightweight *links* which are prone to vibrations. This further decreases the accuracy of robots. The present work is based on minimizing the vibrations of these lightweight robots also known as *flexible* robots. The thesis focuses upon the dynamic modeling and control of a Two-Link Flexible robot having two revolute *joints*. For this, firstly a mathematical model of the *flexible* robot is prepared using Lagrangian dynamics. The mathematical model thus obtained involves coupling between the *rigid* and *flexible* motions exhibited by the *flexible* robot. The *rigid* motion is due to the motion of *joints* and is responsible for change in configuration of the robot while the *flexible* motion is due to the vibration of *links*. The *links* undergo two types of vibrations: flexural/ bending vibrations and torsional vibrations. The vibration analysis of the *flexible links* is done using both *assumed modes method* and *finite elements method*. A robotic system is an inertia-variant system because its configuration changes with time. As a result, the natural frequencies of the system change with time. The effect of this time-dependency of natural frequencies of *links* on Joint and Tip responses is taken care of during mathematical modeling. While using *assumed modes method*, the governing equations of the system are obtained to include this effect. Exact boundary conditions for the *flexible links* are obtained while using this method. On the other hand, while using *finite elements method* this effect of time-dependency of natural frequencies is taken care of by continuously updating the mass and stiffness matrices of the system. Furthermore, it is also easy to take care of boundary conditions during 'finite element analyses'. Two different types of shape functions for a three-node frame element are proposed during the finite element formulation. Mass matrix, stiffness matrix and load vector are also derived for the same. Besides that, stiffness matrix for a one-dimensional torsional finite element under the influence of bending is also provided. Validation of the mathematical model of the Two-Link Flexible manipulator is done with the results available in literature and also through experiments. The control of vibrations of *flexible links* is achieved by using passive damping technique using viscoelastic material and active damping technique using piezoceramics. While using passive damping technique, the phenomenon of viscoelasticity is modeled using Kelvin-Voigt elements. The active vibration control of *flexible links* is achieved with the help of piezoelectric sensors and actuators applied in segmented fashion on the *links*. Direct velocity feedback is

used. A hypothesis is presented for active vibration control of torsional vibrations. Results are also presented. Proportional-derivative gains are used during active vibration control and it is shown that good results are obtained at low values of control gains. To significantly reduce the vibration of *flexible links*, both the vibration control techniques are used together to achieve hybrid damping. Since, a robot is to be used for the performance of specified tasks, trajectory planning is must. In the present work, trajectory planning is done using both ‘point-to-point’ and ‘continuous path’ trajectories. It is shown that through proper planning of trajectory, tip vibrations, initial jerk and *joint* torque requirements can be reduced significantly. While making a robot follow a certain trajectory with minimum deviation from the desired path, control techniques are required. Computed-torque control and robust control techniques are used for this. Another control technique: Coupled-error dynamics control technique is also used in the present work. This is an innovative control technique discovered during the research work. It is based upon *independent modal space control* proposed by Meirovitch. The performance of this control technique is compared with computed-torque and robust control schemes in terms of error in path followed, effect of uncertainties within the system like mass uncertainty and *link* flexibility and control torque output. It is found that the performance of newly developed control scheme is better than computed-torque control and close to robust control.

Keywords: Flexible manipulator, dynamic analysis, vibration control

1. Introduction

Most of the robots used for industrial applications like welding, have two *links*. These robots are not perfectly rigid and hence possess some vibrations due to which the accuracy at the tip gets affected. The requirement of high performance in robotics asks for high speed of operation and good accuracy. Space applications demand for construction of large space structures by using lightweight space robot manipulator. All these requirements make it necessary to consider the structural flexibility in robotic arms during design stage. When compared with conventional *rigid* robots, elastic *link* manipulators have special potential advantages of higher operational speed and greater payload-to-manipulator weight ratio but, the flexibility of the arms leads to deformation and vibrations at the tips of the *links* during the motion. As a consequence, the dynamics behaviour becomes extremely complicated. Appearance of oscillations also makes the control problems really difficult. The present work is an attempt towards accurate modelling of a Two-Link Flexible manipulator as well as implementing different control strategies for the *flexible* manipulator. Mathematical model is prepared using Lagrangian dynamics to predict the behaviour of the manipulator. The *links* are modelled as Euler-Bernoulli beams. Discretization is done using assumed modes method (AMM) with variable frequency equation and Lagrangian-finite elements method (FEM) including torsional vibration modes. The control problem is divided into two parts, *viz.*, *joint* position control and vibration control of *links*. The *joint* position control is achieved using the actuators at the *joints*. For vibration control of *links*, both passive and active damping methods are used. Thus, damping is of hybrid nature. Few new proposals have also been made.

The aim of the research work is to achieve the position control of the end effector of a Two-Link Flexible robot using active and passive vibration control methods. The following objectives are established to realize this goal.

1. To prepare a dynamic model of a Two-Link Flexible manipulator considering both flexural and torsional vibrations of the *links*.
2. To control the position of the tip of the Two-Link Flexible manipulator using passive and active vibration control techniques
3. To perform the trajectory control of the Two-Link Flexible manipulator

1.1 Organization of the chapter

The complete work is divided into six sections. The **first section** gives a brief **introduction** of the present work. The **second section** provides the **literature review** of research in the area of *flexible* robotics. It highlights the different design and control concepts used by various

researchers in the field of *flexible* robotics. The **third section** presents **mathematical modelling of Two-Link Flexible manipulator** using the approaches of Lagrangian-AMM and Lagrangian-FEM. In the **fourth section**, the **vibration control of *flexible links*** is described using viscoelastic, active and hybrid damping methods. In the **fifth section**, **trajectory control of Two-Link Flexible manipulator** is discussed. The trajectory control is achieved using both continuous path (CP) planning and point-to-point (PTP) planning methods. The position control of tip of *flexible* manipulator is achieved using the approaches of computed-torque control (CTC), robust control and coupled-error dynamics (CED). A comparison of these different approaches is made. The **sixth section** presents the **conclusions and recommendations** based on the present work.

2. Literature review

A comprehensive literature review was conducted to accomplish the aim and objectives of the present work. The literature review includes the survey on work done by various authors in the area of *flexible* robotics.

2.1 Literature survey on *flexible* robotics

The research on *flexible* manipulators started way back in year 1975 and is still going on. Dwivedy and Eberhard [1] have provided a comprehensive literature review on modelling and control of *flexible* manipulators. Table 2.1 highlights the major breakthroughs in this area in a chronological fashion.

Table 2.1: Major breakthroughs in the field of *flexible* robotics since 1975

S. No.	Year	Breakthroughs
1	1975- 1980	Starting years of research on <i>flexible</i> robots; Focus on single <i>flexible link</i> ; Dynamic modelling of <i>flexible</i> robots; Frequency-domain and time-domain analyses; Use of Lagrangian approach; Use of feedback control schemes
2	1981-1986	Dynamic modelling using Finite element method; Feedback control of vibrations; Inverse and Forward dynamics; Consideration of <i>joint</i> flexibility, Development of other control methods- singular perturbation, composite control, etc., Consideration of effect of gravity, Use of Newton-Euler approach in dynamic modelling

3	1986-1993	Use of nonlinear beam theory, Work started on nonlinear controller, Implementation of damping in dynamic modeling, Development of control strategy using Input shaping, Dynamic modelling of multilink <i>flexible</i> manipulators, Consideration of active damping using Linear quadratic regulator, Consideration of dynamic boundary conditions, Research on stability conditions, Feedforward control for gravity compensation
4	1994-2000	Hybrid force and position control, Adaptive control, Bending-torsion vibrations of a single <i>flexible</i> link, Comparison of AMM-FEM, Introduction of <i>flexible link</i> with prismatic joint, Stability characteristics considering effect of damping and tip mass, Adaptive nonlinear control, Effect of payload variations, Effect of geometric nonlinearities, Concept of Equivalent rigid-link system for dynamic modeling
5	2001-2008	Nonlinear Lyapunov control, Robustness and stability issues in model based control, Use of smart materials for active vibration damping, Fractional order controllers, Optimization techniques for controllers for vibration reduction, Redundant manipulators, Integral resonant control
6	2009 onwards	Control strategy based on intelligent techniques, Sliding mode control, Nonlinear observer, Intelligent control techniques, Robust input shaping, Spring-damper based mathematical model, Study of transient response, Study of effect of actuator on vibration modes

From the literature survey, it was found that different design methods have been used by various researchers for preparing the mathematical model of the *flexible* manipulators. Table 2.2 highlights the various design methods.

Table 2.2: Design methods used by various researchers for modelling the *flexible* manipulators

S.No.	Design Method	Researchers
1	Euler-Bernoulli beam theory	Book et al, 1975 [2]; DU et.al.,1996 [34]; Macchelli et. al.,2011 [63]; etc.
2	Spring-damper system	Zimmert and Sawodny, 2010 [56]
3	Timoshenko beam theory	Naganathan et al, 1986 [10]; Kermani,2010 [57]; Loudini,2013 [74]
4	Lagrangian dynamics and Finite Element Method	Sunada et al, 1981 [4]; Usoro et al, 1986 [11]; Bakr and Shabana, 1986 [12]; Bayo, 1987 [13]; Chedmail et al, 1991 [17]; Gaultier et.al.,1992 [21]; Stylianou and Tabarrok, 1994 [27], [28]; Zebin et.al.,2010 [59]; etc.
5	Controllable local degrees of freedom/ Redundant manipulator	Gao et. al.,2008 [46]; Bian et.al.,2009 [52]; Bian et.al.,2011 [68], etc.
6	Wave-based approach	O'Connor,2007 [44]; O'Connor et.al.,2009 [54]
7	Equivalent Rigid Link System	Vidoni et. al.,2013 [72] Gasparetto et. al.,2013 [73]
8	Lagrangian dynamics and Assumed modes method	Oakley et al, 1989 [15]; Luca et.al.,1991 [19]; Li and Sankar, 1993 [23]; Mayo et al, 1995 [33]; Lu et.al.,1996 [35]; Theodore and Ghosal, 1997 [36]; Ata et.al.,2012 [69]; Loudini,2013 [73]; etc.
9	Hamilton's principle	Gaultier et.al.,1992 [21], etc.
10	Newton-Euler dynamics and FEM	Nagnathan and Soni, 1986 [10]; Mohan and Saha [75]; etc.
11	Decoupled Natural Orthogonal Compliment	Mohan and Saha [75]

In order to achieve the tip position control of *flexible* manipulators, various control approaches have been used by the researchers. These are- Feed-forward control [56], [63], [71]; Integral resonant control [45], [53]; Input shaping [43], [58]; Sliding mode control [51], [55]; Model predictive control [66]; PD control [42], [74] and Lyapunov control [22], [39]. From the literature review it is observed that the most of the papers deal with planar single *link flexible* robotic arms with small 3D motions. For such *links*, a linear model is sufficient to describe the dynamic characteristics. A lot of research is going on, for non-linear models of *flexible* arms. The simple case of non-linearity in *flexible* arms is that of a *two-link* case which have been described in a few papers. Furthermore, *links* having revolute *joints* have been studied a lot. Most of the authors have focussed on the design of controllers according to the accurate dynamic model of the *flexible* arm. Both AMM and FEM have been used to model the *flexible* arm without compromising the accuracy. Some recent researchers have tried to use intelligent control techniques like fuzzy logic [59], [74], neural networks [31], [50], [71] and genetic algorithm [59], [74] for designing robust controllers as these do not require complicated mathematical modelling. There are two types of vibration control schemes: feed-forward and feedback. Trajectory control using *forward* and *inverse* dynamics methods [6], [7] and effect of gravity [24] on the motion of *flexible links* have been studied in a limited manner. Few authors recommend the use of nonlinear beam theory [14], [25] to account for geometric nonlinearities and a nonlinear controller [9], [31] for effective vibration control of *flexible* manipulators. In order to improve the dynamic performance of *flexible* manipulators, few optimization techniques have also been proposed. But, the most attractive one is the use of kinematic redundancy feature for minimizing *joint* torques and vibration suppression. The literature also gives a comparison between AMM and FEM [30], [32] and stability analysis of *flexible* manipulators. The proper placement of actuators made of smart materials on *flexible* links plays a crucial role in damping the vibrations [40]. The control approaches found in the literature apply well for the *single-link* planar case with small *elastic* displacements. For *multi-link* case, Feed-forward based and other advanced techniques might be suitable.

2.2 Research gaps identified in the existing knowledge

Following gaps are found in the literature review presented in this chapter:

1. Use of internal damping is considered in very few papers. Most of the papers do not consider damping during dynamic modelling of the *flexible* manipulator system. This important parameter affecting the response needs to be included.

2. Combined bending-torsion vibrations of Two-Link Flexible manipulator become very important and needs to be analyzed. In fact, this coupling increases a lot in *multi-link* situation.
3. There is ample scope of research on optimal placement of actuators according to the mode shapes for active damping. Although one paper presents a study on this area for bending vibrations, but is silent about the effect of *rigid* body motion on mode shapes.
4. Consideration of centrifugal and Coriolis' forces/ torques and gravity terms need to be considered while forming the equation of motion.
5. The control approaches used by various researchers are suitable for *single-link flexible* planar manipulator only and that too for small *elastic* displacements. For *multi-link flexible* manipulators, either feed-forward based techniques might be suitable or some different technique should be developed/ used.
6. A robotic arm as a plant is a time-varying system. Use of Adaptive Neural controllers or intelligent controllers is very limited. There exists scope for improvement using these.
7. Stability analysis of intelligent controllers is also another area of research on which hardly any literature is available.

3. Mathematical modelling of Two-Link Flexible manipulator

The mathematical modelling is done using both Lagrangian dynamics. Discretization is done using both AMM and FEM. For the AMM approach, the frequency equation is time-variant and this equation is evaluated at every time step.

3.1 Lagrangian dynamics for *flexible* manipulator

An accurate dynamic model of a Two-link Flexible manipulator having two revolute *joints* undergoing both small bending and small torsional deformations was prepared. Fig. 3.1 shows a Two-Link Flexible manipulator undergoing both bending and torsional deformations along with *rigid* revolutions at the *joints*.

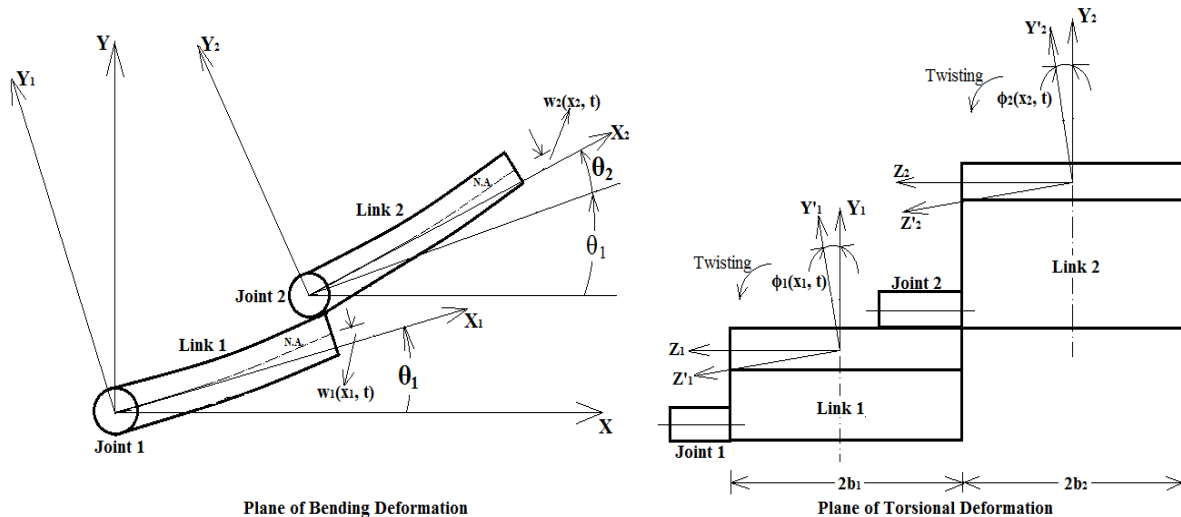


Fig. 3.1: Dynamic analysis of Two-Link Flexible manipulator undergoing both bending and torsional deformations.

In figure 3.1, plane X-Y is the plane of bending while plane Y-Z is the plane of torsion. X-Y-Z is the reference/ ground frame while X_1 - Y_1 - Z_1 and X_2 - Y_2 - Z_2 are the local frames attached to Link-1 and Link-2 respectively. Axis X_1 is aligned along the un-deformed neutral axis (N.A.) of Link-1 while axis X_2 is aligned along the un-deformed neutral axis of Link-2. The origins of these local frames are located at Joint-1 and Joint-2 respectively. Joint-1 is given a *rigid* rotation of θ_1 and Joint-2 is given a *rigid* rotation of θ_2 . The position of any point on Link-1 with respect to ground is given by:

$$\{p_1\} = [T_1][T_{1T}]\{r_{1T}\} + [T_1]\{r_1\} \quad (3.1)$$

Similarly, the position of any point on Link-2 with respect to ground is given by:

$$\{p_2\} = [T_1]\{r_1^*\} + [T_1][T_{1T}^*]\{r_{1T}^*\} + [T_A^*][T_1][T_2]\{r_2\} + [T_1][T_2][T_{2T}]\{r_{2T}\} \quad (3.2)$$

In above expressions,

$$T_1 = \begin{bmatrix} \cos \theta_1 & -\sin \theta_1 & 0 \\ \sin \theta_1 & \cos \theta_1 & 0 \\ 0 & 0 & 1 \end{bmatrix}; T_2 = \begin{bmatrix} \cos \theta_2 & -\sin \theta_2 & 0 \\ \sin \theta_2 & \cos \theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix}; \{r_1\} = \begin{Bmatrix} x_1 \\ w_1(x_1, t) \\ 0 \end{Bmatrix};$$

$$\{r_1^*\} = \begin{Bmatrix} L_1 \\ w_1(L_1, t) \\ 0 \end{Bmatrix}; \{r_2\} = \begin{Bmatrix} x_2 \\ w_2(x_2, t) \\ 0 \end{Bmatrix}; T_A^* = \begin{bmatrix} \cos(w_1^*) & -\sin(w_1^*) & 0 \\ \sin(w_1^*) & \cos(w_1^*) & 0 \\ 0 & 0 & 1 \end{bmatrix};$$

$$\{r_{iT}\} = \{0 \quad b_i \phi_i \quad b_i\}' ; \{r_{iT}^*\} = \{0 \quad b_i \phi_i^* \quad b_i\}' ; \{g\}' = \{0 \quad g \quad 0\}' ;$$

$$[T_{iT}] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \phi_i & -\sin \phi_i \\ 0 & \sin \phi_i & \cos \phi_i \end{bmatrix} ; [T_{iT}^*] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \phi_i^* & -\sin \phi_i^* \\ 0 & \sin \phi_i^* & \cos \phi_i^* \end{bmatrix} ; \quad (3.3)$$

L_1 and L_2 = lengths of Link-1 and Link-2 respectively,

θ_1 and θ_2 = *joint* rotations (rigid) of Joint-1 and Joint-2 respectively,

x_1 and x_2 = distances measured along un-deformed Link-1 and Link-2 axes, i.e. X_1 and X_2 respectively,

$w_1(x_1, t)$ and $w_2(x_2, t)$ = *elastic* displacements of Link-1 and Link-2 respectively undergoing bending vibrations

w_1^* = bending angle at end point of Link-1 = $\frac{dw_1^*}{dx_1}$

$\{r_1\}$ = position coordinates of any point on Link-1 w.r.t to un-deformed Link-1 axis i.e., X_1 in plane X_1 - Y_1

$\{r_2\}$ = position coordinates of any point on Link-2 w.r.t to un-deformed Link-2 axis i.e., X_2 in plane X_2 - Y_2

$\{r_1^*\}$ = position coordinates of end point of Link-1 w.r.t. un-deformed beam-1 axis X_1 in plane X_1 - Y_1

$\{r_{iT}\}$ = position coordinates of any point on Link- i in plane Y_i - Z_i

$\phi_i = \phi_i(x_i, t)$ = torsional deformation of any point on Link- i

$\phi_i^* = \phi_i(L_i, t)$ = torsional displacement of end point of Link- i ; i represents the *link* number ($i = 1$ and 2)

The total kinetic energy of the manipulator system is given by:

$$K.E. = \frac{1}{2} \rho_1 A_1 \int_0^{L_1} \{p_1\}' \{p_1\} dx_1 + \frac{1}{2} \rho_2 A_2 \int_0^{L_2} \{p_2\}' \{p_2\} dx_2 \quad (3.4)$$

Total potential energy of the manipulator system is given by:

$$P.E. = \frac{E_1 I_1}{2} \int_0^{L_1} \left(\frac{\partial^2 w_1^2}{\partial x_1^2} \right)^2 dx_1 + \frac{G_1 J_1}{2} \int_0^{L_1} \left(\frac{\partial \phi_1}{\partial x_1} \right)^2 dx_1 + \rho_1 A_1 \int_0^{L_1} \{g\}' \{p_1\} dx_1 +$$

$$\frac{E_2 I_2}{2} \int_0^{L_2} \left(\frac{\partial^2 w_2^2}{\partial x_2^2} \right)^2 dx_2 + \frac{G_2 J_2}{2} \int_0^{L_2} \left(\frac{\partial \phi_2}{\partial x_2} \right)^2 dx_2 + \rho_2 A_2 \int_0^{L_2} \{g\}' \{p_2\} dx_2$$

(3.5)

In equation 3.5, J_1 and J_2 are the polar moment of inertias of Link-1 and Link-2 respectively.

The *joint* torques can be obtained using Lagrangian dynamics as follows:

$$\frac{d}{dt} \left(\frac{\partial \mathcal{L}}{\partial \dot{q}} \right) - \frac{\partial \mathcal{L}}{\partial q} = F \quad (3.6)$$

In above expression, \mathcal{L} represents Lagrangian of the system and is obtained by taking the difference of total kinetic energy and total potential energy of the system; q represents generalized coordinates and F represents generalized torque/force.

$$q = \{\theta_1 \quad \theta_2 \quad w_1 \quad w_1^* \quad w_2 \quad w_2^* \quad \phi_1 \quad \phi_1^* \quad \phi_2 \quad \phi_2^*\}' \quad (3.7a)$$

$$F = \{\tau_1 \quad \tau_2 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0\}' \quad (3.7b)$$

where, τ_1 and τ_2 are the external torques applied at *joint-1* and *joint-2* respectively.

3.2 Assumed modes method

While using assumed modes method (AMM), only bending vibrations of *flexible links* are considered. The term ‘ $w_i(x_i, t)$ ’ for any Link- i can be found out by the solution of equation of motion of Euler-Bernoulli beam. The equation is as follows.

$$\frac{\partial^2 w_i}{\partial t^2} + \left(\frac{E_i I_i}{\rho_i A_i} \right) \frac{\partial^4 w_i}{\partial x_i^4} = f(x_i, t) \quad (3.8a)$$

The transient solution of above equation is given as follows.

$$w_i(x_i, t) = \sum_{n=1}^{\infty} W_n(x_i) T_n(t) \quad (3.8b)$$

In equation 3.8, n = number of modes ($n = 1, 2, \dots, \infty$); $W_n(x_i)$ = n th mode shape and is a function of distance ‘ x ’ measured along un-deformed beam axis for Link- i ; $T_n(t)$ = time-dependent function of n th mode. Since it is impossible to include all the infinite number of modes of the system, hence it is modeled with reduced number of modes by assuming some definite number of modes which best describe the behavior of the system. Thus, we can rewrite the above equation with reduced number of modes say m , as follows:

$$w_i(x_i, t) = \sum_{n=1}^m W_n(x_i) T_n(t) \quad (3.9a)$$

In equation 3.9a, m = number of assumed modes. The boundary conditions used for the *flexible links* are time-dependent and given as follows:

$$i) \quad E_i I_i \frac{\partial^2 w_i(0,t)}{\partial x_i^2} = -J_{pi_left} \left[\frac{\partial^2}{\partial t^2} \left(\frac{\partial w_i(0,t)}{\partial x_i} \right) \right] \quad (3.10a)$$

$$ii) \quad E_i I_i \frac{\partial^3 w_i(0,t)}{\partial x_i^3} = M_{pi_left} \left[\frac{\partial^2 w_i(0,t)}{\partial t^2} \right] \quad (3.10b)$$

$$iii) \quad E_i I_i \frac{\partial^2 w_i(L_i,t)}{\partial x_i^2} = -J_{pi_right} \left[\frac{\partial^2}{\partial t^2} \left(\frac{\partial w_i(L_i,t)}{\partial x_i} \right) \right] \quad (3.10c)$$

$$iv) \quad E_i I_i \frac{\partial^3 w_i(L_i,t)}{\partial x_i^3} = M_{pi_right} \left[\frac{\partial^2 w_i(L_i,t)}{\partial t^2} \right] \quad (3.10d)$$

In equations 3.10, the symbols have their usual meanings. The word ‘left’ means the left end of *link* and the word ‘right’ means the right end of the *link*. The frequency equation (equation 3.11) of any Link- i undergoing flexural vibrations is also derived and found to be varying with time.

$$\begin{aligned} & (1 + \cosh(z_{ni}) \cos(z_{ni}) + a_i z_{ni} (\cos(z_{ni}) \sinh(z_{ni}) \\ & \quad - \cosh(z_{ni}) \sin(z_{ni})) \\ & \quad - b_i z_{ni}^3 (\cosh(z_{ni}) \sin(z_{ni}) \\ & \quad + \cos(z_{ni}) \sinh(z_{ni})) - a_i b_i z_{ni}^4 (\cosh(z_{ni}) \cos(z_{ni}) - 1) = 0 \end{aligned}$$

(3.11)

In equation 3.11, $z_{ni} = \beta_{ni} L_i$; $a_i = \frac{M_{pi}}{\rho_i A_i L_i}$; $b_i = \frac{J_{pi}}{\rho_i A_i L_i^3}$. The expression for mode shape can be found out as follows:

$$W_n(x_i, t) = C_{1n}[\cosh(\beta_n x_i) - \cos(\beta_n x_i) + \alpha_n\{\sin(\beta_n x_i) - \sinh(\beta_n x_i)\}] \quad (3.12)$$

where, $\alpha_n = \left(\frac{\sinh(\beta_n L_i) - \sin(\beta_n L_i) + a_i \beta_n L_i (\cosh(\beta_n L_i) - \cos(\beta_n L_i))}{\cos(\beta_n L_i) + \cosh(\beta_n L_i) + a_i \beta_n L_i (\sinh(\beta_n L_i) - \sin(\beta_n L_i))} \right)$; $\beta_n^4 = \left(\frac{\rho_i A_i}{E_i I_i} \right) \omega_n^2$; $\omega_n = n$ th

mode natural angular frequency of the Link- i ; C_{1n} = arbitrary normalization constant. The time-dependent term- ‘ $T_n(t)$ ’ in equation (3.8b) is given by equation 3.13 as follows.

$$T_n(t) = e^{-\xi_n \omega_n t} \{A_n \cos(\omega_{dn} t) + B_n \sin(\omega_{dn} t)\} + \frac{1}{\rho_i A_i b_i \omega_{ni}} \int_0^t Q_{ni}(\tau) \sin \omega_n(t - \tau) d\tau$$

(3.13)

where, $Q_{ni}(\tau) = \int_0^\tau f(x_i, \tau) W_n(x_i) dx_i$

$\xi_n = n$ th mode damping ratio,

$\omega_n = n$ th mode natural angular frequency,

$\omega_{dn} = n$ th mode damped angular frequency = $\omega_n \sqrt{1 - \xi_n^2}$.

The complete equation of motion of the Two-Link Flexible manipulator after considering the effect of payload is given as follows:

$$[M(q)]_{6 \times 6} \{\ddot{q}\}_{6 \times 1} + [H(q, \dot{q})]_{6 \times 6} \{\dot{q}\}_{6 \times 1} + [G(q)]_{6 \times 1} + [C(q)]_{6 \times 6} \{\dot{q}\}_{6 \times 1} + [K(q)]_{6 \times 6} \{q\}_{6 \times 1} + [K(q)]_{6 \times 1}^\# = \{Q(t)\}_{6 \times 1} \quad (3.14)$$

In equation 3.14, M stands for mass matrix, H stands for Coriolis and centrifugal torque vector, G stands for gravity torque vector, C stands for damping and gyroscopic couple matrix, K stands for stiffness matrix, $K^\#$ is the miscellaneous matrix that includes unmodelled dynamics and Q stands for torque vector. The vector q in equation 3.14 contains first six variables mentioned in equation 3.7a.

3.3 Finite element method

The finite element method (FEM) is used to model the vibratory motions of the *flexible links*. This involves division of *flexible links* into some finite number of elements and finding the inertia and stiffness matrices that govern the dynamics of the system under consideration. Figure 3.2 shows the discretization of *flexible links* using two Space-frame elements [76].

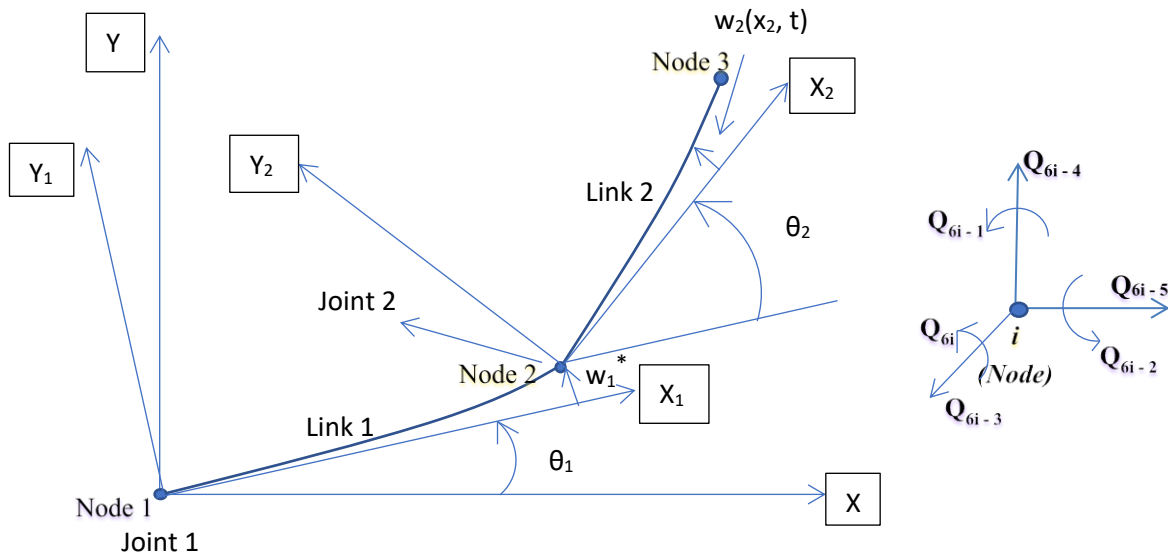


Fig. 3.2: Dynamics modelling of a Two-Link Flexible manipulator using two Space-frame finite elements.

A ‘space-frame element’ has two nodes with each node having six degrees of freedom: three translational (Q_{6i-5} , Q_{6i-4} and Q_{6i-3}) and three rotational (Q_{6i-2} , Q_{6i-1} and Q_{6i}) (refer to Fig. 3.2). The complete equation of motion of the *flexible* manipulator is given by equation 3.15a. The symbols have their usual meanings.

$$\begin{bmatrix} M_{rr} & M_{rf} \\ M_{fr} & M_{ff} \end{bmatrix}_{(n+N) \times (n+N)} \begin{Bmatrix} \dot{q}_r \\ \dot{q}_f \end{Bmatrix}_{(n+N) \times 1} + \begin{bmatrix} C_{rr} & 0 \\ 0 & C_{ff} \end{bmatrix}_{(n+N) \times (n+N)} \begin{Bmatrix} \dot{q}_r \\ \dot{q}_f \end{Bmatrix}_{(n+N) \times (n+N)} + \begin{bmatrix} 0 & 0 \\ 0 & K_{ff} \end{bmatrix}_{(n+N) \times (n+N)} \begin{Bmatrix} q_r \\ q_f \end{Bmatrix}_{(n+N) \times (n+N)} + \begin{bmatrix} H \\ 0 \end{bmatrix}_{(n+N) \times 1} + \begin{bmatrix} G \\ 0 \end{bmatrix}_{(n+N) \times 1} = \begin{Bmatrix} F_r \\ F_f \end{Bmatrix}_{(n+N) \times 1} \tag{3.15a}$$

In equation 3.15a, subscripts- *r* and *f* stand for *rigid* and *flexible* respectively. *N* represents the *rigid* degrees of freedom present in the system and *n* represents the *flexible* degrees of freedom obtained from finite element formulation. For the present case, since there are two *flexible links*, we have $N = 2$. Hence, M_{rr} consists of two diagonal elements- M_{11} and M_{22} . M_{rf} and M_{fr} represent the coupling between *rigid* and *flexible* motions. It is also seen that

$$M_{fr} = M'_{rf} \tag{3.15b}$$

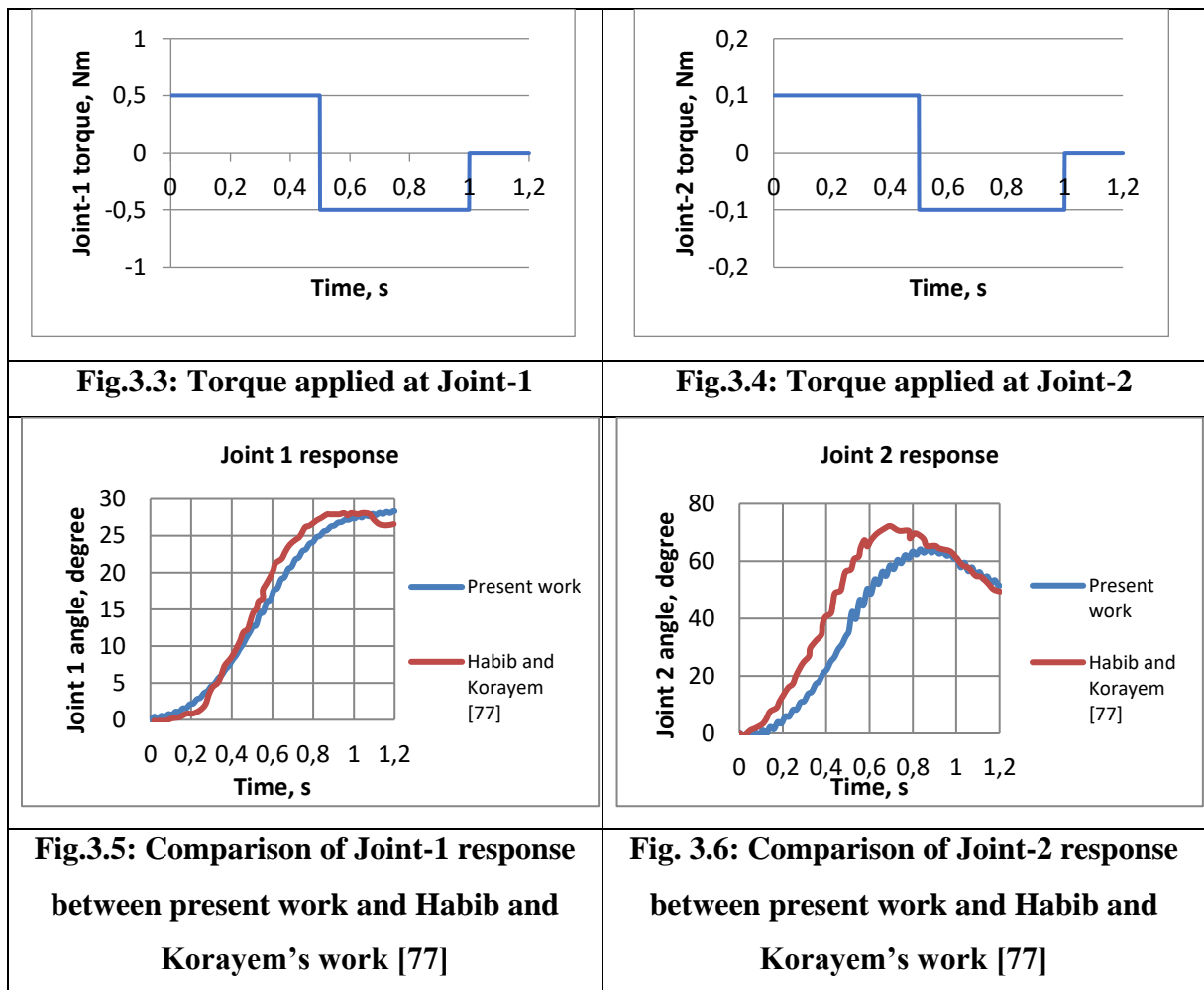
3.4 Simulation results

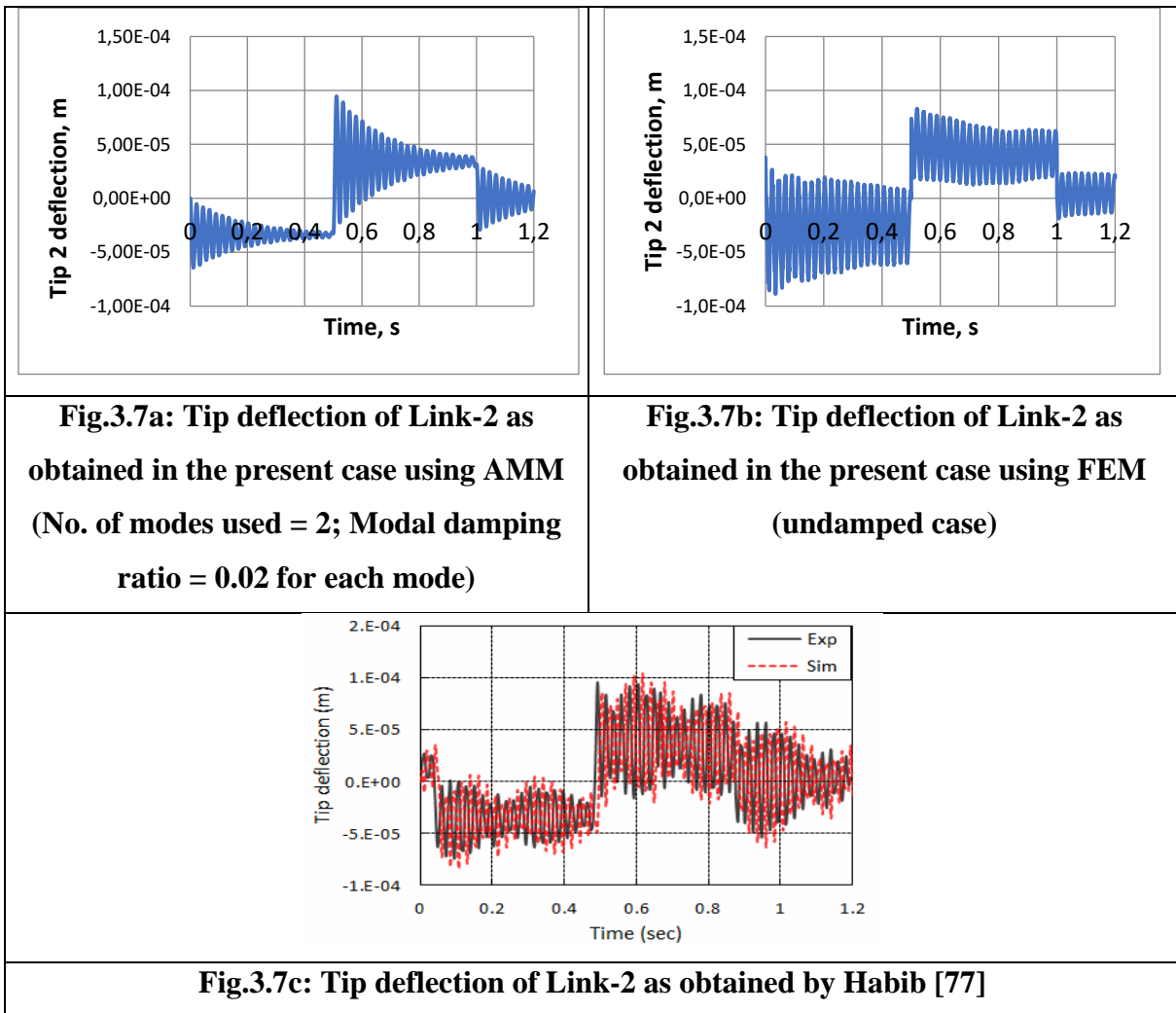
Some typical simulation results based on models described earlier have been presented. Table 3.1 describes the physical and simulation parameters used for a Two-Link Flexible manipulator used by Habib and Korayem [77].

Table 3.1: Physical and simulation parameters for Two-Link Flexible manipulator [77]

Link parameters	Value
Length of links	$L_1 = L_2 = 0.5$ m
Width of links	$b_1 = 4$ cm; $b_2 = 5.17$ cm
Thickness of the links	$t_1 = 4$ mm; $t_2 = 1.5$ mm
Flexural rigidity of links	$EI_1 = 14.93$ Nm ² ; $EI_2 = 1.017$ Nm ²
Mass per unit length of links	$\mu_1 = 0.504$ kg/m; $\mu_2 = 0.2442$ kg/m
Joint 1 torque (Fig. 3.3)	Square wave of amplitude 0.5 Nm and time-period 1 s
Joint 2 torque (Fig. 3.4)	Square wave of amplitude 0.1 Nm and time-period 1 s

The simulation results are shown in Fig. 3.5 to Fig. 3.7b. The natural frequencies and the general nature of response level matches with the predictions by Habib and Korayem [77].





4. Vibration control of *flexible links*

The vibration control of *flexible links* can be achieved in three ways: by passive viscoelastic damping, by active damping using piezoceramics and by hybrid damping. In viscoelastic damping method, a viscoelastic material (e.g., rubber) is pasted upon either throughout the *flexible link* or in the form of patches. Tzou and Wan [16] and Alberts et al [20] have used viscoelastic damping for controlling the vibrations of a *flexible* manipulator. In active damping, piezoelectric sensors and actuators are used for minimizing the vibrations of *flexible links*. The sensor-actuator pairs are applied in segmented fashion over the *flexible link*. In the third method of hybrid damping, both the viscoelastic damping and active damping are used together.

4.1 Vibration control using viscoelastic damping

The vibration control using viscoelastic damping involves the use of some viscoelastic material that is pasted over the *links*. Significant work has been done by Grootenhuis [78], Kapur et al [79], Dutt and Roy [80], etc. in the area of vibration control using viscoelastic materials. Adhikari and Woodhouse [81] tried to model the damping present within the structures. A prime

contributor to viscoelastic damping is the shear strain within the viscoelastic material. The physical properties of these materials are found out to be frequency-dependent. These materials can be applied on the structure either in a constrained or unconstrained manner. Once applied, they become an integral part of the structure and provide a fixed damping behaviour. The mathematical modelling of viscoelastic damping is done using Kelvin-Voigt elements. For the Kelvin-Voigt element used for modelling the phenomenon of viscoelasticity, the stored energy and rate of dissipation in differential forms are given as follows [82]:

$$\text{Stored energy, } dU_e = \int_0^A \frac{1}{2} \sigma^T \epsilon \, dx \, dA \quad (4.1a)$$

$$\text{Rate of dissipation, } d\phi_e = \int_0^A \eta (D\epsilon)^2 \, dx \, dA \quad (4.1b)$$

In equations-4.1, σ = stress within the viscoelastic element of length dx and area dA , ϵ = strain within the viscoelastic element, η = dynamic viscosity of the viscoelastic material and A = total cross-sectional area of the viscoelastic patch pasted on the *flexible link*. The mass, stiffness and damping matrices for the viscoelastic material were found using FEM. The mass and stiffness matrices thus obtained were assembled with the mass and stiffness matrices of equation 3.15f. Damping matrix, \mathbf{c}^e for the viscoelastic material was derived and is as follows (equation 4.2):

$$\mathbf{c}^{e'} = \begin{bmatrix} \mathbf{c}_{11}^e & \mathbf{c}_{12}^e \\ \mathbf{c}_{21}^e & \mathbf{c}_{22}^e \end{bmatrix} \quad (4.2a)$$

$$\mathbf{c}_{11}^e = \begin{bmatrix} \frac{\eta A_e}{l_e} & 0 & 0 \\ 0 & \frac{12\eta l_e}{l_e^3} & \frac{6\eta l_e}{l_e^2} \\ 0 & \frac{6\eta l_e}{l_e^2} & \frac{4\eta l_e}{l_e} \end{bmatrix}; \quad \mathbf{c}_{12}^e = \begin{bmatrix} \frac{-\eta A_e}{l_e} & 0 & 0 \\ 0 & \frac{-12\eta l_e}{l_e^3} & \frac{6\eta l_e}{l_e^2} \\ 0 & \frac{-6\eta l_e}{l_e^2} & \frac{2\eta l_e}{l_e} \end{bmatrix};$$

$$\mathbf{c}_{21}^e = \begin{bmatrix} \frac{-\eta A_e}{l_e} & 0 & 0 \\ 0 & \frac{-12\eta l_e}{l_e^3} & \frac{-6\eta l_e}{l_e^2} \\ 0 & \frac{6\eta l_e}{l_e^2} & \frac{2\eta l_e}{l_e} \end{bmatrix}; \quad \mathbf{c}_{22}^e = \begin{bmatrix} \frac{\eta A_e}{l_e} & 0 & 0 \\ 0 & \frac{12\eta l_e}{l_e^3} & \frac{-6\eta l_e}{l_e^2} \\ 0 & \frac{-6\eta l_e}{l_e^2} & \frac{4\eta l_e}{l_e} \end{bmatrix}$$

The damping matrix described in equation 4.2a is for a Plane-frame element. In case of torsion, the damping matrix was derived as follows:

$$\mathbf{c}^{e'} = \frac{\eta J_e}{l_e} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \quad (4.2b)$$

Using matrices 4.2a and 4.2b, damping matrix C_{ff} for Space-frame element was formulated. In equations- 4.2a and 4.2b, A_e = area of cross-section of the element, l_e = length of the element, I_e = area moment of inertia of the element, J_e = polar area moment of inertia of the element and η = dynamic viscosity of the element.

4.2 Active vibration control using piezoceramics

A huge body of literature exists for vibration control of structures using piezoceramics, e.g., Cannon and Schmitz [83], Sakawa, Matsuno and Fukushima [84], Goh and Caughey [85], Chen et al [86], Sun et al [40], Preumont [88], etc. In active vibration control using piezoceramics, sensors and actuators are applied at suitable locations over the *flexible links*. When the sensor and actuator are at the same location, it is referred to as collocated arrangement and when the sensor and actuator are at different locations, it is known as non-collocated arrangement. Most of the researchers have used the approach of modal sensor and modal actuator [88] for active vibration control but in the present work, the vibration control is achieved by using direct feedback of velocity variables. Fig. 4.1 shows a smart beam having piezo-sensor and piezo-actuator applied on it. FEM is used to model the smart beam.

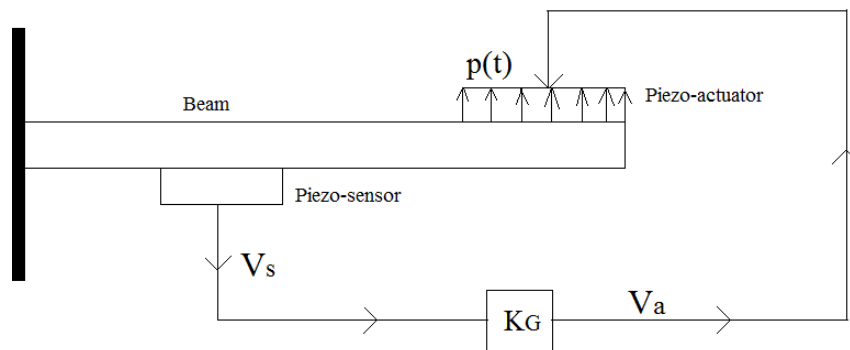


Fig.4.1: Schematic diagram for active vibration control of a smart beam/ link. The piezo-actuator is modelled as a source of time-dependent uniformly distributed load, $p(t)$. K_G is feedback gain.

The time-dependent uniformly distributed load, $p(t)$ is added to the load vector F_f given by equation 3.15f. This is responsible for vibration damping of the *flexible links*. The voltage generated by piezo-sensor (considering it as a current amplifier) is given as follows:

$$v_s(t) = -R_f E_p h d_{31} \int_a^b \dot{w}'' b_p(x) dx \quad (4.3)$$

where, R_f = piezo-resistance, w represents the deflection of any point on the beam and w' represents the slope at that point, $b_p(x)$ = width of the piezo-sensor, a and b represent the initial and final coordinates of the points on the beam/link between which the piezo-sensor is located. These coordinates are measured along the beam axis, such that, ' $(b-a)$ ' represents the length of the piezo-sensor. Taking $b_p''(x) = \text{constant}$, the voltage generated by the piezo-sensor will be expressed as follows.

$$v_s(t) = -R_f E_p h d_{31} \cdot [b_p(x) \{ \dot{w}'(b) - \dot{w}'(a) \} - b_p'(x) \cdot \{ \dot{w}(b) - \dot{w}(a) \}] \quad (4.3b)$$

where, $\dot{w}'(b)$ = rate of change of slope at point b , $\dot{w}'(a)$ = rate of change of slope w.r.t. time at point a on the beam, $\dot{w}(b)$ = rate of change of deflection at point b and $\dot{w}(a)$ = rate of change of deflection at point a on the beam. The equation of motion for the beam with piezo-actuator is given by equation 4.4 as follows.

$$m\ddot{w} + (EIw'')'' = -E_p d_{31} v_a(t) b_p''(x) h \quad (4.4)$$

In equation 4.4, m = mass per unit length of the beam, EI = flexural rigidity of the beam, E_p = Young's modulus of the piezo-ceramic, h = thickness of the beam, w = deflection of the beam, v_a = voltage applied at the actuator and d_{31} = piezoelectric constant. Equation 4.4 is valid only when the thickness of the piezo-ceramic is negligible in comparison to the beam thickness. Fig. 4.2 shows the relative placement of sensors and actuators on the *flexible links* of the Two-Link Flexible manipulator.

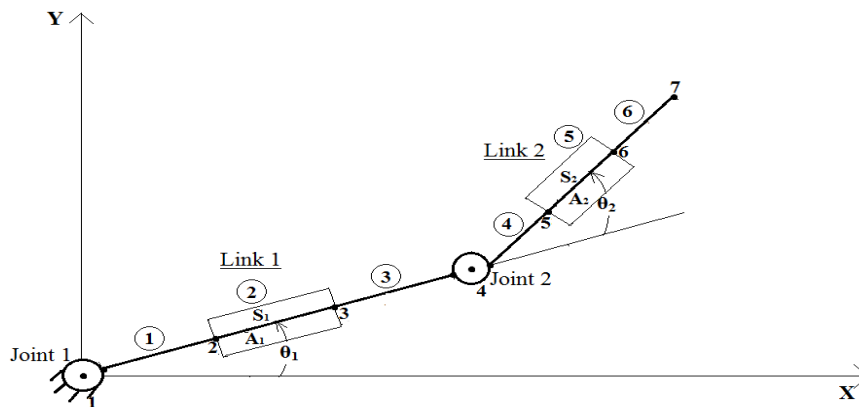


Fig. 4.2: Diagram showing the relative placements of sensors and actuators on the flexible links of the Two-Link Flexible manipulator. (In the figure, S_1 = Sensor on Link-1; S_2 = Sensor on Link-2; A_1 = Actuator on Link-1 and A_2 = Actuator on Link-2.)

As described before, we can have collocated and non-collocated arrangement for active vibration control of the *flexible links*. In Fig. 4.2, collocated arrangement of sensors and actuators are shown.

4.2.1 Use of piezoceramics for controlling torsional vibrations

In this section, mathematical models for piezo-sensor and piezo-actuator in torsion will be presented based upon the theory of piezoactuation provided by Preumont [88]. Using torsion equation we can write:

$$\tau = \frac{Tr}{J} \text{ and } T = GJ \frac{\partial \phi}{\partial x} = GJ \phi' \quad (4.5a)$$

$$\text{Thus, } \tau = Gr \phi' = G\gamma \quad (4.5b)$$

In above equations, τ = shear stress, T = twisting torque, J = polar moment of inertia, G = modulus of rigidity, ϕ = twist, γ = shear strain and r = radius (refer to Fig. 4.3). Taking the torsional piezo-sensor as current amplifier, the voltage, v generated by it can be expressed as:

$$v = R d_{24} G_p r \int_a^b b_p(x) \dot{\phi}'(x) . dx \quad (4.6a)$$

where, R = resistance of piezo-sensor, d_{24} = piezoelectric constant, G_p = modulus of rigidity of piezo-sensor and b_p = width of piezo-sensor. If $b_p(x) = b_p = \text{constant}$ then,

$$v = R d_{24} G_p r b_p [\dot{\phi}'(b) - \dot{\phi}'(a)] \quad (4.6b)$$

For torsional piezo-actuator we can write,

$$T = \int \left(2E_{44}\epsilon_{23} - \frac{d_{24}v}{b_p} E_{44} \right) r . dA = GJ\phi' - \frac{d_{24}vE_{44}}{b_p} \int r . dA \quad (4.7)$$

where, E_{44} = Young's modulus of piezo-actuator, ϵ_{23} = shear strain in piezo-actuator and A = area of cross-section of piezo-actuator.

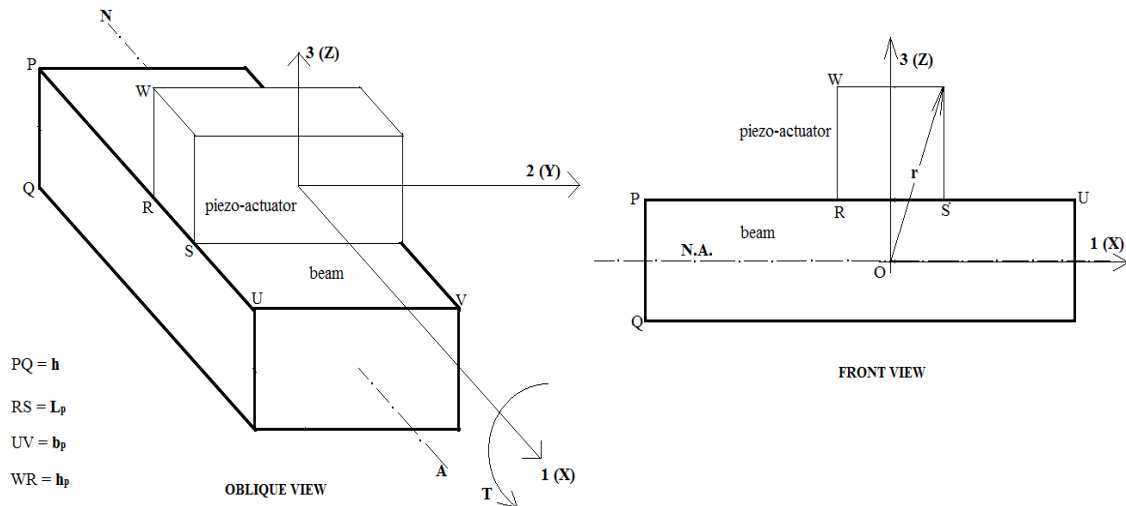


Fig.4.3: Development of mathematical model of torsional piezo-actuator

From Fig. 4.3 we can write,

$$\int r . dA = A \sqrt{(0.5h + h_p)^2 + 0.25b_p^2} \quad (4.8)$$

where, $A = h_p L_p$, h = beam thickness, h_p = thickness of piezo-actuator and L_p = length of piezo-actuator. Using above equation, we can write:

$$T = GJ\phi' - \frac{d_{24}vE_{44}h_pL_p}{b_p} \cdot \frac{b_p}{2} \cdot \left[1 + \left(\frac{0.5h+h_p}{0.5b_p} \right)^2 \right]^{1/2} \quad (4.9)$$

$$\text{For } (0.5h+h_p) \ll b_p, \left(\frac{0.5h+h_p}{0.5b_p} \right)^2 \ll 1$$

$$\text{So, } T = GJ\phi' - \frac{1}{2} (d_{24}vE_{44}h_pL_p) \quad (4.10)$$

Now, inertia torque is represented as: $I_m \ddot{\phi} = -T$

Therefore we get,

$$I_m \ddot{\phi} + GJ\phi' = \frac{1}{2}(d_{24}vE_{44}h_pL_p) \quad (4.11)$$

where, I_m = mass moment of inertia of beam. It is known that shear stress is always complimentary. So, in order to control the torsional vibrations, two piezo-actuators should be attached on the opposite faces of the beam at the same location. Thus, above equation will get modified as follows.

$$I_m \ddot{\phi} + GJ\phi' = (d_{24}vE_{44}h_pL_p) \quad (4.12)$$

4.3 Simulation results on vibration damping of *flexible links*

In this section, typical simulation results using viscoelastic damping, active damping and hybrid damping are discussed. Table 4.1 enlists the physical and simulation parameters used during simulation.

Table 4.1: Physical and simulation parameters for vibration damping of *flexible links* of Two-Link Flexible manipulator

Link parameter	Value
Length of <i>links</i>	$L_1 = L_2 = 0.5$ m
Width of <i>links</i>	$b_1 = 4$ cm; $b_2 = 5.17$ cm
Thickness of <i>links</i>	$t_1 = 4$ mm; $t_2 = 1.5$ mm
Flexural rigidity of <i>links</i>	$EI_1 = 14.93$ Nm ² ; $EI_2 = 1.017$ Nm ²
Density of <i>links</i>	7850 kg/m ³
Joint 1 torque, tau1	A square wave of amplitude 0.5 Nm and frequency 100 Hz for Fig. 4.4, Fig. 4.6 and Fig. 4.7 50 Hz for Fig. 4.5 and Fig. 4.8
Joint 2 torque, tau2	tau1 + A square wave of amplitude 0.1 Nm and frequency 100 Hz for Fig. 4.4, Fig. 4.6 and Fig. 4.7 50 Hz for Fig. 4.5 and Fig. 4.8
Type of finite element used	Frame element/ Space-frame element
Dynamic viscosity of viscoelastic material (rubber)	1.8 Ns/m ²
Density of viscoelastic material (rubber)	1200 kg/m ³
Physical parameters of piezoceramic	$R_f = 1$; $E_p = E_{44} = 1$; $d_{31} = d_{44} = 1$

Simulation results are shown in Fig. 4.4 to Fig. 4.8. In figure 4.4, the undamped response and viscoelastically damped response of the tip of second *flexible link* are compared with each other.

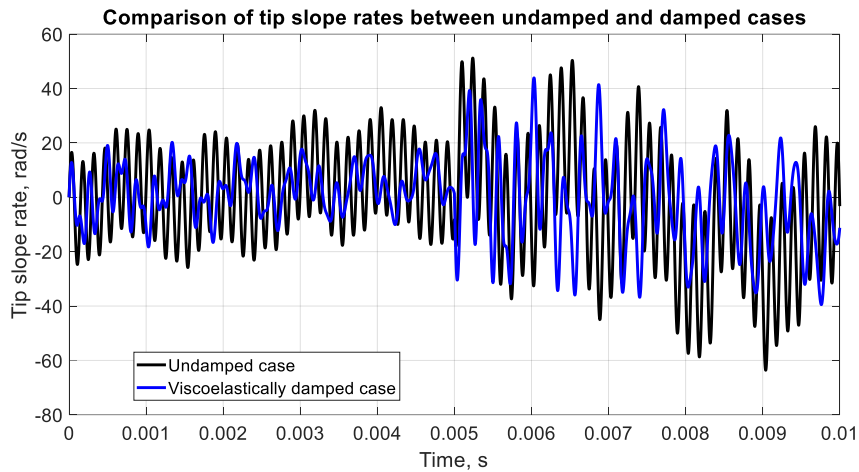


Fig. 4.4: Comparison of tip slope rates (rate of change of slope) of tip of second *flexible link* of Two-Link Flexible manipulator between viscoelastically damped and undamped cases

In Fig. 4.4, the rates of change of slope of tip of second *flexible link* for damped and undamped cases are compared. From the figure, it is clear that due to the presence of viscoelastic damping, the amplitude of vibration decreases. In Fig. 4.5, comparison of tip responses is shown for collocated and non-collocated arrangements. Descriptions about collocated and non-collocated control are already found within the literature [88].

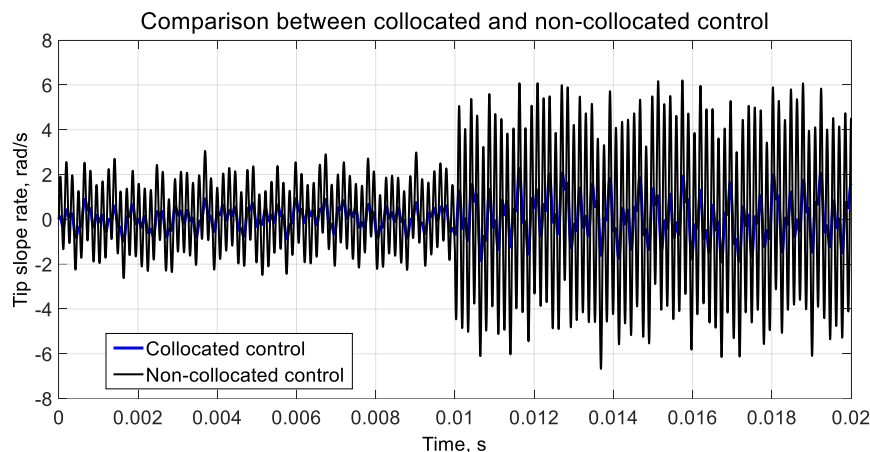


Fig. 4.5: Comparison of slopes of tip of second *flexible link* of Two-Link Flexible manipulator for collocated and non-collocated sensor-actuator pairs.

In Fig. 4.5, the slope rates of tip of second *flexible link* are compared at different arrangements of sensor-actuator pair. The values of proportional (K_p) and derivative (K_v) gains are taken as 4 for the both *links*. It is observed positional accuracy of collocated arrangement is the best. In

figure 4.6, a comparison is done between the tip responses obtained by active damping and hybrid damping. During hybrid damping, both viscoelastic damping and active damping are used. In order to introduce viscoelastic damping, one thousand Kelvin-Voigt (K-V) elements are used.

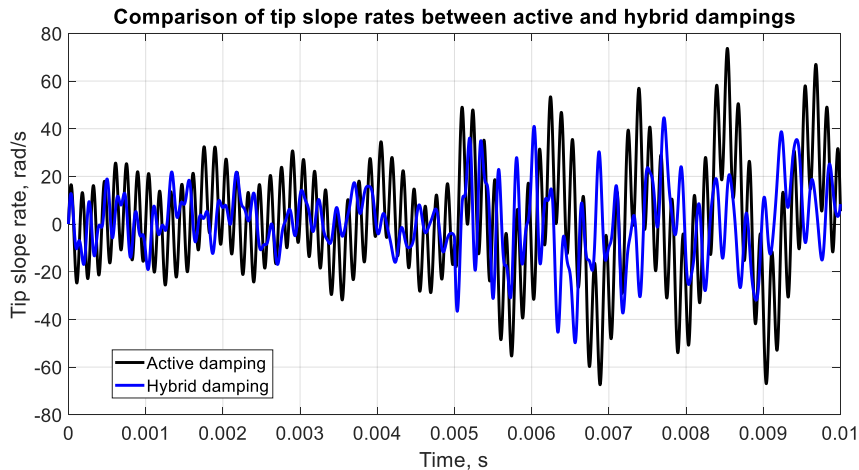


Fig. 4.6: Comparison of bending deflections of tip of second flexible link of Two-Link Flexible manipulator between active damping control and hybrid damping control.

From Fig. 4.6, it can be inferred that hybrid damping results in better vibration control. The positional accuracy described by zero vibration of the tips can be further increased by increasing the proportional gains- K_p . Fig. 4.7 shows the torsional deformations of tip of second flexible link under actively damped case and undamped case. Space-frame elements were used for obtaining this result.

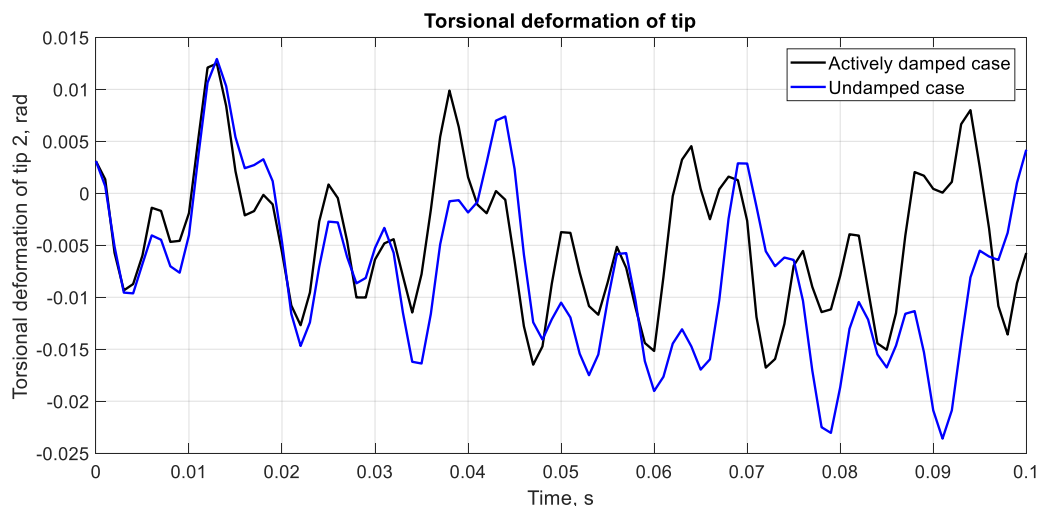


Fig. 4.7: Comparison of torsional deformations of tip of second flexible link of Two-Link Flexible manipulator between active damping control case and undamped case.

From Fig. 4.7, it can be observed that, the response of ‘actively damped case’ is closer to the zero line of reference than the response of ‘undamped case’. The effect of vibrations on positional accuracy of tip of Two-Link Flexible manipulator is shown in Fig. 4.8.

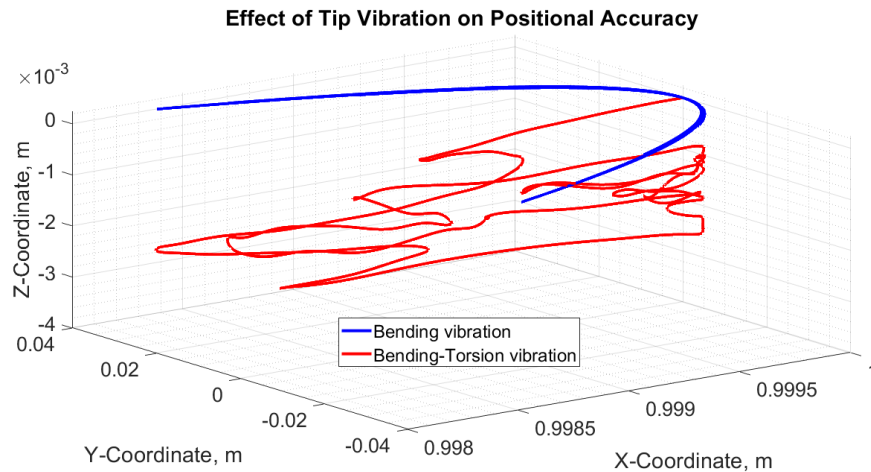


Fig. 4.8: Effect of vibration on positional accuracy of tip of Two-Link Flexible manipulator

In Fig. 4.8, the blue-coloured curve corresponds to the tip position of *flexible* manipulator when only bending vibration is considered. It can be seen that the curve lies in X-Y plane. The red-coloured curve corresponds to the tip position of *flexible* manipulator when both bending and torsional vibrations are considered. The curve does not remain in plain and the positional accuracy of the tip is also deteriorated.

5. Trajectory control of Two-Link Flexible manipulator

In this chapter, the position of tip of the *flexible* manipulator will be controlled by controlling the torque provided by the motors at the *joints*. For this purpose, it is required to perform the trajectory planning. A *flexible* manipulator exhibits two kinds of motion- ‘rigid motion’ and ‘elastic motion’. Trajectory planning makes use of the ‘rigid motion’. It can be done in two ways- continuous path (CP) planning and point-to-point (PTP) path planning. Trajectory can be defined either by using Joint-space trajectory or by using Cartesian-space trajectory. This trajectory planning forms the basis of manipulator control problem [90] which is stated as:

To find the joint actuator torques required to produce a planned trajectory, i.e., location, velocity and acceleration, for the entire work cycle such that planned task is performed as specified.

Even though the trajectory is planned properly, still there will be positional inaccuracy at the tip of the *flexible* manipulator. This is due to the ‘elastic motion’ exhibited by the *flexible links*. In the present case, the ‘elastic motion’ is modelled as a non-linearity and its effect is minimized

by using three control techniques: computed torque control (CTC) [91], robust control [91] and a newly developed scheme called as coupled-error dynamics (CED).

5.1 Coupled-error dynamics

In this technique developed, the dynamics of the system is described in terms of *joint*-angle errors. Fig. 5.1 shows a Two-Link Rigid manipulator having a payload at its end. The dynamics equation of such a manipulator is given as follows:

$$\begin{Bmatrix} \tau_1 \\ \tau_2 \end{Bmatrix} = \begin{bmatrix} M_{11} & M_{12} \\ M_{21} & M_{22} \end{bmatrix} \begin{Bmatrix} \ddot{\theta}_1 \\ \ddot{\theta}_2 \end{Bmatrix} + \begin{bmatrix} N_1 \\ N_2 \end{bmatrix} + \begin{bmatrix} G_1 \\ G_2 \end{bmatrix} \quad (5.1)$$

where, τ_1 and τ_2 are *joint* torques, θ_1 and θ_2 are *joint* angles and

$$M_{11} = (m_1 + m_2)L_1^2 + m_2L_2^2 + 2m_2L_1L_2 \cos \theta_2 + I_{h1} + M_p(L_1^2 + L_2^2 + 2L_1L_2 \cos \theta_2) + m_{h2}L_1^2$$

$$M_{12} = M_{21} = m_2L_2^2 + m_2L_1L_2 \cos \theta_2 + M_p(L_1L_2 \cos \theta_2 + L_2^2)$$

$$M_{22} = m_2L_2^2 + I_{h2} + M_pL_2^2$$

$$N_1 = -m_2L_1L_2(2\dot{\theta}_1\dot{\theta}_2 + \dot{\theta}_2^2) \sin \theta_2 + M_pL_1L_2(2\dot{\theta}_1\dot{\theta}_2 - \dot{\theta}_2^2) \sin \theta_2$$

$$N_2 = m_2L_1L_2\dot{\theta}_1^2 \sin \theta_2 - 2M_pL_1L_2 \sin \theta_2 \cdot \dot{\theta}_1\dot{\theta}_2$$

$$G_1 = (m_1 + m_{h2} + m_2 + M_p)gL_1 \cos \theta_1 + (m_2 + M_p)gL_2 \cos(\theta_1 + \theta_2)$$

$$G_2 = (m_2 + M_p)gL_2 \cos(\theta_1 + \theta_2)$$

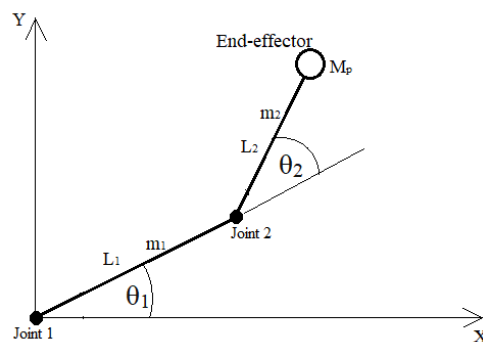


Fig.5.1: A Two-Link Rigid serial robot having two Revolute Joints in X-Y plane.

In equation 1, m_1 and m_2 are masses of Link-1 and Link-2 respectively, L_1 and L_2 are lengths of Link-1 and Link-2 respectively, I_{h1} and I_{h2} are *joint/hub* mass moment of inertias at Joint-1 and Joint-2 respectively, m_{h2} is the mass of hub of Joint-2 and M_p is mass of payload attached at the end of Link 2, i.e., at the end-effector. It can be seen from equation 5.1 that the mass matrix is coupled and depends upon configuration of the manipulator. This makes the control problem difficult. Now, a robot is designed to move along a desired trajectory for performing an assigned task. Thus, the desired *joint* angles are: θ_{1d} for Joint 1 and θ_{2d} for Joint 2. The *joint* errors will be defined as follows.

$$\theta_{je} = \theta_{jd} - \theta_j \quad (5.2)$$

where, j represents joint number ($=1, 2$), subscript- 'e' stands for 'error' and subscript- 'd' stands for 'desired'. After substituting for θ_1, θ_2 and their derivatives from equation 5.2 into equation 5.1 and performing necessary mathematical operations, following equations are obtained:

$$\begin{Bmatrix} \tau_{1d} - \tau_1 \\ \tau_{2d} - \tau_2 \end{Bmatrix} = \begin{bmatrix} M_{e11} & M_{e12} \\ M_{e21} & M_{e22} \end{bmatrix} \begin{Bmatrix} \ddot{\theta}_{1e} \\ \ddot{\theta}_{2e} \end{Bmatrix} - \begin{bmatrix} C_{e11} & C_{e12} \\ C_{e21} & C_{e22} \end{bmatrix} \begin{Bmatrix} \dot{\theta}_{1e} \\ \dot{\theta}_{2e} \end{Bmatrix} - \begin{bmatrix} G_{11e} & G_{12e} \\ G_{21e} & G_{22e} \end{bmatrix} \begin{Bmatrix} \theta_{1e} \\ \theta_{2e} \end{Bmatrix} \quad (5.3a)$$

Defining the control torque as:

$$u = \tau = K_v \dot{\theta}_e + K_p \theta_e \quad (5.4)$$

for each *joint* of the manipulator and substituting in eq. (5.3a), we get

$$\mathbf{M}_e \ddot{\theta}_e + (\mathbf{K}_v - \mathbf{C}_e) \dot{\theta}_e + (\mathbf{K}_p - \mathbf{G}_e) \theta_e = \tau_d \quad (5.3b)$$

In eq. (5.3b), the matrices- \mathbf{M}_e , \mathbf{C}_e and \mathbf{G}_e are time-varying and also involve non-linear terms. It refers to the case of *coupled control* [92]. The values of gains- \mathbf{K}_v and \mathbf{K}_p must lie within certain range so that the controller performance may not deteriorate even though the coefficients in (5.3b) change with time. The ranges for \mathbf{K}_v and \mathbf{K}_p can be found out by designing the controller for minimum and maximum values of θ_d and $\dot{\theta}_d$. After applying the concept of *independent modal-space control* (IMSC) [92] on equation 5.3b, the relationship between \mathbf{K}_v and \mathbf{K}_p for critically damped response of the controller can be found out as follows:

$$(\mathbf{K}_v - \mathbf{C}_e) = \alpha_1 \mathbf{M}_e + \alpha_2 (\mathbf{K}_p - \mathbf{G}_e) \quad (5.5)$$

where, α_1 and α_2 are some constants that depend upon the inertial and elastic properties of the manipulator system. In case of CTC, each joint is controlled separately and the relationship between controller gains is given as follows:

$$\mathbf{K}_v = 2\sqrt{\mathbf{K}_p} \quad (5.6)$$

5.2 Simulation results for trajectory control

Performances of three types of controllers based on CTC, robust control and CED are compared through the simulation results. The control task is that the tip of the *flexible* manipulator should trace a straight line in X-Y plane described below:

$$y = 0.268x + 0.5 \quad (5.7)$$

The *joints* of the manipulator follow a five-degree polynomial trajectory. The simulation results are presented below. Same values of controller gains were used during simulation for comparing the performances of the three controllers. Fig. 5.2 compares between the tip

positions of the *flexible* manipulator as obtained by using controller based upon CTC scheme and CED scheme. Fig. 5.3 compares between the tip positions of the *flexible* manipulator as obtained by using controller based upon robust control scheme and CED scheme. The control torque requirement at Joint 1 is shown and compared with each other for the three controllers in Fig. 5.4.

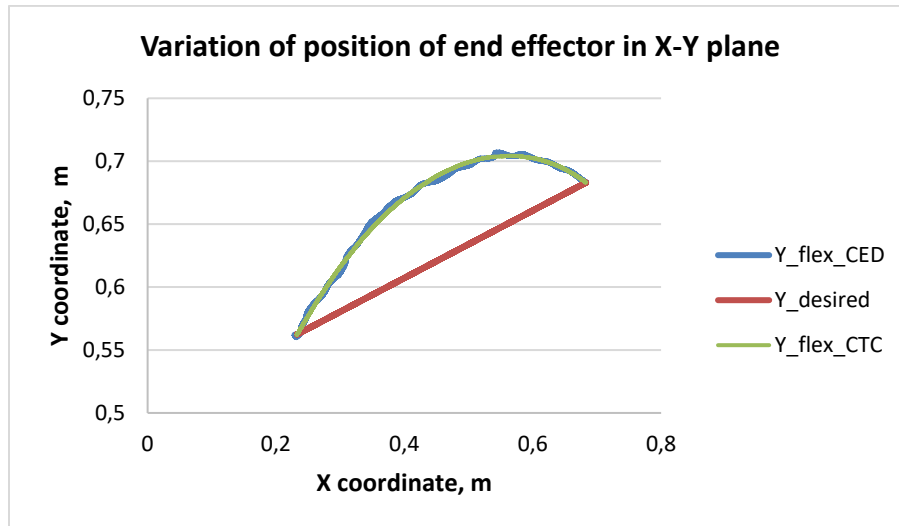


Fig. 5.2: Comparison between the tip positions of *flexible* manipulator as obtained by using CTC and CED for same PD gains

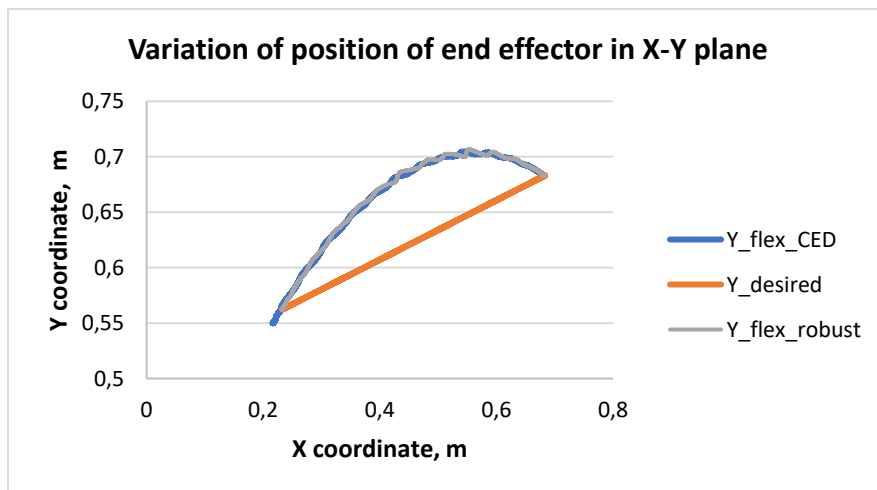


Fig. 5.3: Comparison between the tip positions of *flexible* manipulator as obtained by using robust control and CED for same PD gains

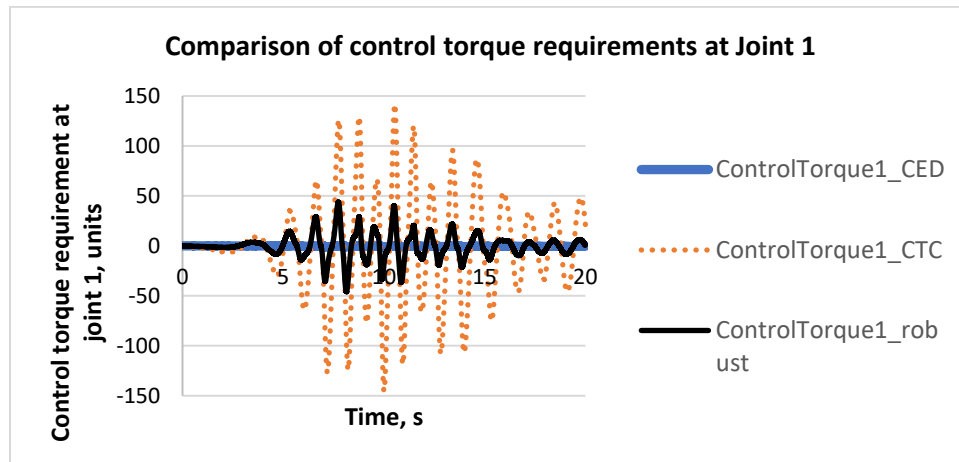


Fig. 5.4: Comparison of control torque requirements at Joint 1 as provided by controller based upon CTC, robust control and CED for same PD gains (The control torque in ‘CED’ case lies between -0.7 units to 0.1 units.)

After looking at Fig. 5.2 and Fig. 5.3, it can be concluded that the performance of CED-based controller lies between that of the CTC and the robust controller for same values of controller (PD) gains. When Fig. 5.4 is viewed, it can be inferred that the CED-based controller gives the output comparable to the other controllers at minimum control torque.

6. Conclusions and recommendations

In this chapter, conclusions based upon the present work are made and new proposals are suggested.

6.1 Conclusions

The objectives of dynamics modelling, vibration control and trajectory control of a Two-Link Flexible robot have been accomplished in this work. While preparing the dynamic model, internal damping using the phenomenon of viscoelasticity has been considered. Combined bending and torsional vibrations of the *flexible links* were considered during mathematical modelling. Both AMM and FEM were used for mathematical modelling. The boundary conditions are easily addressed by using the FEM approach. In the present case, the differential equations obtained as a result of finite element (FE) formulation were solved directly to find out the responses at each node. The uniqueness lies in solving the equations of *rigid* and *elastic* motions for the *flexible links* simultaneously using a single computer program. During mathematical modelling, it was observed that the Two-Link Flexible manipulator exhibits time-varying boundary conditions. As a result, the frequency equation and hence the mode shapes also become time-dependent. This time-variance is due to the change in variables representing

'rigid motion' of the *flexible* manipulator with time. The non-linear effects due to the presence of centrifugal and Coriolis terms and gravity are also included in the formulation.

The process of active vibration control is based on direct feedback control using PD controller. The effect of relative position of sensors and actuators located on *flexible links* has been observed. It was found that collocated arrangement provides better positional accuracy than the non-collocated arrangement. The latter may provide better response when there is high internal damping within the system. The trajectory control of the *flexible* manipulator was achieved using three techniques, *viz.* CTC, robust control and CED. Out of these, the first two are well established techniques while the third one was developed during the research work. The mathematical model for active control of torsional vibrations has already been described.

6.2 Future recommendations

Literature provides three methods of mathematical modelling of a mechanical system- Lagrangian dynamics, Newton-Euler approach and Kane's method. The computational efficiencies of the computer programs based on these three methods can be checked. The conventional approach of active vibration control makes use of modal sensors and actuators. Literature describes the control problems associated with these, like residual modes and spillover effects. In the present work, direct feedback is used and the concept of modal sensor and actuator is not used. There is need of finding the control problems associated with this approach. Use of intelligent controllers and stability analysis of various controllers need to be done.

References

- Dwivedy S.K. and Eberhard Peter, Dynamic analysis of flexible manipulators: a review, *Mechanism and Machine Theory*, 2006, pp. 749-777.
- Book et al, Feedback control of two beam, two joint systems with distributed flexibility, *Journal of Dynamic Systems, Measurement and Control* (1975).
- W. Sunada and S. Dubowsky, The application of finite element methods to the dynamic analysis of flexible spatial and co-planar linkage systems, *Journal of Mechanical Design*, Vol. 103 (1981) pp. 643-651.
- Robert P. Judd and Donald R. Falkenburg, Dynamics of nonrigid articulated robot linkages, *IEEE Transactions on Automatic Control*, Vol. 30 (1985).
- M. Dado and A.H. Soni, A generalized approach for forward and inverse dynamics of elastic manipulators, *IEEE* (1986) pp. 359-364.
- R. Marino and M.W. Spong, Nonlinear control techniques for flexible joint manipulators: A single link case study, *IEEE* (1986) pp. 1030-1036.
- G. Naganathan and A.H. Soni, Non-linear flexibility studies for spatial manipulators, *IEEE* (1986) pp. 373-378.
- Usono et al, A finite element/Lagrange approach to modelling lightweight flexible manipulators, *Journal of Dynamic Systems, Measurement and Control*, Vol. 108 (1986) pp. 198-205.
- Bakr and Shabana, Geometrically nonlinear analysis of multibody systems, *Computers & Structures*, Vol. 23 (1986) pp. 739-751.
- Eduardo Bayo, A finite-element approach to control the end-point motion of a single-link flexible robot, *Journal of Robotic Systems*, Vol. 4 (1987) pp. 63-75.
- Simo and Vu-Quoc, The role of nonlinear theories in transient dynamic analysis of flexible structures, *Journal of Sound and Vibration*, Vol. 119 (1987) pp. 487-508.
- Oakley and Cannon, End-point control of a two-link manipulator with a very flexible forearm: issues and experiments, *Proceedings of American Control Conference* (1989) pp. 1381-1388.
- Tzou and Wan, Distributed structural dynamics control of flexible manipulators-I, *Structural dynamics and distributed viscoelastic actuator*, *Computers & Structures*, (1990) pp. 669-677.
- Chedmail, Aoustin and Chevallereau, Modelling and control of flexible robots, *International Journal for Numerical Methods in Engineering*, Vol. 32 (1991) pp. 1595-1619.
- Alessandro De Luca and Bruno Siciliano, "Closed-Form Dynamic Model of Planar Multilink Lightweight Robots", *IEEE Transactions on System, Man, and Cybernetics*, Vol. 21, No. 4 July/August (1991) pp. 826-839.
- Alberts et al, Dynamic analysis to evaluate viscoelastic passive damping augmentation for the space shuttle remote manipulator system, *Journal of Dynamic Systems, Measurement and Control*, Vol. 114 (1992) pp. 468-475.
- Philippe E. Gaultier, William L. Cleghorn, A spatially Translating and Rotating Beam Finite Element for Modeling Flexible Manipulators, *Mech. Mach. Theory*, Vol. 27 (1992) pp. 415-433.
- Omer Morgul, Dynamic boundary control of a Euler-Bernoulli beam, *IEEE Transactions on Automatic Control*, Vol. 37 (1992) pp. 639-642.
- Li and Sankar, Systematic methods for efficient modeling and dynamics computation of flexible robot manipulators, *IEEE Transactions on Systems, Man and Cybernetics*, Vol. 23 (1993) pp. 77-95.
- Luca and Siciliano, Regulation of flexible arms under gravity, *IEEE Transactions on Robotics and Automation*, Vol. 9, (1993) pp. 463-467.

- Hu and Ulsoy, Dynamic modeling of constrained flexible robot arms for controller design, *Journal of Dynamic Systems, Measurement and Control*, Vol. 116 (1994) pp. 56-65.
- Stylianou and Tabarrok, Finite element analysis of an axially moving beam, Part I: Time integration, *Journal of Sound and Vibration*, Vol. 178 (1994) pp. 433-453.
- Stylianou and Tabarrok, Finite element analysis of an axially moving beam, Part II: Stability Analysis, *Journal of Sound and Vibration*, Vol. 178 (1994) pp. 433-453.
- W.H. Elmaraghy, H.A. Elmaraghy, A Zaki, A. Massoud, Design and control of robots with flexibilities, *Annals of the CIRP*, Vol. 43 (1994) pp. 359- 362.
- Meghdari and Ghassempouri, 'Dynamics of Flexible Manipulators', *Journal of Engineering, Islamic Republic of Iran*, Vol. 7 (1994) pp. 19-32
- Khorrami et al, Experimental results on adaptive nonlinear control and input preshaping for multi-link flexible manipulators, *Automatica*, Vol. 31 (1995) pp. 83-97.
- Rex J. Theodore and Ashitava Ghosal, Comparison of the assumed modes method and finite element models for flexible multilink manipulators, *The International Journal of Robotics Research*, Vol. 14 (1995).
- Mayo, Dominguez and Shabana, Geometrically nonlinear formulations of beams in flexible multibody dynamics, *Journal of Vibration and Acoustics*, Vol. 117 (1995) pp.501-509.
- H. DU, M.K. Lim and K.M. Liew, A Non-Linear Finite Element Model for Dynamics of Flexible Manipulators, *Mech. Mach. Theory*, Vol. 31, No. 8 (1996) pp. 1109-1119.
- Jianming Lu, et al, Vibration Control of Flexible Robotic Arms using Robust Model Matching Control (1996) pp. 663-668.
- Theodore and Ghosal, Modeling of flexible-link manipulators with prismatic joints, *IEEE Transactions on Systems, Man and Cybernetics- Part B: Cybernetics*, Vol. 27 (1997) pp. 296-305.
- S.K. Tso, T.W. Yang, et. al, Vibration control for a flexible- link robot arm with deflection feedback, *International Journal of Non-Linear Mechanics*, Vol. 38 (2003) pp. 51-62.
- Sun et al, A PZT actuator control of a single-link flexible manipulator based on linear velocity feedback and actuator placement, *Mechatronics*, Vol. 14 (2004) pp. 381-401.
- C.A. Monje, F. Ramos, V. Feliu, B.M. Vinagre, Tip position control of a lightweight flexible manipulator using a fractional order controller, *IET Control Theory Appl.*, Vol. 1 (2007) pp. 1451-1460.
- M.S. Alam, M.A. Hossain, M.O. Tokhi, Design of command shaper using gain-delay units and particle swarm optimization for vibration control of a flexible system, *ICSV14, Cairns, Australia*, 9-12 July (2007).
- William J. O' Connor, Wave-Based Analysis and Control of Lump-Modeled Flexible Robots, *IEEE Transactions on Robotics*, Vol. 23 (2007) pp. 342-352.
- E. Pereira, S.O.R. Moheimani, S.S. Aphale, Analog implementation of an integral resonant control scheme, *Smart Materials and Structures*, Vol. 17 (2008) pp. 1-6.
- Zhihui Gao, Chao Yun, Minimizing joint-torques of the flexible redundant manipulator on the premise of vibration suppression, *International Journal of Intelligent Computing and Cybernetics*, Vol. 1 (2008) pp. 634-645.
- Hicham Chaoui, Pierre Sicard, Wail Gueaieb, ANN- based adaptive control of robotic manipulators with friction and joint elasticity, *IEEE Transactions on Industrial Electronics*, Vol. 56 (2009) pp. 3174- 3187.
- M.H. Korayem, R. Haghghi, A. Nikoobin, A. Alamdari, A.H. Korayem, Determining maximum load carrying capacity of flexible link manipulators, *Transaction B: Mechanical Engineering*, Vol. 16 (2009) pp. 440- 450.
- Yushu Bian, Zhihui Gao, Chao Yun, Motion control of the flexible manipulator via controllable local degrees of freedom, *Nonlinear Dynamics*, Vol. 55 (2009) pp. 373-384.

- Emiliano Pereira, Sumeet S. Aphale, Vicente Feliu, S.O. Reza Moheimani, A hybrid control strategy for vibration damping and precise tip-positioning of a single-link flexible manipulator, Proceedings of 2009 IEEE International Conference on Mechatronics, Spain, April (2009).
- William J. O' Connor, Francisco Ramos de la Flor, David J. Makeown, Vicente Feliu, Wave-based control of non-linear flexible mechanical systems, Nonlinear Dynamics, Vol. 57 (2009) pp. 113-123.
- G. Mamani, J.N. Andrade-Da Silva, V. Feliu-Batlle, Least Squares State Estimator based Sliding Mode Control of a Very Lightweight Single-Link Flexible Robot Arm, Proceedings of 2009 IEEE International Conference on Mechatronics, Malaga, Spain, April (2009).
- Nico Zimmert, Oliver Sawodny, Active damping control for bending oscillations of a forklift mast using flatness based techniques, 2010 American Control Conference, Marriott Waterfront, Baltimore, MD, USA, June 30- July 02 (2010).
- Mehrdad R. Kermani, Analytic modal analyses of a partially strengthened Timoshenko beam, IEEE Transactions on Control Systems Technology, Vol. 18 July (2010) pp. 850- 858.
- Ivan M. Diaz, Emiliano Pereira, Vicente Feliu, Juan J.L. Cela, Concurrent design of multimode input shapers and link dynamics for flexible manipulators, IEEE/ ASME Transactions on Mechatronics, Vol. 15 (2010) pp. 646- 651.
- Tahmina Zebin, M.S. Alam, Dynamic modelling and fuzzy logic control of a two-link flexible manipulator using genetic optimization techniques, Proceedings ICCIT 2010, 23-25 December (2010) Dhaka, Bangladesh, pp. 418-423.
- Alessandro Macchelli, Claudio Melchiorri, A formal method for improving the transient behaviour of a non- linear flexible link, Mathematical and Computer Modelling of Dynamical Systems, Vol. 17 (2011) pp. 3-18.
- L. Bossi, C. Rottenbacher, G. Mimmi, L. Magni, Multivariable predictive control for vibrating structures: An application, Control Engineering Practice, Vol. 19 (2011) pp. 1087-1098.
- Yushu Bian, Zhihui Gao, Chao Yun, Study on vibration reduction and mobility improvement for the flexible manipulator via redundancy resolution, Nonlinear Dynamics, Vol. 65 (2011) pp. 359-368.
- Atef A. Ata, Waleed F. Fares, Mohamed Y. Sa'adeh, Dynamic analysis of a two-link flexible manipulator subject to different sets of conditions, IRIS 2012, Procedia Engineering, Vol. 41 (2012) pp. 1253- 1260.
- Hicham Chaoui, Pierre Sicard, Adaptive Neural Network Control of Flexible-Joint Robotic Manipulators with Friction and Disturbance, IEEE IECON 2012, Montreal, 25-28 Oct. (2012) pp. 2644-2649.
- Renato Vidoni, Alessandro Gasparetto, Marco Giovagnoni, Design and implementation of an ERLS- based 3-D dynamic formulation for flexible-link robots, Robotics and Computer-Integrated Manufacturing, Vol. 29 (2013) pp. 273-282.
- Alessandro Gasparetto, Amir Kiaeian Moosavi, Paolo Boscariol, Marco Giovagnoni, Experimental Validation of a Dynamic Model for Lightweight Robots, International Journal of Advanced Robotics Systems, Vol. 10, 182 (2013), pp. 1-7.
- Malik Loudini, Modelling and Intelligent Control of an Elastic Link Robot Manipulator, International Journal of Advanced Robotic Systems, Vol. 10, 81 (2013) pp. 1-18.
- Ashish Mohan, S.K. Saha, A recursive, numerically stable, and efficient simulation algorithm for serial robots, Multibody System Dynamics, Vol.17 (2007), pp. 291-319.
- Chandrupatla and Belegundu, Introduction to Finite Elements in Engineering, Third Edition, PHI, New Delhi

- Habib and Korayem, Accurate nonlinear modeling for flexible manipulators using mixed finite element formulation in order to obtain maximum allowable load, *Journal of Mechanical Science and Technology*, 29(9), 2015, pp. 3971-3982.
- Grootenhuis, The control of vibrations with viscoelastic materials, *Journal of Sound and Vibration*, Vol. 11(4), 1970, pp. 421-433.
- Kapur A. D., Nakra B. C. and Chawla D. R., Shock response of viscoelastically damped beams, *Journal of Sound and Vibration*, Vol. 55(3), 1977, pp. 351-362.
- Dutt J.K. and Roy H., Viscoelastic modelling of rotor-shaft systems using an operator-based approach, *Proc. IMechE Part C: J. Mechanical Engineering Science*, 2010, pp. 73-87.
- Adhikari S and Woodhouse J, Identification of damping: Part 1, Viscous damping, *Journal of Sound and Vibration*, Vol. 243(1), 2001, pp. 43-61.
- Bland D, *The Theory of Linear Viscoelasticity*, 1960, Pergamon Press.
- Cannon Robert H. and Schmitz, Initial Experiments on the End-Point Control of a Flexible One-Link Robot, *The International Journal of Robotics Research*, 1984, pp. 62-75.
- Yoshiyuki Sakawa, Fumitoshi Matsuno and Shigenobu Fukushima, Modeling and Feedback Control of a Flexible Arm, *Journal of Robotic Systems*, Vol. 2(4), 1985, pp. 453-472.
- Goh C.J., and Caughey T.K., On the stability problem caused by finite actuator dynamics in the collocated control of large space structures, *International Journal of Control*, Vol. 41(3), 1985, pp. 787-802.
- Chen S. H., Wang Z.D. and Liu X.H., Active Vibration Control and Suppression for Intelligent Structures, *Journal of Sound and Vibration*, Vol. 200(2), 1997, pp. 167-177.
- Preumont A., *Vibration Control of Active Structures: An Introduction*, Third Edition, Springer.
- R.K. Mittal, I.J. Nagrath, *Robotics and Control*, Tata Mc-Graw Hill Education.
- Frank L. Lewis, Darren M. Dawson, Chaouki T. Abdallah, *Robot Manipulator Control- Theory and Practice*, Marcel Dekker, 2004.
- Leonard Meirovitch, *Dynamics and Control of Structures*, John Wiley and Sons.

**COVID-19 PANDEMİ DÖNEMİNDE UZAKTAN EĞİTİMDE ÖĞRETMENLERİN
DİJİTAL ÖĞRETİM MATERYALİ GELİŞTİRMEDEKİ YETERLİLİKLERİN
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ÖZET

Bilişim Teknolojilerinin gelişmesiyle web 2.0 teknolojileri, eğitimin her alanında olduğu gibi uzaktan eğitimde yaygın bir şekilde kullanılan öğretim materyallerinden olmuştur. Bu materyaller, öğrencilerin etkileşim halinde olabileceği, katılımcı bir öğrenme deneyimi sunar. Covid-19 salgınıyla birlikte uzaktan eğitim daha da önem kazanmıştır. Ülkemizde bu süreçte uzaktan eğitime geçilmiştir. Bu çalışmada uzaktan eğitimde öğretmenlerin dijital yeterliliklerini farklı değişkenler açısından incelenmesi amaçlanmıştır. İlişkisel tarama modeli kullanan bu çalışma, öğretmenlerin dijital öğretim materyalleri geliştirme konusundaki yeterliliklerini belirlemeyi amaçlamaktadır. Bu çalışmaya 262 öğretmen çevrimiçi olarak katılmıştır. Öğretmenlerin öz yeterliliklerini, cinsiyetlerini, yaşlarını, eğitim kurumu düzeylerini, dijital ders kitabı kullanıp kullanmadıklarını ve dijital içerik geliştirme eğitimi ve Web 2.0 teknolojisi alıp almadıklarını incelemek için ilişkisel tarama modeli kullanılmaktadır. Araştırma sonuçlarına göre; öğretmenlerin tasarım alanında öz yeterlilik algısı daha yüksek, 18-31 yaş arası genç öğretmenlerin tasarım becerisi 31 yaş üstü öğretmenlere göre daha yüksek, okul öncesi öğretmenlerinin web 2.0 geliştirme becerisi ve tasarım becerisi diğer öğretmenlere göre daha düşüktür. Dijital öğretim materyallerinin kullanılıp kullanılmamasının, öğretmenlerin dijital materyal geliştirme öz-yeterliliği üzerinde bir etkisinin olmadığı ve web 2.0 araçlarını kullanan öğretmenlerin, diğer araçları kullanan öğretmenlere göre daha yüksek web 2.0 geliştirme becerilerine sahip olduğunu bulmuştur. Dijital içerik geliştirme konusunda eğitim almış öğretmenlerin, eğitim almamış öğretmenlere göre web 2.0 geliştirme ve tasarım becerilerinin daha yüksek olduğu, web 2.0 teknolojileri konusunda bilgi sahibi olan öğretmenlerin ise web 2.0 geliştirme ve tasarım becerilerine daha fazla sahip olduğu görülmüştür. Bu araştırma ve yapılan diğer araştırmaların sonuçları incelendiğinde, öğretmenlerin uzaktan ve örgün eğitimde dijital yeterliliklerinin geliştirmede öğretmenlerin daha öncesindeki aldıkları eğitimin önemli olduğu anlaşılmaktadır. Öğretmenlerin dijital yeterliliklerini geliştirmek için düzenlenen hizmet içi eğitimlerin yanı sıra, eğitim kurumları ve hükümetlerin dijital eğitim alanında politikalar ve stratejiler geliştirmesi gerekmektedir. Bu, öğretmenlerin ve öğrencilerin dijital dünyaya daha iyi adapte olmalarını ve daha etkili bir şekilde öğrenmelerini sağlayabilir. **Anahtar Kelimeler:** Dijital materyal geliştirme öz yeterliliği, Uzaktan eğitim

GİRİŞ

Bilişim teknolojileri günümüzde hızla gelişim göstermektedir ve bu gelişmelerin içinde web teknolojileri de öne çıkmaktadır. Web, internetin ortaya çıkışından sonra bilgiye erişim için geliştirilmiş bir sistem olarak tanımlanabilir. (Deperlioğlu & Köse, 2010). Bilginin paylaşılması ve anlamlandırılması, bilişim teknolojilerinin ve web teknolojisi standartlarının gelişmesine sebep olmuştur. Bu gelişmelerin sonucunda O'Reilly Media, Web 2.0 kavramını ilk olarak 2003 yılında tanıttı. (Karaman, Yıldırım ve Kaban, 2008). Web 2.0 standart HTML yapısına sahip klasik web ortamlarından sonra ortaya çıkan, etkileşim düzeyi yüksek, işbirliği ve paylaşımı içeren, kullanıcı merkezli, yeni web ortamı olarak tanımlanmaktadır (Deperlioğlu & Köse, 2010). Horzum'a (2010) göre, Web 2.0 teknolojilerinin temel amacı, İnternet'in sosyal etkileşim ve işbirliği potansiyelinden yararlanmak, kullanıcıların herhangi bir teknik bilgiye ihtiyaç duymadan içeriği kolayca paylaşmasına olanak sağlamaktır.

Web 2.0 teknolojileri, eğitimin her alanında olduğu gibi uzaktan eğitimde de yaygın bir şekilde kullanılan öğretim materyallerindedir. Uzaktan eğitim, elektronik veya elektronik olmayan teknolojik sistemler aracılığıyla kendine özgü iletişim yöntemleri kullanarak zaman ve mekân sınırlarını ortadan kaldıran birçok öğrenme faaliyetini öğrencilere sunan planlı ve kapsamlı bir öğrenme faaliyetidir. Web 2.0 teknolojileri, uzaktan eğitimde kullanılan etkileşimli materyallerin geliştirilmesine yardımcı olur. Bu materyaller, öğrencilerin etkileşim halinde olabileceği, katılımcı bir öğrenme deneyimi sunar. Bu sayede öğrenciler, sadece kendi hızlarında ilerlemekle kalmaz, aynı zamanda farklı öğrencilerle ve öğretmenlerle etkileşimde bulunarak, birbirlerinden öğrenirler. (Altıparmak, 2011). 1990'ların sonu ve 2000'li yılların başından itibaren bilişim teknolojilerinin hızla gelişmesi, uzaktan eğitim yoluyla sunulan eğitim fırsatlarının artmasına ve uzaktan eğitim yönteminin ülkemizdeki eğitim sisteminin ana akımı haline gelmesine neden olmuştur. Bugün milyonlarca öğrenci, uzaktan eğitim yoluyla eğitim almaktadır. Uzaktan eğitim, öğrencilere daha geniş bir eğitim yelpazesi sunarken, aynı zamanda öğrenme sürecinde daha fazla özgürlük ve esneklik sağlar. Bu nedenle, uzaktan eğitim, geleneksel sınıf ortamında mümkün olmayan birçok öğrenme fırsatı sunar ve her geçen gün daha da yaygınlaşmaktadır. (Kırık,2014).

Son yıllarda bilişim teknolojilerinin hızlı gelişimi, uzaktan eğitim fırsatlarını arttırmış ve bu yöntem milyonlarca öğrenci tarafından tercih edilmeye başlamıştır. Ancak Covid-19 salgınıyla birlikte, uzaktan eğitim daha da önem kazanmıştır. Bu küresel salgın, Türkiye'de ve dünya genelinde birçok alanda değişikliklere neden olmuştur. Eğitim alanı da bu değişimlerden etkilenmiştir. Ülkemizde ilk vakanın görülmesiyle birlikte, ulusal önlemler alınmak zorunda

kalmış ve yüz yüze eğitime ara verilerek uzaktan eğitime geçilmiştir. Bu sayede, eğitim süreci kesintiye uğramadan devam etmiştir. (Arslan vd.,2021)

Uzaktan eğitimde etkili bir eğitim ve öğretimin sağlanabilmesi için diğer dünya ülkelerinde olduğu gibi Türkiye de dijital teknolojileri kullanarak uzaktan eğitimle bu süreci yürütülmüştür. Perienen (2020), tüm yaşam alanlarını etkileyen teknolojinin Covid-19 sürecinde eğitim sektörünün de yönünü değiştirdiğini ifade etmiştir. Türkiye’de uzaktan eğitim sürecinde öğretmenler ve öğrenciler eğitim ve öğretim sürecinde hâlihazırda kullandıkları teknoloji ile daha yakından meşgul olmak durumunda kalmışlardır. Covid-19 döneminde uygulanan uzaktan eğitim sebebiyle, öğretmenler ve akademisyenler, öğrencilere ilgili içerikleri öğretmek ve ders içeriklerini dağıtmak için dijital öğretim yöntemlerini öğrenmek ve geliştirmek zorunda kalmıştır. Covid-19 sürecinde, dijital cihazlar, çevrimiçi kaynaklar, sosyal medya, ve dijital materyallerinin daha etkin ve fazla kullanımını artıran bir etmen olmuştur.(Mulenga ve Marban, 2020). Uzaktan eğitimde dijital öğretim materyalleri aktif şekilde kullanılmaktadır. Dijital öğretim kullanılan uzaktan eğitiminde öğrenmenin ana bileşeni dijital içerik ve materyallerdir. (Kumar & Kushwaha, 2010). Howell ve O'Donnell'e (2017) göre dijital materyaller; internet kaynakları, projektörler, bilgisayarlar vb. farklı medya kaynaklarının bir araya gelmesi ve elektronik ortamda sunulmasıdır.

Öğrenme ve öğretme sürecinde kullanılan materyaller, öğrencilerin derse olan ilgi ve öğrenmeleri üzerinde önemli bir etkiye sahiptir. Öğretmenlerin böylesine etkili bir sınıf ortamı yaratmak için öğretim araçlarını nasıl geliştireceklerini bilmeleri gerektiğini belirtilmektedir. (Bakaç, Özen, 2015). Korkmaz, Arıkaya ve Altıntaş (2019), öğretmenlerin bu becerilere sahip olma düzeyini belirlemenin yollarından birinin de bu becerilere ilişkin öz yeterlik düzeylerini, diğer bir deyişle öz yeterlik algılarını belirlemek olduğunu belirtmektedir.

İlgili alan yazında öğretmenlerin veya akademisyenlerin dijital yeterliklerinin farklı bağlamlarda değerlendirildiği çalışmalar mevcuttur. Bazı araştırmalarda öğretmenlerin orta düzeyde dijital yeterliğe sahip olduğu (Gökbulut, Keserci ve Akyüz, 2021; Ocak ve Karakuş, 2019; Yontar, 2019), bazılarının ise düşük düzeyde olduğu görülmüştür (Napal Fraile, Penalva-Velez ve Mendioroz Lacambra, 2018). Öğretmenler arasında yüksek düzeyde dijital yeterlik olduğunu gösteren araştırmalar da bulunmaktadır (Arslan, 2019; Demirdağ, 2021). Araştırma sonuçları incelendiğinde sonuçların birbirinden farklı olduğu görülmekte olup öğretmenlerin çeşitli değişkenlere göre dijital yeterlikleri üzerinde önemli etkisi olduğu söylenebilir. Alan yazındaki çalışmalara bakıldığında öğretmenlerin dijital yeterliliklerinin çeşitli değişkenlere göre değiştiği gözlenmiştir. Bu sebeple çalışmamızda; öğretmenlerin cinsiyet, yaş eğitim

kurumu, öğretim materyali kullanıp kullanmama durumu, kullanılan dijital eğitim platformu, eğitim alma durumu ve Web 2.0 hakkında bilgi sahibi olma durumu değişkenlerine göre bir farklılaşma durumu olup olmadığı araştırılmıştır.

Problem Durumu

Alinyazındaki çalışmalar incelendiğinde öğretmenlerin uzaktan eğitimde daha etkin bir şekilde öğretim faaliyetlerini yerine getirebilmesi için öğretmenlerin dijital yeterliliklerini daha aktif bir şekilde kullanması gerektiği ve daha da geliştirmesi gerektiği söylenebilir. Bu durumdan dolayı bu araştırmayla öğretmenlerin dijital yeterliliklerini incelemek amaçlanmıştır.

Çalışmanın Amacı

Bu çalışmayla, uzaktan eğitimde öğretmenlerin dijital yeterliliklerini farklı değişkenler açısından incelenmesi amaçlanmıştır. Bunun için öğretmenlerin; dijital öğretim materyali geliştirme öz-yeterliliklerinin düzeylerini ölçmek amaçlanmıştır. Diğer bir amaç ise dijital öğretim materyalleri geliştirmedeki yeterliliklerinin cinsiyete, yaşa, çalıştıkları eğitim kurumu düzeyi, dijital öğretim materyallerini kullanıp kullanmama durumu, kullanılan dijital öğretim platformları, dijital içerik geliştirme üzerine her hangi bir eğitim alma durumu ve web 2.0 teknolojisi hakkında bilgi sahibi olma durumuna göre farklılığını bulmak amaçlanmıştır.

YÖNTEM

Bu bölümde araştırmanın modeli, katılımcıları, veri toplama aracı ve verilerin analizi ile ilgili bilgilere yer verilmiştir.

Araştırma Modeli

İlişkisel tarama modeli kullanan bu çalışma, öğretmenlerin dijital öğretim materyalleri geliştirme konusundaki yeterliliklerini belirlemeyi amaçlamaktadır. İlişki araştırması, iki veya daha fazla değişken arasındaki varyasyon miktarını bulmayı amaçlayan bir yöntemdir (Karasar, 2016). Bu çalışma, öğretmenlerin öz yeterliliklerini, cinsiyetlerini, yaşlarını, eğitim kurumu düzeylerini, dijital ders kitabı kullanıp kullanmadıklarını, dijital öğretim platformlarını kullanıp kullanmadıklarını ve dijital içerik geliştirme eğitimi ve Web 2.0 teknolojisi alıp almadıklarını incelemek için ilişkisel tarama modeli kullanmaktadır. Dijital öğretim materyali geliştirme. Durumunu bilen bir değişkene göre değişip değişmediğini kontrol edilmiştir.

Çalışma Grubu

Çalışma grubu araştırmaya çevrimiçi anketle katılan 262 öğretmenden oluşmaktadır. Tablo 1'de anketin geçerli olduğu düşünülen katılımcı verilerinin demografik özellikleri verilmiştir.

Tablo-1 Ankete Katılan Öğretmenlerin Demografik Özellikleri

Özellik		Sayı	Yüzde
Cinsiyet	Erkek	97	37
	Kadın	165	63
Yaş	18-30	87	33,2
	30-41	137	52,3
	41 ve Üstü	38	14,5
Çalışılan Eğitim Kurumu Düzeyi	Okul Öncesi	11	4,2
	İlkokul	31	11,8
	Ortaokul	102	38,9
Dijital Öğrenme Metaryelleri Kullanma	Lise	118	45
	Evet	257	98,1
Kullanılan Dijital Öğretim Metaryelleri	Hayır	5	1,9
	Office Programları(Word,PowerPoint vb.)	141	53,8
Dijital içerik geliştirme eğitimi alma	Web 2.0 Araçları(E-Kitap,Animasyon Araçları,Kavram Haritası Araçları vb)	87	33,2
	Görüntü İşleme Programları(Paint,Adobe Photoshop,Picasa vb.)	34	13
	Hayır	168	64,1
Web 2.0 teknolojisi hakkında bilgi	Evet	94	35,9
	Hayır	136	51,9
Toplam	Hayır	126	48,1

Tablo-1 de görüldüğü gibi ankete katılan öğretmenlerin 165(%63)'i kadın 97(%37) si erkektir. 18-30 yaş arası 87(%33,2), 30-41 yaş arası 137(52,3) , 41 ve üstü 38(%14,5) yaş aralığındadır.

Veri Toplama Aracı

Bu araştırmada, veri toplamak için Korkmaz, Arıkaya ve Altıntaş (2019) tarafından geliştirilen "Öğretmenlerin Dijital Öğretim Materyali Geliştirme Öz-Yeterlik Ölçeği" kullanılmıştır. Ölçek, 38 maddeden ve 3 faktörden oluşmaktadır ve maddeler, pozitif ifadeler için "kesinlikle katılmıyorum" ile "kesinlikle katılıyorum" arasında, negatif ifadeler için ise "kesinlikle katılıyorum" ile "kesinlikle katılmıyorum" arasında yer alan 5 puanlık bir ölçekte

değerlendirilir. Pozitif ifadeler için ölçek 1 ("kesinlikle katılmıyorum") ile 5 ("kesinlikle katılıyorum") arasında, negatif ifadeler için ise puanlama ters çevrilir. Ölçek, Web 2.0 Geliştirme faktörü için 14, Tasarım faktörü için 18 ve Olumsuz Bakış faktörü için 6 madde içermektedir. Ölçekten alınabilecek en yüksek puan 190 en düşük puan ise 38 dir. Bu çalışmada öğretmen adaylarına uygulanan ölçeğin Cronbach Alpha iç güvenilirlik katsayısı; Web 2.0 Geliştirme faktörü için .970, Tasarım faktörü için .945, olumsuz Bakış faktörü için .869 güvenilirlik değerine sahip olduğu görülmüştür. Ölçeğin toplam Cronbach Alpha güvenilirlik katsayısını .961 olarak bulmuştur. Bu çalışmada da öğretmenlere uygulanan öz-yeterlilik ölçeği iç tutarlılık katsayısı .974 olarak hesaplanmıştır.

Verilerin Analizi

Verilerin analizi öncesinde normal dağılımın sağlanıp sağlanmadığı kontrol edilmiştir. Bu amaçla, verilerin çarpıklık ve basıklık değerleri incelenmiştir. Alt boyutlara ait bu değerler Tablo-2'de görüldüğü gibi çarpıklık değerleri ± 2 arasında olduğundan, normal dağılımın sağlandığı kabul edilmiştir. George ve Mallery (2010), çarpıklık ve basıklık değerlerinin ± 2 arasında olması halinde normal dağılımın sağlandığını belirtmektedir. Bu araştırmada, anket verilerinin analizi için bağımsız örneklem için t-testi ve tek yönlü varyans analizi (one way ANOVA) kullanılmıştır.

Tablo-2 Çarpıklık ve Basıklık Değerleri

Boyutlar	Çarpıklık	Basıklık
Web 2.0 Geliştirme	-.593	.152
Tasarım	-1,037	1,646
Olumsuz Bakış	-.130	-.054

BULGULAR

Öğretmenlerin dijital öğretim materyali geliştirme öz yeterliklerinin cinsiyet, yaş, çalıştıkları eğitim kurumu düzeyi, dijital öğretim materyalleri kullanıp kullanmama durumu, kullanılan dijital öğretim platformları, dijital içerik geliştirme üzerine her hangi bir eğitim alma durumu ve Web 2.0 teknolojisi hakkında bilgi sahibi olma durumuna göre anlamlı farklılık gösterip göstermediği analiz edilmiştir. Belirlenen alt problemlere göre bulgular aşağıda verilmiştir.

Araştırmaya katılan öğretmenlerin 38 maddeden oluşan ankete verdikleri yanıtlara göre dijital materyal geliştirme öz yeterlik düzeyleri Tablo 3'te gösterilmektedir.

Tablo-3 Alt Boyutların Betimsel Analizleri

Boyutlar	N	Min.	Max.	\bar{X}	SS
Web 2.0 Geliştirme	262	1	5	3.4299	.96223
Tasarım	262	1	5	3.8444	.78057
Olumsuz Bakış	262	1	5	3.2239	.88077
Toplam	262				

Tablo-3 e göre yapılan analizler incelendiğinde göre en yüksek ortalama puanı Tasarım alt boyutunda (\bar{X} =3.84 en düşük ortalama puanı ise Olumsuz Bakış (\bar{X} =3.22) alt boyutunda olduğu görülmektedir. Diğer alt boyutu olan web 2.0 geliştirme alt boyutunda ise (\bar{X} =3.42) olduğu görülmektedir. Başka bir ifadeyle araştırmaya katılan öğretmenlerin tasarım alanında öz yeterliliklerinin daha fazla olduğu şeklinde yorumlanabilir.

Öğretmenlerin öz-yeterliğinin cinsiyete göre anlamlı fark gösterip göstermediğini saptamak için Bağımsız Örneklem t Testi ile analizler yapılmıştır ve analiz sonuçları Tablo-4' de verilmiştir.

Tablo-4 Cinsiyet Değişkenine Göre Analiz Sonuçları

Boyutlar		N	\bar{X}	SS	t	p
Web 2.0 Geliştirme	Erkek	97	3.7069	.85878	3.21	.443
	Kadın	160	3.3362	.91752		
Tasarım	Erkek	97	3.9404	.69190	.826	.889
	Kadın	160	3.8660	.70635		
Olumsuz	Erkek	97	3.2784	.90066	.960	.225
	Kadın	160	3.1719	.83812		

Tablo-3 e göre yapılan analizler incelendiğinde cinsiyet değişkeninin öğretmenlerin dijital materyal geliştirme öz yeterlilik alt boyutlarında anlamlı bir farklılık göstermediği görülmüştür ($p>.05$).

Öğretmenlerin dijital materyal geliştirme öz-yeterliliklerinin yaşla anlamlı farklılık gösterip göstermediğini belirlemek için Tukey'nin post hoc testi ile tek yönlü ANOVA

yapılmıştır. Analiz sonuçları Tablo 5'te gösterilmektedir. Analiz yapılırken ortalama ve standart sapma değerleri dikkate alınmış ve tabloda belirtilmiştir.

Tablo-5 Yaş Değişkenine Göre Analiz Sonuçları

Boyutlar	Yaş	N	\bar{X}	Ss	Sd	F	p	Anlamlı Fark
Web 2.0 Geliştirme	18-31	86	3.6154	.7978	2	1,528	,219	Yok
	31-41	134	3.4120	.97183	254			
	41 ve Üstü	37	3.3842	.92771	256			
Tasarım	18-31	86	4.0633	.54093	2	5,718	,004	1-2
	31-41	134	3.8615	.72152	254			
	41 ve Üstü	37	3.8941	.85147	256			
Olumsuz Bakış	18-31	86	3.2791	.92935	2	1,163	,314	Yok
	31-41	134	3.2214	.83064	254			
	41 ve Üstü	37	3.0225	.80523	256			

Tablo-5'e göre öğretmenlerin yaşları Tasarım alt boyutunda anlamlı bir farklılık olduğu bulunmuştur ($p < .05$). Tukey Post-hoc test sonuçları incelendiğinde ortalama ve standart sapma değerlerine göre 18-31 yaş grubu ($\bar{X}=4.06$), 31-41 yaş grubu ($\bar{X}= 3.86$) ve 41 yaş üstü ($\bar{X}= 3.89$) arasında 18-31 yaş grubu lehine anlamlı bir farklılık görülmüştür. Diğer bir ifadeyle 18-31 yaş aralığında olan genç öğretmenlerin tasarım becerileri yaşları 31 den büyük olan öğretmenlerden daha yüksek olduğu anlaşılmaktadır.

Öğretmenlerin dijital materyal geliştirme öz-yeterliklerinin eğitim kurumu düzeyleri arasında anlamlı farklılık gösterip göstermediğini belirlemek için Tukey'nin post hoc testi ile tek yönlü ANOVA yapılmıştır. Analiz sonuçları Tablo 7'de verilmiştir.

Tablo-7 Çalışılan Eğitim Kurumu Düzeyine Göre Analiz Sonuçları

Boyutlar	Kurum	N	\bar{X}	Ss	Sd	F	p	Anlamlı Fark
Web 2.0 Geliştirme	Okul Öncesi	11	2,5455	,94937	3	3,656	,013	
	İlkokul	31	3,4171	,78811	258			
	Ortaokul	102	3,5399	1,03405	261			
	Lise	118	3,4207	,90658				
Tasarım	Okul Öncesi	11	3,1818	1,16801	3	3,273	,022	
	İlkokul	31	3,8835	,78493	258			
	Ortaokul	102	3,9363	,72732	261			
	Lise	118	3,8164	,76034				
Olumsuz	Okul Öncesi	11	3,5606	,94066	3	,822	,483	Yok
	İlkokul	31	3,3333	,89132	258			
	Ortaokul	102	3,2108	,95265	261			
	Lise	118	3,1751	,80709				

Tablo-7 incelendiğinde öğretmenlerin çalıştıkları kurumlara göre Web 2.0 geliştirme alt boyutunda anlamlı bir farklılık bulunmuştur($p < .05$). Ortalama ve standart sapma istatistikleri incelendiğinde bu anlamlı farklılığın okul öncesi öğretmenlerinin aleyhine anlamlı bir farklılık olduğu tespit edilmiştir. Tasarım alt boyutunda anlamlı bir farklılık bulunmuştur($p < .05$). Tasarım alt boyutunda da anlamlı farklılığın okul öncesi öğretmenlerinin aleyhine anlamlı bir farklılık olduğu tespit edilmiştir. Bir başka ifadeyle okul öncesi öğretmenlerinin web 2.0 geliştirme becerileri ve Tasarım becerileri diğer kurumlarda çalışan öğretmenlere göre daha düşük olduğu anlaşılmaktadır.

Öğretmenlerin dijital öğretim materyallerini kullanma öz-yeterliklerinde anlamlı bir fark olup olmadığını belirlemek için bağımsız örneklem t testi analiz için kullanılmış ve analiz sonuçları Tablo 8'de gösterilmiştir.

Tablo-8 Dijital Öğretim Materyalleri Kullanma Durumu Değişkenine Göre Analiz Sonuçları

Boyutlar		N	\bar{X}	SS	t	p
Web 2.0 Geliştirme	Evet	257	3,4327	,96751	.338	.459
	Hayır	5	3,2857	,69253		
Tasarım	Evet	257	3,8415	,78477	-.417	.645
	Hayır	5	3,9889	,56026		
Olumsuz	Evet	257	3,2419	,87299	2.390	.990
	Hayır	5	2,3000	,86923		

Tablo-8 incelendiğinde öğretmenlerin öğretim materyalleri kullanma durumunun ($p>.05$) Üç alt boyutlardan web 2.0 geliştirme, tasarım ve olumsuz arasında anlamlı bir fark olmadığı anlaşılmaktadır. Bulunan sonuçlara göre dijital öğretim materyali kullanıp kullanmama durumunun öğretmenlerin dijital materyal geliştirme öz yeterlilikleri üzerinde bir etkisinin olmadığı söylenebilir. Öğretmenlerin dijital materyal geliştirme konusundaki öz-yeterliğinin kullanılan dijital öğretim materyalleri bakımından anlamlı fark gösterip göstermediğini saptamak için Tek Yönlü ANOVA ve Tukey Post-hoc testleri yapılmıştır. Analiz sonuçları Tablo 9’de verilmiştir. Analiz yapılırken ortalama ve standart sapma değerleri kontrol edilerek bakılmıştır.

Tablo-9 Dijital Öğretim Materyalleri Değişkenine Göre Analiz Sonuçları

Boyutlar	Yaş	N	\bar{X}	Ss	Sd	F	p	Anlamlı Fark
Web 2.0 Geliştirme	Office Programları(Word,PowerPoint vb.)	139	3,3099	,88914	2	5,209	,006	2-1
	Web 2.0 Araçları(E-Kitap,Animasyon Araçları,Kavram Haritası Araçları vb.)	87	3,6806	,89120	254			
	Görüntü İşleme Programları(Paint,Adobe Photoshop,Picasa vb.)	31	3,6475	,95154	256			
Tasarım	Office Programları(Word,PowerPoint vb.)	139	3,8177	,78251	2	1,841	,161	Yok
	Web 2.0 Araçları(E-Kitap,Animasyon Araçları,Kavram Haritası Araçları vb.)	87	3,9936	,60778	254			
	Görüntü İşleme Programları(Paint,Adobe Photoshop,Picasa vb.)	31	3,9570	,50199	256			

	Office Programları(Word,PowerPoint vb.)	139	3,1295	,78097	2			
Olumsuz	Web 2.0 Araçları(E-Kitap,Animasyon Araçları,Kavram Haritası Araçları vb.)	87	3,3793	,97172	254	2,509	,083	Yok
	Görüntü İşleme Programları(Paint,Adobe Photoshop,Picasa vb.)	31	3,1129	,84040	256			

Tablo-9 incelendiğinde Web 2.0 Geliştirme alt boyutunda anlamlı bir farklılık görülmüştür.($p<.05$). Web 2.0 Geliştirme alt boyutundaki istatistikler incelenmiştir. Web 2.0 araçları kullanan öğretmenlerin ($\bar{X}=3.68$ $SS=.89$) lehine anlamlı bir farklılık görülmüştür. Bir başka ifadeyle web 2.0 araçlarını kullanan öğretmenlerin web 2.0 geliştirme becerileri diğer araçları kullanan öğretmenlere göre daha yüksek olduğu anlaşılmaktadır.

Öğretmenlerin öz-yeterliklerinin herhangi bir dijital içerik geliştirme eğitimi alma durumuna göre anlamlı bir farklılık gösterip göstermediğini belirlemek için Tablo 10'da gösterilen sonuçların analizinde bağımsız örneklem t-testi kullanılmıştır.

Tablo-10 Öğretmen Dijital Materyal Geliştirme Öz-Yeterliklerinin Dijital İçerik Geliştirme Üzerine Herhangi Bir Eğitim Alma Değişkenine Göre Analiz Sonuçları

Boyutlar		N	\bar{X}	SS	t	p
Web 2.0 Geliştirme	Evet	94	4,0403	,65746	8.518	.008
	Hayır	163	3,1507	,88045		
Tasarım	Evet	94	4,1998	,53507	5.621	.034
	Hayır	163	3,7178	,72499		
Olumsuz	Evet	94	3,5585	,90818	5.129	.052
	Hayır	163	3,0123	,76881		

Tablo-10 incelendiğinde öğretmenlerin dijital içerik geliştirme üzerine herhangi bir eğitim alma durumu öz yeterlilik alt boyutlarının Web 2.0 Geliştirme alt boyutunda anlamlı bir farklılık görülmüştür ($p<.05$). Dijital içerik geliştirme üzerine herhangi bir eğitim alan öğretmenlerin lehine anlamlı bir farklılık görülmüştür. Tasarım alt boyutunda da dijital içerik geliştirme üzerine herhangi bir eğitim alan öğretmenlerin lehine anlamlı bir farklılık görülmüştür($p<.05$). Bir başka ifadeyle dijital içerik geliştirme eğitimi alan öğretmenlerin eğitim almayan öğretmenlere göre web 2.0 geliştirme ve Tasarım becerilerinin daha yüksek olduğu anlaşılmaktadır.

Öğretmenlerin öz-yeterliklerinin Web 2.0 teknolojilerine ilişkin bilgilerine göre anlamlı bir şekilde farklılaşıp farklılaşmadığını belirlemek amacıyla analiz için bağımsız örneklem t-testi kullanılmış ve analiz sonuçları Tablo 11'de gösterilmiştir.

Tablo-11 Öğretmen Dijital Materyal Geliştirme Öz-Yeterliklerinin Web 2.0 Teknolojisi Hakkında Bilgisi Olma Durumu Değişkenine Göre Analiz Sonuçları

Boyutlar		N	\bar{X}	SS	t	p
Web 2.0	Evet	136	3,9900	,64472	11.931	.027
	Hayır	121	2,8985	,81929		
Tasarım	Evet	136	4,1593	,53526	7.015	.002
	Hayır	121	3,5960	,74511		
Olumsuz	Evet	136	3,4767	,90998	5.509	.008
	Hayır	121	2,9146	,69659		

Tablo-11 incelendiğinde dijital öğretim materyali geliştirme öz yeterliklerinden olan web 2.0 geliştirme, tasarım ve olumsuz öz yeterliliklerinde web 2.0 teknolojisi hakkında bilgisi olan öğretmenlerin lehine anlamlı bir farklılık görülmüştür ($p < .05$). Bir başka ifade ile web 2.0 teknolojisi hakkında bilgisi olan öğretmenlerin web 2.0 geliştirme ve tasarım becerilerinin bilgisi olmayanlara göre daha yüksek olduğu anlaşılmaktadır. Bunun yanında olumsuz bakışın ise bilgisi olanların daha fazla olduğu anlaşılmıştır.

SONUÇ VE ÖNERİLER

Bu çalışmada öğretmenlerin uzaktan eğitimde görev yapan öğretmenlerinin dijital öğretim materyalleri geliştirmedeki yeterliliklerinin farklı değişkenler açısından incelenmiştir.

Araştırmanın sonuçlarına göre, öğretmenlerin öz yeterlilik alt boyutlarından Tasarım alt boyutu en yüksek ortalamaya sahiptir. Bu durum, öğretmen adaylarının kendilerini Tasarım konusunda daha yeterli gördüklerini göstermektedir. Ancak, Web 2.0 geliştirme alt boyutuna göre dijital materyal geliştirme konusunda öğretmenlerin olumsuz bir bakış açısına sahip oldukları sonucuna varılmıştır. Bu bulgular, öğretmenlerin dijital materyal geliştirme konusunda daha fazla eğitim ve desteğe ihtiyaç duyduklarını göstermektedir.

Öğretmenlerin öz yeterlilikleri cinsiyete göre anlamlı bir farklılaşma görülmemekle beraber erkek öğretmenlerin kadın öğretmenlere göre ortalamalarının yüksek olduğu tespit edilmiştir. Aynı şekilde Gökbulut, Keserci ve Akyüz (2021) tarafından yapılan çalışmada da

cinsiyet deęişkenleri ile öz yeterlik arasında anlamlı bir fark bulunmamıştır. Başka çalışmalarda da Arslan, 2021; Ata ve Yıldırım, 2019 benzer şekilde anlamlı bir farklılık bulamamıştır. Bazı araştırmalarda erkeklerin kadınlara göre dijital yeterliliklerinin daha fazla olduęu görülmüştür. (Cabezas-Gonzalez, Casillas-Martín, Sanches-Ferreira ve Teixeira Diogo, 2017; Korkmaz, 2020; Lucas ve dię., 2020; Yontar, 2019).

Öğretmenlerin öz yeterlilikleri yaş deęişkenine göre sadece tasarım alt boyutunda anlamlı bir farklılaşma görülmüştür dięer alt boyutlarda anlamlı bir farklılık görülmemiştir. Genç öğretmenlerin genel anlamda Tasarım alt boyutunda dięer yaş gruplarına kıyasla daha fazla Tasarım öz yeterlilięine sahip oldukları yorumlanabilir. Benzer bir çalışmada da genç öğretmenlerin dijital becerilerinin daha fazla olduęu tespit edilmiştir(Aksoy N ve dię., 2021).Çalışılan kurum düzeyine göre öz yeterlilikleri Web 2.0 Geliştirme ve Tasarım alt boyutunda anlamlı bir farklılık görülmüştür. Olumsuz alt boyutunda anlamlı bir farklılık görülmemiştir. Web 2.0 ve tasarım alt boyutunda ortaokulda görev yapan öğretmenlerin dięer kurumlarda görev yapan öğretmenlere kıyasla daha fazla öz yeterlilięe sahip olduęu söylenebilir. Benzer bir çalışmada kurum düzeyinin anlamlı bir farklılık olduęu görülmüş ve ortaokulda görev yapan öğretmenlerinin dijital yeterliklerinin yüksek olduęu tespit edilmiştir (Gümüş, 2021)

Dijital materyalleri kullanma durumu öğretmenlerin öz yeterliliklerine göre anlamlı bir farklılık göstermemiştir. Fakat kullanılan dijital öğretim materyalleri deęişkenine göre Web 2.0 Geliştirme alt boyutunda anlamlı bir farklılık görülmüştür. Web 2.0 araçları kullanan öğretmenlerin Web 2.0 geliştirme öz yeterlilięine daha fazla sahip olduęu anlaşılabilir. Öğretmenlerin daha önceden dijital içerik geliştirme üzerine herhangi bir eğitim almaları Web 2.0 Geliştirme ve Tasarım alt boyutunda anlamlı bir farklılık görülmüştür. Eğitim almayan öğretmenlere göre daha fazla Web 2.0 geliştirme öz yeterlilięine sahip olduęu görülmektedir. İçerik geliştirme eğitimi alan öğretmenlerin Tasarım öz yeterlilięi eğitim almayan öğretmenlere göre daha yüksek olduęu söylenebilir. Benzer bir çalışmada öğretmenlerin dijital materyal geliştirmeye yönelik öz yeterliklerinin, ders içerięi geliştirmek için web 2.0'ı önceki kullanımlarına göre anlamlı düzeyde farklı olduęu belirlenmiştir (Bediroęlu, 2021).

Web 2.0 hakkında daha önceden bilgisi olma durumu öğretmenlerin öz yeterliliklerine göre anlamlı bir farklılık görülmektedir. Daha önceden bilgisi olan öğretmenin dijital öz yeterlilikleri bilgisi olmayana göre daha yüksektir şeklinde yorumlanabilir. Bunun yanında daha önceden bilgisi olan öğretmenlerin dijital materyal geliştirmeye yönelik olumsuz bakış yüksektir. Bunun sebebi dijital materyal geliştirirken yaşadığı zorluklardan kaynaklanabilir.

Atalmış ve Şimşek tarafından 2022 yılında yapılan çalışmada WEB 2.0 eğitimi alıp almama değişkenine göre eğitim almayanlara göre anlamlı farklılık tespit edilmiştir.

Kavak ve Yıldırım 2017 yılında 203 öğretmen adayı ile yaptıkları çalışmalarında öğretmen adaylarının dijital öğretim materyali geliştirme yeterliliklerinin orta düzeyde olduğu belirlenmiştir. Öğretmen adaylarının dijital öğretim materyali geliştirme yeterliliklerini artırmak için en önemli yol olarak, öğretmen adaylarına öğrenme fırsatları sağlanması gerektiği vurgulanmıştır. Ayrıca, öğretmen adaylarının dijital öğretim materyali geliştirme yeterliliklerinin artırılması için eğitim programlarının ve müfredatlarının yeniden düzenlenmesi gerektiği de çalışmanın sonuçları arasında yer almaktadır.

Gökbulut tarafından 2018 yılında yapılan çalışmada da en ve teknoloji öğretmenlerinin dijital öğretim materyali geliştirme yeterlilikleri incelenmiştir. Çalışmanın sonucuna göre, öğretmenlerin dijital öğretim materyali geliştirme yeterliliklerinin orta düzeyde olduğu tespit edilmiştir. Öğretmenlerin dijital öğretim materyalleri oluşturma sürecinde karşılaştıkları zorluklar arasında zaman yetersizliği, teknoloji araçlarının kullanımında yetersizlikler ve materyallerin kalitesi gibi faktörler yer almıştır. Ayrıca öğretmenlerin dijital öğretim materyalleri geliştirme konusunda yeterliliklerini artırmak için özellikle teknoloji araçlarının kullanımı, materyal Tasarımı ve materyal değerlendirme konularında hizmet içi eğitimlere ihtiyaçları olduğu vurgulanmıştır.

Çalışmadan alınan sonuçların yanında sınırlılıklarında mevcuttur. Çalışmanın örneklem sayısı çevrimiçi ankete katılan öğretmenlerden oluşmakta birlikte küçük olmasından kaynaklı ortaya çıkan sonuçların genelleyebilir olmamasıdır. Bu sebeple benzer bir çalışma ilerleyen zamanlarda akademisyenlerin ve diğer eğitim kurumlarında bulunan eğitimcilerin de içinde bulunduğu daha geniş daha kapsamlı ölçekli bir örneklem grubu üzerinde tekrarlanabilir. Bu çalışmada sınırlı değişkenler kullanılmıştır. İlerleyen zamanlarda yapılacak çalışmada daha kapsamlı değişkenler incelenebilirler.

Bu araştırma ve yapılan araştırmaların sonuçları incelendiğinde, öğretmenlerin uzaktan ve örgün eğitimde dijital yeterliklerinin geliştirmede öğretmenlerin daha öncesindeki aldıkları eğitimin önemli olduğu anlaşılmaktadır. Öğretmenlerin dijital yeterliliklerini geliştirmek için düzenlenen hizmet içi eğitimlerin yanı sıra, eğitim kurumları ve hükümetlerin dijital eğitim alanında politikalar ve stratejiler geliştirmesi gerekmektedir. Bu, öğretmenlerin ve öğrencilerin dijital dünyaya daha iyi adapte olmalarını ve daha etkili bir şekilde öğrenmelerini sağlayabilir.

KAYNAKÇA

- Aksoy, N., Karabay, E., & Aksoy, E. (2021). Sınıf öğretmenlerinin dijital okuryazarlık düzeylerinin incelenmesi [Examination of primary school teachers' digital literacy levels]. *Selçuk İletişim*, 14(2), 859-894. <https://doi.org/10.18094/josc.871290>
- Altıparmak, M. (2011). E-öğrenme ve uzaktan eğitimde açık kaynak kodlu öğrenme yönetim sistemleri. Malatya: Akademik Bilişim'11 - XIII. Akademik Bilişim Konferansı Bildirileri Kitabı, 319-327.
- Altıparmak, M., Kurt, İ., D. & Kapıdere, M. (2011). E-öğrenme ve uzaktan eğitimde açık kaynak kodlu öğrenme yönetim sistemleri. Akademik Bilişim Konferansı Bildirileri, İnönü Üniversitesi, Malatya, (<http://ab.org.tr/ab11/liste.html>).
- Arslan, Kevser, Görgülü Arı, Aslı ve Hayır Kanat Meryem. "Covid-19 Pandemi Sürecinde Verilen Uzaktan Eğitim Hakkında Veli Görüşleri". *ulakbilge*, 57 (2021 Şubat): s. 192–206. doi: 10.7816/ulakbilge-09-57-03
- Arslan, R. (2021). Okul yöneticilerinin dijital yeterlilikleri ve dijital öğretim materyali kullanımına yönelik görüşleri. *Eğitim ve Öğretim Araştırmaları Dergisi*, 10(1), 264-277.
- Arslan, S. (2019). İlkokullarda ve ortaokullarda görev yapan öğretmenlerin dijital okuryazarlık düzeylerinin çeşitli değişkenler açısından incelenmesi. (Yayımlanmamış yüksek lisans tezi). Sakarya Üniversitesi. Sakarya.
- Arslan, S. (2019). İlkokullarda ve ortaokullarda görev yapan öğretmenlerin dijital okuryazarlık düzeylerinin çeşitli değişkenler açısından incelenmesi. (Yayımlanmamış yüksek lisans tezi). Sakarya Üniversitesi. Sakarya.
- Ata, R. ve Yıldırım, K. (2019). Exploring Turkish pre-service teachers' perceptions and views of digital literacy. *Education Sciences*, 9(1), 40. doi: 10.3390/educsci9010040
- Atalmış, S. & Şimşek, G. (2022). Sosyal Bilgiler ve Fen Bilimleri Öğretmenlerinin WEB 2.0 Araçlarını Kullanım Yeterlilikleri . *Journal of Innovative Research in Social Studies* , 5 (1) , 1-19 . DOI: 10.47503/jirss.1039178
- Bakaç, E. & Özen, R. (2015). Materyal Tasarımı öz-yeterlik inancı ölçeği: geçerlik ve güvenilirlik çalışması. *International Journal of Human Sciences*, 12(2), 461-476. doi: 10.14687/ijhs.v12i2.3341.
- Bediroğlu, R. (2021). Fen bilgisi öğretmen adaylarının dijital öğretim materyali geliştirme öz-yeterlilikleri. (Yayımlanmış yüksek lisans tezi). Yıldız Teknik Üniversitesi. İstanbul.
- Cabezas-Gonzalez, M., Casillas-Martín, S., Sanches-Ferreira, M., & Teixeira Diogo, F. L. (2017). Do gender and age affect the level of digital competence? A study with university students. *Fonseca Journal of Communication*, 15, 109-125.
- Demirdağ, M. (2021). Öğretmenlerin dijital okuryazarlık düzeyleri ile araştırma okuryazarlık becerileri arasındaki ilişkinin incelenmesi. (Yayımlanmamış yüksek lisans tezi). Atatürk Üniversitesi, Erzurum.
- George, D. & Mallery, P. (2010). *SPSS for Windows step by step. A simple study guide and reference* (10. Baskı). GEN, Boston, MA: Pearson Education, Inc.
- Gökbulut, B. (2021). Öğretmenlerin dijital okuryazarlık düzeyleri ile hayat boyu öğrenme eğilimlerinin incelenmesi. *Yükseköğretim ve Bilim Dergisi*, 11(3), 469-479.
- Gökbulut, B., Keserci, G. ve Akyüz, A. (2021). Eğitim fakültesinde görev yapan akademisyen ve öğretmenlerin dijital materyal Tasarım yeterlilikleri. *Journal of Social Sciences and Education*, 4(1), 11-24. doi: 10.53047/josse.917536
- Gökbulut, Y. (2018). Fen ve teknoloji öğretmenlerinin dijital öğretim materyali geliştirme yeterlilikleri. *Eğitim Teknolojisi Kuram ve Uygulama*, 8(2), 144-159.

- Gümüş, M. (2021). Öğretmenlerin dijital yeterlilikleri. (Yayımlanmış yüksek lisans tezi). Amasya Üniversitesi. Amasya.
- Karakuş, G. & Ocak, G. (2019). Öğretmen adaylarının Dijital Okuryazarlık Öz-yeterlilik Becerilerinin Farklı Değişkenler Açısından İncelenmesi . Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi , 21 (1) , 129-147 . DOI: 10.32709/akusosbil.466549
- Karaman, S., Yıldırım, S., & Kaban, A. (2008). Öğrenme 2.0 yaygınlaşıyor: Web 2.0 uygulamalarının eğitimde kullanımına ilişkin araştırmalar ve sonuçları. XIII. Türkiye’de İnternet Konferansı Bildirileri, 35-40. Ankara.
- Karasar, N. (2016). Bilimsel araştırma yöntemi: kavramlar, ilkeler, teknikler (31. baskı). Ankara: Nobel Yayıncılık.
- Kavak, Y. ve Yıldırım, S. (2017). Öğretmen adaylarının dijital öğretim materyali geliştirme yeterlilikleri ve bu yeterlilikleri geliştirmeye yönelik görüşleri. Eğitimde Nitel Araştırmalar Dergisi, 5(3), 1-22.
- Kırık, A. (2014). Uzaktan eğitimin tarihsel gelişimi ve Türkiye’deki durumu . Marmara İletişim Dergisi , 0 (21) , 73-94 . Retrieved from <https://dergipark.org.tr/tr/pub/maruid/issue/22159/238064>
- Korkmaz, Ö , Arıkaya, C , Altıntaş, Y . (2019). Öğretmenlerin Dijital Öğretim Materyali Geliştirme Öz-Yeterlilik Ölçeğinin Geliştirilmesi Çalışması . Turkish Journal of Primary Education , 4 (2) , 40-56 . Retrieved from <https://dergipark.org.tr/tr/pub/tujped/issue/50537/609625>
- Kumar, S. & Kushwaha, A. K. (2010). Development of an innovative e-content generation process. In Technology for Education (T4E), 2010 International Conference, 180-185
- Lucas, M., Bem-Haja, P., Siddiq, F., Moreira, A., & Redecker, C. (2021). The relation between in-service teachers’ digital competence and personal and contextual
- MEB. (2021, Mart 8). Bakan Selçuk, 23 Mart’ta Başlayacak Uzaktan Eğitime İlişkin Detayları Anlattı. [Press release]. Retrieved from <https://www.meb.gov.tr/bakan-selcuk-23-martta-baslayacak-uzaktan-egitime-iliskin-detaylari-anlatti/haber/20554/tr>
- Mulenga, E. M., & Marbán, J. M. (2020). Is COVID-19 the gateway for digital learning in mathematics education? Contemporary Educational Technology, 12(2), ep269. <https://doi.org/10.30935/cedtech/7949>
- Napal Fraile, M., Penalva-Velez, A., & Mendioroz Lacambra, A. M. (2018). Development of digital competence in secondary education teachers’ training. Education Sciences, 8, 104. doi: 10.3390/educsci8030104
- Ocak, G. ve Karakuş, G. (2019). Öğretmen adaylarının dijital okuryazarlık öz-yeterlilik becerilerinin farklı değişkenler açısından incelenmesi. Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi, 21(1), 129-147. doi: 10.32709/akusosbil.466549
- Perienen, A. (2020). Frame works for ICT integration in mathematics education- a teacher’s perspective. Eurasia Journal of Mathematics, Science and Technology Education, 16(6), em1845. <https://doi.org/10.29333/ejmste/7803>
- Yontar, A. (2019). Öğretmen adaylarının dijital okuryazarlık düzeyleri. Ana Dili Eğitimi Dergisi, 7(4), 815-824. doi: 10.16916/aded.593579

**SINIF KESİR ÖĞRETİMİNDE TEKNOLOJİK MATERYAL KULLANIMININ
ÖĞRENCİLERİN BAŞARI DÜZEYİNE ETKİSİ**

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ÖZET

Bu çalışmada ilkokul 4. sınıf matematik dersi kesirler ünitesinin öğretiminde Milli Eğitim Talim Terbiye Kurulunun (TTKB) yöntem teknikleri ve Colorado Üniversitesinin geliştirmiş olduğu simülasyonla (benzetim) öğretim yönteminin öğrenci başarısına etkileri incelenmiştir. Araştırmanın modeli öntest–sontest kontrol gruplu deneysel desen olarak tasarlanmıştır. Araştırmanın evreni, 2022-2023 Eğitim-Öğretim yılında Van ili merkez İpekyolu ilçesinde bulunan ilkokullardaki 4. sınıf öğrencileri oluşturmaktadır. Çalışma grubunu 2022-2023 Eğitim-Öğretim yılında Van ili merkez İpekyolu ilçesinde bulunan ve kolay ulaşılabilir örnekleme yöntemiyle belirlenen bir ilkokuldaki 4. sınıfta bulunan 52 öğrenci oluşturmaktadır. Çalışma, Milli Eğitim Talim Terbiye Kurulu tarafından hazırlanan müfredata uygun yöntem ve tekniklerin kullanıldığı kontrol grubu, simülasyonla (benzetim) öğretimin uygulandığı deney grubu olmak üzere 2 sınıftan oluşan 2 grup ile yürütülmüştür. 2 hafta süreyle devam eden çalışmada deney gruplarına araştırmacı tarafından hazırlanan ve Milli Eğitim Bakanlığı'nın güvenilirlik geçerliliği test edilmiş bir açık uçlu ve on adet çoktan seçmeli sorulardan oluşan bir test uygulanmıştır. Araştırma sonucunda, simülasyon (benzetim) ile öğretimin matematik dersi kesirler ünitesinin öğretiminde ilkokul 4. sınıf düzeyinde öğrencilerin başarı sağlamasında etkili olduğu saptanmıştır. Bu yöntemin öğrenci başarısı üzerine etkilerine bakıldığında istatistiki olarak anlamlı bir fark çıkmıştır ($p < .05$). Elde edilen bulgulara göre simülasyon ile öğretimin öğrenci başarı puanları ortalamalarında olumlu yönde katkı sağladığı söylenebilir. Matematik dersi kesirler ünitesinin öğretilmesinde simülasyon yönteminin daha fazla kullanılması önerilebilir.

Anahtar Kelimeler: Matematik öğretimi, kesirler, teknolojik materyal, simülasyon.

**THE EFFECT OF USING TECHNOLOGICAL MATERIALS IN 4TH GRADE
FRACTION TEACHING ON STUDENTS' ACHIEVEMENT LEVEL**

ABSTRACT

In this study, the effects of the method techniques of the National Education Board (TTKB) and the simulation teaching method developed by the University of Colorado on the success of the students in the teaching of the fractions unit of the 4th-grade mathematics lesson were examined. The model of the research was designed as an experimental design with the pretest-posttest control group. The universe of the research consists of 4th-grade students in primary schools in the central Ipekyolu district of Van province in the 2022-2023 academic year. The study group consists of 52 students in the 4th grade of a primary school located in the central Ipekyolu district of Van province in the 2022-2023 academic year and determined by the easily accessible sampling method. The study was carried out with 2 groups consisting of 2 classes, the control group, in which methods and techniques suitable for the curriculum prepared by the National Education Board of Education and Discipline were used, and the experimental group, in which simulation teaching was applied. In the study, which lasted for 2 weeks, a test consisting of open-ended and ten multiple-choice questions prepared by the researcher and tested by the Ministry of National Education was applied to the experimental groups. As a result of the research, it has been determined that teaching with simulation (simulation) is effective in the achievement of 4th-grade students in the teaching of the fractions unit in the mathematics lesson. Considering the effects of this method on student achievement, there was a statistically significant difference ($p < .05$). According to the findings, it can be said that teaching with simulation contributes positively to the average student achievement scores. It can be suggested that the simulation method should be used more in teaching the fractions unit in the mathematics lesson.

Keywords: Teaching mathematics, fractions, technological material, simulation.

Giriş

Matematik eğitimi, eğitimin her kademesinde var olan en önemli disiplinlerdendir. Matematik, çeşitli soyut modeller ve bunlar arasındaki ilişkiler dersidir, bilimin bir parçasıdır, bir düşünme sürecidir, özünde bir düzen ve kararlılık vardır, dikkatlice özenle terim ve sembollerden oluşan bir dil ve araçtır (Yıldırım, C. 1996). Bu da öğrencinin temel matematik konularını öğrenmesinin ilk basamağı olan ilkökul kademesinde kalıcı öğrenmeler son derece önemlidir. Eğitim teknolojisinin doğrudan faydalarını incelendiğinde; aktif öğrenme, somutlaştırma, kademeli öğrenmeyi basamaklandırma, düşüncede kalıcılığı sağlama, özel bireylerde özel hedefler gerçekleştirme vb. öğrencilerin özgün ürün çıkarmaya sevk etme, öğretmenin rolünü geliştirme, motivasyon oluşturma, öğrencilerin eğlenerek öğrenmesini kolaylaştırmada ve birinci elden kaynak sağlamaktır (Yaylacı, 1999; Yüksel, Yılmaz & Yeşilyurt 2022). Yeterli bir matematik eğitimi için temel matematik kavram ve kazanımlar ilkökul eğitim sürecinde tam ve doğru olarak öğretilmesi son derece önemlidir. Öğrencilerin kazanımları anlamaları ve zihinlerinde bu kazanımları kalıcılığını sağlamak için farklı yöntem ve teknikleri kullanmak gerekmektedir. Öğrencilerin çoğu günlük hayatta paylaşma kavramını sık sık kullanmasına rağmen kesirlerin soyut kavram olarak düşünmesinden zor olarak görmektedir (McLeod ve Newmarch). Sayılarla ilgili bir çokluğu belirtmek ve istenilen kadarını ayırmak zor olmamaktadır, fakat kesirler arasındaki soyut kavram ilişkilerinin varlığı birçok öğrencinin bu konuda sorun yaşamasına sebep olmaktadır (ESRC, 2006). Tüm derslerde olduğu gibi matematik dersinde de bazı kavramları öğretirken zorlanabiliriz. Özellikle öğretmen, soyut kavramları öğrenci zihninde kolayca yerleşmeyen kavram ve konuları öğretirken farklı yöntem ve tekniklerden sık sık yararlanmalıdır. Gelişen teknoloji ile birlikte bu tür soyut kavramları öğretmek ve kalıcılığı sağlamak daha da kolaylaşmıştır. Teknolojilerin faydaları düşünüldüğünde kesirler konusunun bilgisayar destekli simülasyonlar aracılığı ile öğretilmesinde büyük fayda vardır. Kesir kavramını somutlaştırmada kesir ve sayılar arasındaki ilişkilerin görsellerle desteklenmesi açısından son derece önemlidir.

Literatür çalışmalarına baktığımızda da teknoloji kullanımının oldukça faydalı olduğu görülmektedir (Yeşilyurt, 2021). Eğitimcilerin ve araştırmacıların çoğu etkin kullanılan öğretim teknolojilerinin eğitim sisteminin kalitesini iyileştirecek potansiyele sahip olduğu fikrinde ortak kaniya varmışlardır. (Jonassen & Reeves, 1996; Means, 1994; Çağiltay, Çakıroğlu, Çağiltay & Çakıroğlu, 2001). Eğitimcilerin ve Araştırmacıların teknolojinin eğitim-öğretimde kullanılmasını bir amaç olmaktan öte bir araç olarak kullanılması gerektiği konusunda hem fikirdirler (Strudler & Wetzel,1999; Loucks-Horsley, Hewson, Love, & Stiles, 1998; Turhan &

Yeşilyurt, 2020). Bulut ve Yüksel (2011) çalışmalarında ortaokul 8. sınıf düzeyinde 28 öğrenciyle çalışmışlar ve matematik dersi desenler konusunda bilgisayar animasyonları ve etkinlikler kullanılmıştır. Öntest-sontest çalışması sonucunda öğrencilerin akademik başarı puanlarında istatistiki olarak anlamlı bir fark oluşmuştur.

Yapılan bu araştırmadaki temel amaç, 4. Sınıf kesirleri ünitesinin öğretiminde simülasyonla öğretim uygulamasının öğrenci başarısı üzerindeki etkilerini ortaya çıkarmaktır. Bu araştırmayla sınıf öğretmenlerinin kesir ünitesiyle ilgili öğretim süreçlerinde kullanabileceği farklı yöntem ve teknikler ortaya konulabilecektir. Alanyazında simülasyon yöntemi kullanılarak kesirler ünitesinin öğretimine yönelik herhangi bir çalışma olmaması bu araştırmayı özgün ve önemli kılmaktadır.

Problem

İlkokul 4. sınıf kesirler ünitesinin öğretiminde simülasyonla öğretimin öğrencilerin başarı düzeylerine etkisi ne düzeydedir?

Alt problemler

1. Simülasyonla ile öğrenen öğrencilerin öntest ve sontest puanları arasında anlamlı bir fark var mıdır?
2. TTKB yöntem ve teknikleri ile öğrenen öğrencilerin öntest ve sontest puanları arasında anlamlı fark var mıdır?
3. Kesirler ünitesinin öğretiminde simülasyonla öğretim yapılan öğrenciler ile TTKB yöntem ve teknikleri ile öğretim yapılan öğrencilerin öntest ve son test puanları arasında anlamlı bir fark var mıdır?

Araştırmanın Sınırlılıkları

1. Bu araştırma Van ili İpekyolu İlçesi bir devlet okulunda 4. Sınıfta bulunan 56 öğrenci ile sınırlıdır.
2. Bu araştırma 'Basit, bileşik ve tam sayılı kesri tanıy ve modellerle gösterir.' kazanımıyla sınırlıdır.
3. Bu araştırma ön test ve son test uygulaması ile sınırlıdır.

Yöntem

Araştırmanın Modeli

Araştırma nicel araştırma yöntemlerinden tarama modeli (ön test-son test) modeli kullanılarak

yürütülmüştür. Bu çalışma ilkokul 4. sınıf düzeyinde 52 öğrencinin 2 hafta süreyle Simülasyonla ile kesirler ünitesinin öğretiminde öğrenci başarısı üzerindeki etkilerini inceleyen öntest-sontest ve kontrol gruplu yarı deneysel desenli bir çalışmadır.

Evren ve Çalışma Grubu

Araştırmanın evreni, Van Merkez İpekyolu ilçesinde bulunan 46 devlet ilkokulundan oluşmaktadır. Çalışma grubu ise, kolay ulaşılabilir örnekleme yöntemi ile belirlenen bir devlet ilkokulunda yer alan 2 tane 4. sınıf ile yürütülmüştür. Araştırmanın çalışma grubunu, deney ve kontrol grupları olmak üzere 52 öğrenci ile oluşturmuştur. Deney grubunda, simülasyonla öğretim uygulaması, kontrol grubunda ise, TTKB yöntem ve teknikleri ders işleyişinde kullanılmıştır.

Veri Toplama Aracı

Araştırmanın verileri çoktan seçmeli 10 soru, 1 tane açık uçlu soru içeren bir kavram başarı testiyle elde edilmiştir. Araştırma sürecinde toplam 2 tane test kullanılmıştır. Bunlar Kesir Kavrayış Ön testi (KKÖT), Kesir Kavrayış Son testi (KKST), oluşmaktadır. Sorular araştırmacılar tarafından incelenerek, Milli Eğitim Bakanlığının yayınlamış olduğu kazanım kavrama sorularından hazırlanmıştır.

Eğitim yazılımı.

Konu. Matematik Dersi Kesirler Ünitesi

Hedef kitle. İlköğretim dördünü sınıf öğrencileri

Kazanımlar. Milli Eğitim Bakanlığı (MEB) İlköğretim dördüncü sınıf öğretim programına göre;

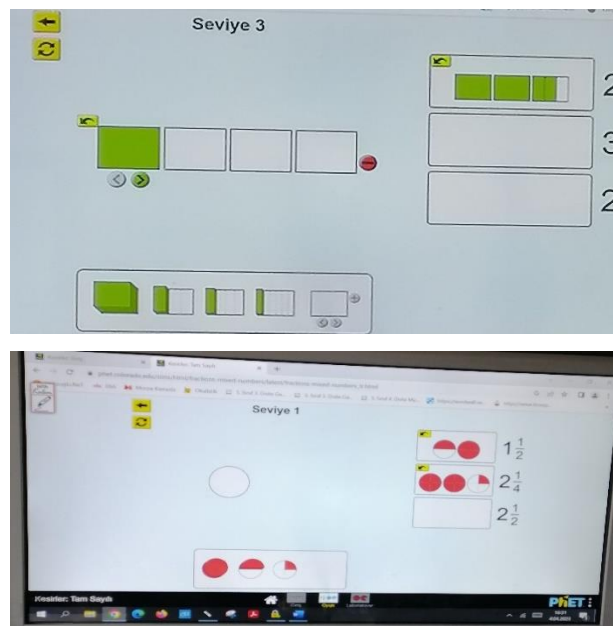
- Payı ve paydası en çok iki basamaklı doğal sayı olan kesirleri, kesrin birimlerinden elde ederek isimlendirir.
- Kesirleri karşılaştırır.
- Tam sayılı kesirleri kavrar.
- Payları eşit, paydaları birbirinden farklı en çok dört kesri, büyükten küçüğe veyaküçükten büyüğe doğru sıralar.
- Bir çokluğun belirtilen bir basit kesir kadarını belirler.

İçerik. İçerik geliştirme ve öğretimin planlanması konusunda alan uzmanı ile birlikte çalışılmıştır. Öğretim materyali programlı öğretim modeli ilkeleri dikkate alınarak, doğrusal

olmayan program modeline göre hazırlanmıştır. MEB'in matematik programı incelenmiş ve kazanımlar göz önünde bulundurularak içerikte neler olması gerektiği belirlenmiştir. Kazanımlara göre konuların başlıkları çıkarılmıştır ve sorularda müfredata uygun hazırlanmıştır. Konular küçük bilgi birimlerine bölünerek hazırlanmıştır. Animasyonlara ve sesli anlatımlara yer verilmiştir. Öğrenci istediği konuya tıklayarak öğretimi başlatabilir. Öğretimin sunumunda MEB İlköğretim 4. sınıf matematik kitabı temel kaynak olarak kullanılmıştır. Bu nedenle, bilgiler hazır olarak verilmemiş örneklerden yola çıkılarak, kavramlara doğru gidilmiştir. Ayrıca anlatımlarda genel olarak gerçek yaşam problemlerine yer verilmiştir. Anlatımlar süresince yer yer alıştırmalar konulmuştur. Öğrenciler cevaplarına göre anında pekiştireç almışlardır. Yanlış cevapladıklarında soruya tekrar dönebilme ya da soruyu geçme esnekliği sağlanmıştır. Yanlış cevaplayan öğrencilere ek açıklamalarla sorunun çözümü hakkında anlatımlar sunulmuştur. Öğrenciler anlatımlar arasında gezinebilmektedirler, birini bitirmeden diğerine geçme esnekliği sağlanmıştır. Bunun nedeni öğrencinin yazılımla etkileşimini sağlamak ve bildiği ya da daha önceden Simülasyonlardan izlediği anlatımları geçmesini sağlamaktır. İleri geri düğmeleri, sürükle bırak yöntemi sorular, boşluk doldurma soruları, “cevabı kontrol et”, “ses açma- kapama” gibi düğmelerle öğrencinin etkin olarak öğrenme sağlanmıştır. Ayrıca, öğrencilerin özellikleri dikkate alınarak, canlı renkler kullanılmış, sevebilecekleri karakterlere ve ders anlatımları sırasında animasyonlara yer verilmiştir.

Uygulanan öğretim modeli

Bu araştırmada bilgisayar destekli öğretim kullanılmıştır. <https://phet.colorado.edu/tr> web sitesindeki kazanıma uygun benzetimler kullanılmıştır.




Şekil 1: Etkinlik örnekleri


Verilerin Toplanması


Araştırmanın verileri toplanırken, öncelikle konu ile ilgili ders kitapları incelenmiş, literatür araştırması yapılmış ve bir soru havuzu hazırlanmıştır. Bu soru havuzundan test hazırlanırken 2 sınıf öğretmenin görüşleri alınmıştır. 10 tane çoktan seçmeli, 1 tane açık uçlu soru yer almaktadır. Mili Eğitim Yardımcı kaynaklarından hazırlanan test ile belirlenen okulda bulunan 2 tane 4. Sınıf öğretmenine araştırmanın genel amacı ve hangi sınıfta nasıl bir uygulama yapılacağı anlatılmıştır. Öntest ve sontestler hakkında bilgiler verilmiştir. Kontrol grubu öğretmenine derslere normal şekilde devam edeceği TTKB yöntem ve teknikleri kullanılarak ders anlatımının yapılacağı, sonrasında da yalnızca öntest ve sontestleri uygulayacağı söylenmiştir. Deney grubunda ise, simülasyonla öğretimin nasıl yapılacağı, nasıl çalıştırılacağına ilişkin bilgiler verilmiştir. Öğretmen simülasyonları incelemiş ve ders planına dâhil etmiştir. Çalışmanın örneklendirilmesi amacıyla, öğretmen gözetiminde ilk derse araştırmacı girerek dersi işlemiş ve daha sonraki dersler öğretmen tarafından benzer şekilde işlenmiştir.

2022-2023 Eğitim Öğretim Yılı 4. Sınıf Kesirler Konusu Kazanım Değerlendirme Soruları.

1- Aşağıdaki şekillerin boyalı kısımları ifade eden kesirleri yazınız.

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2- Aşağıdakilerden hangisi basit kesirdir?

A. $\frac{8}{9}$ B. $\frac{7}{5}$ C. $\frac{5}{2}$ D. $\frac{4}{3}$

3- Aşağıdaki şeklin kesirle ifadesi hangi seçenekte verilmiştir?




A. $\frac{3}{8}$ B. $\frac{3}{5}$ C. $1\frac{5}{8}$ D. $\frac{5}{8}$

4- Üç tam yedi de ikisi şeklinde okunan kesir sayısı aşağıdakilerden hangisidir?

A. $1\frac{7}{2}$ B. $3\frac{3}{7}$ C. $3\frac{2}{7}$ D. $2\frac{7}{2}$

5- Aşağıdaki taralı şeklin kesir olarak okunuşu hangisidir?



A. üç bölü dört B. bir bölü dört
C. dört bölü dört D. iki bölü dört

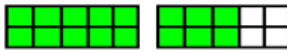
6- Aşağıdakilerden hangisi birim kesirdir?

a) $\frac{3}{8}$ b) $\frac{5}{1}$ c) $\frac{1}{11}$ d) $\frac{2}{7}$

7- $\frac{12}{4}$ basit kesir statümesi için en fazla kaç yazılabilir?

A. 2 B. 3
C. 4 D. 5

8- Şekildeki boyalı bölgeye karşılık gelen kesir sayısı aşağıdakilerden hangisidir?




A) $\frac{16}{10}$ B) $\frac{15}{10}$ C) $\frac{10}{16}$ D) $\frac{6}{10}$

9- $\frac{8+2}{7}$ büyük basit kesir olduğuna göre B doğal sayısı kaçtır?

A. 6 B. 4 C. 3 D. 2

10- Yukarıdaki modellenen kesir aşağıdakilerden hangisidir?



A. $3\frac{1}{4}$ B. $2\frac{2}{4}$ C. $\frac{9}{10}$ D. $\frac{2}{10}$

11- $\frac{11+1}{7}$ kesri basit kesir olduğuna göre 'a' yerine aşağıdakilerden hangisi yazılabilir?

A) 2 B) 3 C) 5 D) 8

Vefa ÇELİKCI

Şekil 2: Kazanım Değerlendirme Soruları

Verilerin Analizi

Kontrol ve deney gruplarının tek başına yöntemsel olarak başarılarına bakmak için, öntest ve sontest değerlendirmelerinde bağımsız gruplar *t* testi kullanılmıştır. Grupların karşılaştırmalarında kullanılacak test çeşidine karar vermeden önce, levne testi ile varyans eşitlikleri kontrol edilmiştir. Varyans eşitliğine göre karşılaştırma testi seçilmiştir. Varyanslar eşit çıktığı için tek yönlü varyans analizinde, *t* testi kullanılmıştır. Öntestler denk çıkmadığı için, sontest öntest puan farkları farkına bakılmıştır.

Deney grubu ve kontrol grubu öntest ve sontest karşılaştırmalarında, bağımsız gruplar *t* testi kullanılmıştır. Öntest değerleri denk çıktığı için, sontest farkları ile başarıları kıyaslanmıştır.

Verilerin analizinde SPSS 25.0 paket programı kullanılmıştır. Sonuçlar uzmanlarla birlikte yorumlanmış ve tablolandırılmıştır. Analiz sonuçlarında $p < .05$ için gruplar arasında istatistiki olarak bir fark olduğu kabul edilmiştir.

Tablo 1. Deney Grubu Ve Kontrol Grubu Öntest ve Sontest Karşılaştırmaları (*t testi*)

	Yöntem	n	X	ss	t	p
Ön test	Kontrol Grubu	23	55,60	7,24	,24	,80
	Deney Grubu	23	54,52	20,04		
Son test	Kontrol Grubu	23	59,60	18,93	-2,21	,03*
	Deney Grubu	23	71,04	16,03		

* $p < .05$

Tablo 1 incelendiğinde, ön test kontrol grubunun ortalaması 55,60. Deney grubunun ortalaması 54,52. Ön testlerin sonucu incelediğinde iki grup arasında anlamlı bir fark olmadığı bulunmuştur. $p = ,80$ ($p < .05$). Son test incelendiğinde kontrol grubu ile deney grubu arasında anlamlı bir fark olduğu bulunmuştur $p = ,03$ ($p < .05$). Yine son test verileri incelediğinde iki grubun da ortalamaları artış göstermiştir.

BULGULAR

1. TTKB yöntem ve teknikleri İle Öğrenen Öğrencilerin Öntest ve Sontest Puanları Arasında Anlamlı Bir Fark Var mıdır? Alt Problemine Yönelik Bulgular

TTKB yöntem ve teknikleri u y g u l a n a n kontrol grubunun öntest-sontest başarı puanları farkına bakılmıştır. Bağımsız gruplar *t* testi sonuçları incelendiğinde $p = .03$ ($p < .05$) çıkmıştır. Buna göre öğrenme gerçekleşmeden önce uygulanan Simülasyonla öğrenme gerçekleştikten sonra uygulanan Sontest başarı puanları farklarına göre öğrenci başarısında bir miktar artış

meydana geldiği söylenebilir. Sonuçlar TTKB yöntem ve teknikleri öğretimin, kesir ünitesinin öğretiminde öğrencilerin başarısını artırdığı ve öğrencilerin ilerlemesine katkı sağladığı yönündedir.

2. Simülasyon İle Öğrenen Öğrencilerin Öntest ve Sontest Puanları Arasında Anlamlı Bir Fark Varmıdır? Alt Problemine Yönelik Bulgular.

Simülasyonla öğretim uygulanan Deney grubunun öntest-sontest başarı puanları farkına bakılmıştır. Bağımsız gruplar *t* testi sonuçlarında $p = .03$ ($p < .05$) olarak hesaplanmıştır. Buna göre öğrenme gerçeğlemeden önce uygulanan öntest(KKÖT) ve öğrenme gerçeğleştikten sonra uygulanan sontest(KKST) başarı puanları farklarına göre öğrenci başarısında artış meydana geldiği söylenebilir. Sonuçlar Simülasyonla öğretimin kesirlerin öğretiminde öğrencilerin başarısını artırdığı ve öğrencilerin ilerlemesine katkı sağladığı yönündedir.

Her iki yönteminden sontest sonuçları incelendiğinde ortalamasının yükseldiği görülmektedir.

SONUÇ ve ÖNERİLER

Eğitim ve öğretimin farklı uygulamaları olan TTKB ve Simülasyonla öğretim yöntemlerinin öğrenci başarısı üzerindeki etkiliğini araştıran bu çalışma öntest-sontest ve kontrol gruplu yarı deneysel bir çalışmadır. Kontrol grubunda Mili Eğitim Bakanlığının yöntem teknikleri ile, Deney grubunda simülasyonla öğretim yapılmıştır.

TTKB ve Simülasyonla öğretim yöntemleri ilkökul dördüncü sınıf kesirler ünitesinin öğretiminde başarılı yöntemlerdir. Ortalama farklarına bakıldığında Simülasyonla öğretim tam olarak uygulayan grubun sontest sonuçlarına göre ve akademik başarı puan ortalamalarına göre üst düzey öğrenmeyi gerçekleştirdiği söylenebilir. Bu sonuçlar literatürde yer alan bir kısım Bilgisayar Destekli Öğretim çalışmalarının sonuçlarıyla paralellik göstermektedir. Camnalbur ve Özdenler (2007) çalışmasında sınıf tabanlı Bilgisayar Destekli Öğretim ile matematik öğretimi gerçekleştirmiştir. Çalışması sonucunda kontrol grubu ile deney grubu arasında istatistiki olarak ($p < .05$) anlamlı bir fark ortaya çıkmamıştır. Ancak deney grubunun başarı ortalaması kontrol grubundan daha fazla çıkmıştır. Ancak bulgular sonucunda simülasyonla öğretim yöntemi bireysel uygulamaların matematik öğretiminde öğrenci başarısını ve öğrenmenin kalıcılığını daha iyi destekleyeceğini belirtmiştir.

Deney grubu sınıf öğretmenin simülasyonla öğretim ile ilgili olumlu görüşlere sahip olduğu ortaya çıkmıştır. Öğretmenin simülasyonla öğretim yöntemi ile başarılı bir öğretim yapacağını düşünmektedir. Simülasyonla öğretim yönteminin kazanımlarla tutarlı, kolay kullanım, açık ve net anlatımı barındırdığını belirtmiştir. Özellikle öğrencilerin dikkatini çektiğini, kavramayı

kolaylaştırdığını, zamanı daha verimli kullanabileceklerini, bilginin hafızada daha uzun süre kalmasını sağlayacağı yönünde görüş bildirmiştir. Çalışma sonuçları ışığında aşağıdaki önerilerde bulunulmuştur.

ÖNERİLER

1. Simülasyonla öğretim yöntemi ilköğretim dördüncü sınıf matematik dersi kesirler ünitesinin öğretilmesinde yapılan bu araştırma diğer sınıf seviyelerinin derslerinde de kullanılmalıdır.
2. Simülasyonla öğretim yönteminin öğrenci başarısını etkileyen faktörleri ortaya çıkarmaya yönelik çalışmalar yapılmalıdır.
3. Simülasyonla öğretim yönteminin uygulanmasında, başarısını anlamlı anlamda artıran olan öğretmen ve öğrenciler ile diğer yöntemin(TTKB) kullanıldığı sınıftaki öğrenci ve öğretmen özelliklerinin neler olduğu nitel araştırma yöntemi ile araştırma yapılarak ortaya çıkarılmalıdır.
4. Simülasyonla öğretim yönteminin başarısının önemini tam olarak ortaya çıkarmak için farklı konu ve sınıf düzeylerine uygulamalar yapılarak, bu yöntemin güçlü yönlerinin neler olduğunu ortaya çıkaran araştırma ve uygulamalar yapılmalıdır.
5. Simülasyonla öğretim yönteminin uygulamaları çalışmanın gerçeği yansıtması ve ihtiyaçların neler olduğunu ortaya çıkarması amacıyla diğer derslerinin kazanımları için de çalışmalar yapılmalıdır.
6. Simülasyonla öğretim yönteminin, etkili bir şekilde yürütülmesi için okulda mutlaka akıllı tahta ve internet altyapısının olması gerekmektedir.
7. Öğretmenlerin Simülasyonla öğretim yönteminin etkin kullanabilmesi ve bu yöntemin öğrenci başarısını artırmadaki önemini kavramaları için hizmet içi eğitim kursları düzenlenmelidir.
8. Eğitim ve öğretimde kullanılan her türlü teknolojik materyal çalışmaları öğretmenlerin yanı sıra öğrenci ve teknolojik materyal geliştirenler ile birlikte inceletilerek nitel araştırma yöntemleri ile değerlendirilmelidir.

KAYNAKÇA

- Aktaş, M., Bulut, M. ve Yüksel, T. (2011). *The effect of using computer animations and activities about teaching patterns in primary mathematics. The Turkish Online Journal Educational Technology*. 10(3), 273-278.
- Camnalbur, M. ve Özden, N. (2008). *İnteraktif akıllı tahtaların, ilköğretim öğrencilerinin matematik başarısı üzerindeki etkileri*. Second international conference on innovations in learning for the future. Istanbul University Rectorate Press.
- Çağiltay, K., Çakıroğlu, J., Çağiltay, N. & Çakıroğlu, E. (2001). Öğretimde Bilgisayar Kullanımına İlişkin Öğretmen Görüşleri. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 21, 19-28.
- Esrc (2006). Fractions difficult but crucial in mathematics learning. <http://www.tlrp.org/dspace/retrieve/1754/Nunes+RB+13+Fractions+FINAL.pdf> adresinden elde edildi.
- Jonassen, D. & Reeves, T. (1996). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 693-719). New York: Macmillan.
- Loucks-Horsley, S., Hewson, P. W., Love, N. & Stiles, K. (1998). *Designing Professional Development for Teachers of Science and Mathematics*. Thousand Oaks, CA: Corwin.
- Means, B. (1994). Using technology to advance educational goals. In B. Means (Ed.), *Technology and education reform: The reality behind the promise* (pp. 1-22). San Fransisco: Jossey-Bass Publishers.
- McLeod, R. & Newmarch, B. (2006). Fractions. National Research and Development Center for Adult Literacy and Numeracy. https://www.ncetm.org.uk/public/files/257666/fractions_booklet.pdf adresinden elde edildi.
- Strudler, N. B. & Wetzel, K. (1999). Lessons from exemplary colleges of education: factors affecting technology integration in preservice programs. *Educational Technology Research and Development*, 47(4), 63-81.
- Turhan S. & Yeşilyurt M., (2020). Teknolojik Materyal ile Gerçekleştirilen Kesir Öğretiminin Özel Öğrenme Güçlüğü Olan Öğrencilerin Başarısı Üzerine Etkisi, 2nd International Young Researchers Student Congress, Burdur.
- Ünal Y. & Yeşilyurt M., (2021). İlkokulda Teknoloji Destekli Bölme İşlemi, 3. Uluslararası Fen, Matematik, Girişimcilik ve Teknoloji Eğitimi Kongresi, Bursa.
- Yaylacı, H., S. ve Yaylacı, F. (1999). *Eğitim teknolojisi dersinde öğretim materyallerinin geliştirilmesi*. AKÜ. Sosyal Bilimler Dergisi, 3, 209-219.
- Yıldırım, C., (1996). *Matematiksel Düşünme*, 2. baskı, Remzi Kitabevi, İstanbul, p. 23.
- Yesilyurt, M. (2021). Meta-Analysis of the Effect of Technologies on Primary School, *Journal of Primary Education*, 3(2), 26- 41. <https://doi.org/10.52105/temelegitim.3.2.3>
- Yüksel R, Yılmaz M & Yeşilyurt M (2022). Eğitsel Oyunun Başarıya Etkisinin Meta Analizi/ Meta-Analysis of The Effect of Educational Game on Achievement, 2st-International Congress on Modern Sciences Tashkent Chemical-Technological Institute.

EMRÎ'NİN (Ö. 1575) EL TASVİRİ YAPTIĞI ORİJİNAL BİR GAZELİ

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ÖZET

Bilindiği gibi İslami gelenekte öngörülen farklı sakıncalardan ötürü gerçekçi tabloların çizimine izin verilmemiştir. Bu nedenle İslam toplumlarında Batı'da olduğu gibi üç boyutlu gerçekçi bir resim sanatı görülmez. Batı'da özellikle göz, ağız, burun, el, ayak gibi vücut kısımlarının tüm ayrıntılarıyla resmedildiği neredeyse anatomik olarak kusursuz çizimler karşımıza çıkarken İslami gelenekte ana hatları verilen gösterme maksatlı resimlere denk geliriz. Bunun yanı sıra resim ve heykele getirilen sınırlamanın tam aksine İslam tarihinde söze dayalı sanatlara rağbet artmıştır. Özellikle şiire gösterilen yoğun ilgiyle birlikte bir beyte dünyalar kadar kültür malzemesi sıkıştıran şairlerimiz görülür. Şairlerimiz günümüz araştırmalarında kısaca “sevgili” olarak tanımlanan mutlak güzelliği sayısız beyitte ince çağrışımlar, türlü hayaller, çeşitli söz ve zekâ oyunları, nüanslar, gündelik yaşam unsurları gibi kültürel malzemelerle zenginleştirerek anlatageldiler. Sevgilinin aşkınlığı, güzelliği, cazibesi genel olarak anlatıldığı gibi güzellik unsurları olarak bilinen göz, kirpik, saç, boy ve bel gibi unsurlarla ayrıntılı olarak da aktarılır. Bu beyitlerin zaman zaman tıpkı bir tablo gibi detaylarla dolu olduğu ve hayal gücünü besleyen renkli anlatılarla bezendiği görülür. Klasik Türk edebiyatının seçkin şairlerinden olan Emrî'nin (ö. 1575) öne çıkan yönlerinden biri de bu bahsettiğimiz tasvir gücüdür. Hayal gücünün zenginliğiyle, detaylara dikkat ederek yaptığı tasvirlerle dikkat çeker. Bu bildiride Emrî'nin şiir geleneğinde sevgilinin güzellik unsurları arasında en az yer verilenlerden biri diyebileceğimiz ele yönelik yazmış olduğu bir gazel ele alınacak. Gazelde yer verilen tasvirler klasik şiir geleneği bakımından değerlendirilecek; kelimelerin yaptığı çağrışımlar ve sosyal yaşam unsurları ortaya konarak şairin bir gazele neler sıkıştırabildiği araştırmacıların ilgisine sunulacaktır.

Anahtar Kelimeler: Emrî, sevgili, güzellik unsurları, el, tasvir, gazel.

AN ORIGINAL GHAZAL OF EMRI (d. 1575) DEPICTING HAND

ABSTRACT

As known, realistic paintings are not allowed to be drawn due to the different drawbacks envisaged in the Islamic tradition. For this reason, a three-dimensional realistic art of painting is not seen in Islamic societies as in the West. While we come across almost anatomically perfect drawings in the West, in which parts of the body such as eyes, mouth, nose, hands, and feet are depicted in all details, we come across illustrations for illustrative purposes outlined in the Islamic tradition. In addition to this, contrary to the restrictions imposed on painting and sculpture, the demand for verbal arts has increased in the history of Islam. Especially with the intense interest in poetry, we see our poets who squeeze as much cultural material into a couplet as the world. Our poets have come to describe the absolute beauty, which is briefly defined as "beloved" in today's research, by enriching it with cultural materials such as subtle associations, various dreams, various word and mind games, nuances, everyday life elements in countless couplets. The transcendence, beauty and charm of the lover are explained in detail with elements such as eyes, eyelashes, hair, height and waist, which are known as beauty elements. It is seen that these couplets are full of details like a painting from time to time and are adorned with colourful narratives that feed the imagination. Emri, one of the distinguished poets of classical Turkish literature (d. 1575) is one of the prominent aspects of this descriptive power. He draws attention with the richness of his imagination and the depictions he made with attention to detail. In this paper, a ghazal written by Emrî for the hand, which we can say is one of the least included among the beauty elements of the beloved in the poetry tradition, will be discussed. The depictions in the ghazal will be evaluated in terms of classical poetry tradition; By revealing the connotations of the words and the elements of social life, what the poet can squeeze into a ghazal will be presented to the attention of the researchers.

Keywords: Emrî, lover, elements of beauty, hand, description, ghazal.

GİRİŞ

Çalışmamızın daha iyi anlaşılması için tasvir üzerine konuya giriş mahiyetinde bir iki söz söylemek icap etmektedir. Zira edebiyatta teşbih, istiare gibi sanatlarla yapılan anlatımlar bir bakıma tasvir olarak nitelenmektedir. Yazımızın başlığında tasvir ifadesini tercih edişimizin nedeni de budur. Tasvir, bir varlığı resmetmek veya şekillendirmek, edebi tasvir ise bir varlığı okuyanın ve dinleyenin zihninde onda estetik duygular uyandırarak tarif etmektir. İnsanlık duygu ve düşüncelerini bilinen en eski zamanlardan beri tasvir yoluyla anlatagelmiştir. Mağara duvarlarına veya kayaların üzerine çizilen resimler hiyerogliflerin ve daha sonra alfabelerin ortaya çıkmasına ön ayak olmuş; böylelikle sözlü ve yazılı anlatım paralel olarak gelişme göstermiştir. İnsanlar bu gelişme aşamasında tarif etmek istedikleri bir varlığı başka varlıklarla kıyaslama yoluna yönelmişlerdir. Önce teşbihin daha sonra istiarenin temelini oluşturan bu kıyaslamalar zamanla estetiğin zirvelerine ulaşan edebî tasvirleri ortaya çıkarmıştır. Aslında tamamen farklı sanat dalları olup kullandıkları malzemelerin tamamıyla farklı olmasına karşın şairler ve ressamlar arasında tasvir çizme ve edebî tasvir ortaya koyma bakımından dikkate değer bir benzerlik bulunur. Bir ressam nasıl ki çizdiği bir tabloyu iki üç fırça darbesiyle güldürüp yine birkaç fırça darbesiyle ağlatabiliyorsa söz sanatçısı olan şair de bir iki kelime oyunu, benzetmeler ve imgelemelerle benzer görüntüleri zihinlerde oluşturmakta mahirdirler (Şentürk 2002: 21-22).

İslam tarihinde resme karşı mesafeli bir duruş söz konusu olduğu söylenebilir. Heykel ve resim; tapınma veya saygı gösterilme amacıyla yapılması, başka bir dinin sembolü olması, çıplaklık unsuru taşıması gibi öngörülen kimi sakıncalar sebebiyle haram kılınmıştır (Başoğlu 2007: 579-582). Bunun kaçınılmaz bir sonucu olarak İslam inancı dairesinde oluşan kültür muhitlerinde plastik sanatlara karşı mesafeli durulmuş; buna karşın söz sanatlarına özellikle de şiire önem verilmiştir.

Günümüzde Divan edebiyatı, Klasik Türk edebiyatı gibi çeşitli adlandırmalarla araştırma konusu olan edebiyat geleneği de plastik sanatlar yerine şiire yöneltilen ilginin bir semeresi olarak varolagelmiştir. Bu edebiyat geleneğinin en önemli özelliklerinden biri içinde doğduğu toplum yapısına uygun olarak belli kurallara ve teşrifata bağlı kalmasıdır. Nasıl ki bir derviş bir tarikate intisap ettiğinde oranın adap ve erkanına göre davranıyorsa bir şair de şiir için kalemi eline aldığı anda gerek duygu gerekse tavır olarak o şiir geleneğinin gereklerine uygun davranmak zorundaydı. Hayatında ağzına bir damla içki sürmemiş bir kişi şiir yazdığı anda kadehi elden düşürmeyen, meyhaneden dışarı adım atmayan bir kişi

hüviyetine bürünür. Şeyhulislam veya padişah bile olsa bu geleneği sürdürür. Bu geleneğe uyan kişi aşkını dile getirecekse gerçek kişiliğiyle değil duygularını kalıp ifadelerle uydurarak söylecek; sevdiği kişiden söz edecekse bunu şiirdeki sevgili tipine uydurmak suretiyle yapacaktır (Akün 1994: 414).

Bu edebiyatta şair geleneğin belirlediği estetiğin kendisine sunduğu hazır malzeme ve unsurlardan hareket etmek durumundadır. Bu estetiğe göre şairin söz edeceği her varlık geleneğin önceden belirlediği kurallarla işlenir. Edebiyatın en temel konularından biri olan sevgili için bu kuralların daha da sıkı olduğunu söylemek mümkündür. Öyle ki yüz dendiğinde gül, ateş, su, bahar; boy dendiğinde selvi, elif, kıyamet gibi kelimeler hemen zihinde belirlemektedir.

Gazel, kaside ve mesnevi gibi bir çok şiirde anlatılagelen bu yüce ve aşkın sevgili, eskilerin tabiriyle “esbab-ı hüsn” günümüzdeki yaygın tanımlama ile “güzellik unsurları” çerçevesinde ele alınır. Bu güzellik unsurları arasından insanın en belirgin yeri yüz olduğu için yanak, dudak, göz, kirpik, kaş vb. yüzle ilgili unsurlar daha çok öne çıkar. Binlerce beyitte işlenen bu güzellik unsurlarına dair müstakil çalışmalar da günümüz klasik edebiyat araştırmalarının önemli bir yekununu oluşturur. Bu çalışmamızda ele aldığımız Emrî *Dîvân*'ında yer alan 254. gazeli (Saraç 2002: 153) de güzellik unsurlarından ele yönelik yazılmış bir gazeldir.

EMRÎ VE ŞAIRLİĞİ

Gazelini araştırma konusu olarak seçtiğimiz Emrî'nin biyografisi ve şairliği hakkında çok söz söylenmiştir. Biz burada bu bilgileri uzun uzadıya tekrar etmek yerine çalışmanın daha iyi anlaşılması için birkaç söz söylemekle yetineceğiz.

Ailesi hakkında pek bir bilgi bulunmayan Emrî'nin Edirne'de dünyada geldiğine dair tezkireler ittifak halindedir. Önceleri bazı imaretlerin kitâbet vazifesiyle meşgul olurken Kınalızâde Ali Çelebi'nin Edirne kadısı olmasından sonra onun himayesiyle Yıldırım Bayezid Medresesi'nin tevliyeti hizmetinde bulunmuş, daha sonra buradan azledilmiştir. Kaynaklar ömrünü tevliyet hizmetleriyle geçirdiğini, Edirne ve İstanbul dışında herhangi bir yerde bulunmadığını ifade ederler (Saraç 2014).

Şuara tezkireleri Emrî'nin şairlik kudretinden övgüyle bahsederler. Onun şiir ilmini bir kuyumcu titizliğiyle işlediğini ve şiire kılı kırk yararcasına hassas yaklaştığını övgülerini dile getiren Aşık Çelebi şairin hayal gücü konusunda hayal Boğa burcuna bile çıkmış olsa şiirin büyüyle ona ulaşmış inekten süt sağır gibi sağabileceğini der (Kılıç 2018: 148). Latîfi

ise onun devrin şairleri arasına kendine özel bir hayal dünyasına sahip olduğunu (hayâl-i hâssa kâdir) ve orijinallik (îcâd) konusunda benzerinin pek olmadığı söyleyerek bu konuda onu över (Canım 2018: 137). Mustafa Âlî ise onun teşbihlerini şairlik yeteneğinin güçlü oluşuna bir kanıt olarak gösterir ve hayal hükümlerine söz tuğrasını vurduğunu söyler (İsen 2017: 112). Görüldüğü gibi Emrî'nin şiirinde öne çıkan onun eşsiz hayal gücü ve teşbihleridir.

EMRÎ'NİN EL TASVİRİ YAPTIĞI GAZELİNİN İNCELENMESİ

El, biyolojide insanların da dahil edildiği primatlar takımında birden fazla parmağı barındıran, kolun bilekten parmak uçlarına kadar olan bölümünü tanımlar. Başparmağın diğer parmaklarla karşılıklı iş görmesi, ufak nesnelere ele alabilme yeteneğini sağlar. Bu özellik sayesinde el, alet kullanımı gibi hassas ve karışık işleri görebilir. Primatların beyininde eli temsil eden alan, diğer hayvanlarınkinden çok daha geniştir ("El" 2022). Sadece bu bilgilerden bile elin insanlık için ne kadar önemli olduğunu anlamak mümkündür.

El tasvirleri tarih öncesi çağlardan beri kazıma ve boyama gibi yöntemlerle mağara duvarlarının yüzeylerinde işlenmiştir (Dobrez 2013: 298-310; aktaran Gital 2017: 625). İlk Türkler tarafından Orta Asya ve Sibirya'da gerek bağımsız olarak gerekse kamların esrime durumlarını göstermek için vücuda göre oldukça büyük şekilde el çizimleri yapılmıştır (Hoppál 2015: 55-57). Gital, çalışmasında bu dönemden günümüze kadar elin sembolik, dini, kültürel anlamlarını özetler (Gital 2017: 625-627).

İnsan için bu kadar önemli olan ve ilk çağlardan beri tasvir edilen elleri elbette divan şairleri görmezden gelmez. Binlerce beyitte tasvir edilen sevgilinin güzellik unsurlarından biri de kuşkusuz eldir. Eller için ay, dal, kâfur merhemi, kanat, kılıç, Musa'nın eli, (yed-i beyzâ), pençe-i mercân, perde, sedef, şafak vakti, yelpaze, levha, yasemin, ay ve güneş, gül-i ra'nâ, kadeh gibi teşbihler yer alırken parmaklar için dal, unnab, masura, gümüş, güneş ışığı, hilal, kakum kuyruğu, kalem, kamaş, külçe, nâme, ok ve zambak goncasına benzetilir (Erdoğan 2013: 438-450).

İnceleme konusu ettiğimiz aldığımız Emrî Divân'ında yer alan 254. gazelde (Saraç 2002: 153) işlenen teşbihleri hilal, kalem, tomar, mum, zambak goncası, dal, levha, boğumlar için hat levhası (kıta), güneş, ay, yed-i beyzâ şeklinde sıralayabiliriz. Görüldüğü gibi Emrî'nin teşbihleri yukarıda sayılan teşbihlerden farklı değildir. Bununla birlikte boğumlar için kıta ve parmaklar için tomar teşbihi bu teşbihler arasında yer almaz. Ayrıca şairin bu yaygın benzetmeleri hayal gücünün sınırlarında gezerek işlediğini de belirtelim.

Şair gazelin matla beytinde parmaklar için teşbih unsuru olan beş unsur (hilal, kalem, tomar, mum, zambak goncası) sayar ve ardından “Beş parmağın beşi bir olmaz” atasözünü aktararak bu unsurların sevgilinin ellerine benzemesinin mümkün olmadığını söyler. Daha sonra bu unsurların her birini bir beyitte işler makta beytinde ise hilal benzetmesini tekrarlayarak toplam yedi beyitte gazelini tamamlar. Şimdi bu teşbih unsurlarını gazeldeki sıraya göre inceleyelim.

Hilal

Sürûrî'nin *Bahrü'l-Ma'ârif* adlı eserinin sevgili ve sevgilin güzellik unsurları ilgili benzetmeleri ele aldığı "Teşbihât ve Mesâil-i Enîsü'l-'Uşşâk Beyânındadır" başlıklı üçüncü bölümünün 22. babı parmak hakkındadır. Burada parmağın hilale benzetildiği aktarıldıktan sonra benzetme yönü de açıklanmıştır. Buna göre parmağın hilale benzetilmesi parmakların hilal gibi çoğu zaman eğri durması nedeniyledir (Şafak 1991: 274).

Pençe-i hurşîd ifadesi ise bire bir çevrildiğinde ‘güneşin eli’ anlamındadır. Onay, bu ifadenin ‘güneş alınlı’ anlamında olduğunu söyler ve şairlerin bunu daha çok sevgili anlamında kullandığı bilgisini verir (1992: 331). Ancak ‘alın’ anlamına gelen kelimenin punçe şeklinde olduğunu belirtelim (Steingass 1892: 257). Anlaşılan şairler güneş ışınlarının yayılışını bir elin açık parmaklarına benzetmişler ve bununla ilgili çeşitli hayaller geliştirmişlerdir.

Beyitte sevgilinin ışıltılı eli önce güneşin etrafa saçılmış ışıklarına benzetilmiş ardından bu benzetme bir ayın yakınındaki beş hilal benzetmesine taşınarak hayal gücünün sınırları zorlanmıştır. Günümüzde bilim-kurgu filmlerinde farklı evrenlerde yer alan gezegenlerin semalarında birden fazla ay (uydu) görülebilmektedir ancak XVI. yüzyılda yaşamış biri için bir ayın etrafındaki beş hilal hayalinin sıradışı olduğunu kabul etmek gerekir. Bu hayal, tezkirelerin onun hayal gücünü neden övdüğünü anlamamız için bir örnektir. Şair bunu yaparken Türkçenin imkanlarından faydalanmayı da ihmal etmiyor. Aya kelimesinin “elin iç tarafında bilekle parmaklar arasında kalan düz kısım, avuç içi” anlamı düşünüldüğünde şairin yeteneği daha da iyi anlaşılacaktır:

Ben anuñ pençesini pençe-i hurşîde beñzetdüm

Görüp dil didi bir aya mukârin beş hilâl ancak

“Ben onun elini güneş ve etrafa saçılmış ışıklarına benzettim. Gönül görüp dedi ki “Bu olsa olsa bir ayın yakınındaki beş hilaldir.”

Tomar ve Kita

Yukarıda sıraladığımız el ve parmakların benzetilenleri arasında tomarın geçmediğini söylemiştik. *Bahrü'l-ma'ârif*'te tomar (tûmâr) kakül ve zülfün benzetilene olarak verilmiştir (Şafak 1991: 408).

Tomar kelimesi iki farklı anlama gelmektedir. Arapça tûmâr kelimesinden gelen tomar yazı için kullanılan deri ve kağıtların uzunlmasına ve eni az olarak kesilip yuvarlanmış şekline denir. Yazılmış ve tezhip ile süslenmiş kağıt ve derilerin kıvrılmamasını ve güneşten etkilenmemesini sağlar. Cilt bulunmadan önce eserler böyle saklanıyordu (Özönder 2003: 23). Mesela aşağıdaki görselini paylaştığımız antlaşma metni tomar şeklindedir (Şekil 1).



Şekil 1. (Rizaei 2022: 404)

Tomarın diğerk anlamı ise şudur: Dikdörtgen biçimindeki mukavvaya yapıştırılmamış kıtaların üstten ve alttan birbirine yapıştırılıp tutturulması ile oluşan ve tomar (rulo) halinde sarıldıktan sonra buna bağılı bir deri mahfazayla korunan hat eserleridir. Tomar XVI. yüzyıldan sonra yerini murakkaa bırakmıştır. Kıta, orta boydaki bir kitap ebadındaki bir kağıda yazılan hat sanatı eserine denir. Kıta mukavvaya yapıştırıldıktan sonra ebru veya tezhiple bezenirdi. Murakka ise çeşitli yöntemlerle süslenmiş kıtaların ciltlenmesiyle hazırlanan albüme denir (Derman 1997: 434-435). Bilindiğı gibi baş parmakta iki diğerk parmaklarda üç boğum vardır. Yukarıda belirttiğimiz gibi baş parmağının diğerk parmakları kavrama yeteneğı insan eline benzersiz bir yetenek sunmaktadır. Hatta Newton'un "Diğerk tüm kanıtları bir yana bırakırsak baş parmak bile benim Tanrı'nın varlığına inanmam için yeterlidir." dediğı iddia edilir.¹³ Eldeki parmakların bu farklı yapısı şairin de dikkatini çekmiş ve bu durumla ilgili şairane bir yorum geliştirmiştir. Parmaktaki boğumlar uzunlamasına olduğı için hat kıtalarında olduğı gibi dikdörtgenimsi bir şekil arz etmektedir ve hat tomarlarındaki gibi uç uca eklenmiştir (Şekil 2). Şair her bir boğumu bir hat kıtasına benzetmiş ve parmakları birinde iki (baş parmak) dördünde üçer kıta bulunan beş tomara benzetmiştir. Bu kıtalardaki yazılar ise hilali anlatmaktadır. Hilal parmaklar için teşbih unsuru olmasından öte dini ve kültürel yönden derin anlamlar içermektedir (Kurnaz 1998: 13-15). Tüm bu bilgiler göz önünde tutulduğunda şairin eldeki parmakları ilahi bir sanat örneğı olarak yorumladığı ortaya çıkmaktadır. Ayrıca beytin sonundaki *el-hak* ifadesi de bunu pekiştirmektedir. El-hak 'doğrusu, gerçekten, hakikaten' anlamındadır. Böylece şair geliştirdiğı teşbihin mecazdan öte hakikati ifade ettiğini ima etmiştir. İfadedeki elif lam takısı (el-) gazelin konusu olan el ile ses benzerliğı (cinas) taşımaktadır. Bu şekilde bakıldığında elin hakikatine vurgu yapılmış olur.

Birisinde iki dördünde üçer kıt'a derc itmiş

Benânuñ mâh-i nev vafında beş tûmârdur el-hak

"Doğrusu parmakların her biri hilali anlatan birisinde iki dördünde üçer kıta derlenmiş beş tomardır."

¹³ Newton'a atfedilen bu söz birçok yerde geçse de bu sözü muteber bir kaynaktan tespit edemedik.



Şekil 2: Hat kıtaları ihtiva eden bir tomar (© Sabancı Üniversitesi Sakıp Sabancı Müzesi Obj. No: 102-0396-X)

Zambak Goncası, Gül ve Ağaç Dalı

Beyazlığı ve zarafetiyle öne çıkan zambak çağrışım alanı olarak zengin olmakla birlikte divan şiirinde nisbeten az kullanılmış çiçeklerden biridir (Açıl 2015: 22). Orta Çağlar boyunca iffetin ve namusun simgesi olan zambak (Madonna Lily) (Kandeler & Ullrich 2009: 1894) divan edebiyatında parmakları simgeler. Zambak goncalarının parmağa benzeyen yapısını (Şekil 3) şairlerimiz türlü hayallerle zenginleştirerek işlemiştir (Demir 2021: 137-141).

Şairin yine bu yaygın teşbihleri alıp sıra dışı bir hayal oluşturduğu görülüyor. Şair önce boy için yaygın bir teşbih olan Tûba teşbihine başvurur. Aşağı doğru ilerleyen dallarının tüm cenneti kapladığına inanılan Tûbâ ağacı Arap, Fars şair ve yazarlarının değişik algılayış biçimleri yanında hayal dünyalarının da katkısıyla zenginleşerek abartılı biçimde anlatılan dinî-edebî bir kavram haline gelmiştir. Bu şekliyle Türk edebiyatında özellikle divan şiiri ve nesrine intikal etmiş, divan edebiyatı mazmun ve remizleri arasına girmiştir (Uzun 2012: 317). Şair geleneğe uygun olarak boyu Tûbâ'ya ve selviye benzetmiş, böylece kolları da dallara benzetmiştir. Ancak teninin güzelliğini övmek için bu dalların gümüşten olduğunu ve dalların ucunda gül bulunduğunu söylemiştir. Avuç için gül gibi kırmızımsı renkte oluşu ve avuç çizgilerinin gülün kıvrımlarını andırması bu teşbihin çıkış noktasıdır. Güle benzeyen avuçların ucunda ise beş beyaz zambağa benzeyen parmaklar yer almaktadır. Bu haliyle beyitteki teşbihin orijinal hâle geldiğini söylemek mümkündür.

Ne tûbâ servdür kaddüñ ki sîmîn şâhlar salmış

Bitürmiş her birinde bir gül ü beş gonçe-i zanbak

“Tuba ağacına benzeyen boyun nasıl bir selvidir ki gümüştan dallar sarkıtmış her bir dalında bir gül ve beş zambak goncası bitirmiş.”



Şekil 3. Zambak goncaları.

Levha ve Kalem

Divan edebiyatında kalem türleri arasında daha çok söz konusu edilen kamış kalemdir (Sefercioğlu 2012: 2). Sevgilinin güzellik unsurları bakımından değerlendirildiğinde kalem parmaklara benzetilir. Günümüzde bile bu teşbih devam etmekte ‘parmakları güzel, düzgün, buruşuksuz ve uzunca olan kimse’ anlamında kalem parmaklı ifadesi kullanılmaktadır (Eyüpoğlu 1973: 273). Kalemin parmaklara benzetilmesi şekil benzerliğinin yanı sıra kalemin parmakla tutulmasından olsa gerektir. Emrî aşağıdaki beytinde avuç içini bir levhaya parmakları kaleme benzettikten sonra oraya kendi gönlünün yazılmasını istiyor. Burada şair bir kelime oyununa başvurmuştur. “Gönül yazmak” ifadesi gönül eğlendirmek anlamındadır (Dilçin 1983: 98). Burada bu ifade hem kalemlerle gönül yazmak anlamında hem de gönlü eğlendirmek, mutlu etmek anlamında kullanılmıştır. Divanı deyim kullanımını yönünden zengin olan şair (Kaya 2011: 129) bu deyim başarıyla işlemiştir.

Elinde bir gümüş levh ile beş sîmîn kalem gördüm

Didüm bu levha yaz gönlüm didi bilmem gönül yazmak

“Elinde bir gümüş sayfa ile beş gümüş kalem gördüm. ‘Bu sayfaya gönlümü yaz.’ dedim. ‘Ben gönül almak nedir bilmem.’ dedi.”

Mum

Elektiriğin icadından önce temel aydınlatma araçlarından mum bu yönüyle gündelik hayatın vazgeçilmezleri arasındaydı. Gündelik hayatı tüm ayrıntılarıyla şiire aktaran divan şairleri haliyle onu şiirlerine sıkça dâhil etmişlerdir. Sevgili mum olarak vasfedilirken yüzü de ışıltısından hareketle muma benzetilir. Burada parmakların kalem ve tomar örneklerinde olduğu gibi uzunca silindirik yapısından ötürü muma benzetildiğini görüyoruz. Beyitte yine Emrî’nin hayal gücüne tanık oluyoruz. Sevgilinin parmakları bulunduğu ortamı ateş olmadan aydınlatan beş muma benzetilmiştir. Beyitteki şem’-i kudret ifadesi yukarıda olduğu gibi bu durumun Allah’ın kudretinin bir eseri olarak yorumlandığını göstermektedir. Sevgili tasvirlerinde kelime oyunlarına sıkça yer veren şair (Alvan 2015: 368) burada bir kelime oyuna başvurur. Beytin sonundaki *elyak* ifadesi ‘layıktır’ anlamında olsa da kelimenin ilk hecesi gazelin konusu olan el ile ikinci hecesi ise beytin üzerinde kurulduğu mum teşbihiyle ilişkili olarak yakmak fiiliyle ses benzerliği taşımaktadır.

Fürûğ-i nârsuz rûşen iderler meclis-i şevki

Ben anuñ pençesin beş şem’-i kudretdür disem elyak

“Ateş parıltısı olmaksızın şevk meclisini aydınlatırlar. Ben onun eline beş kudret mumu desem layıktır.”

Yed-i Beyzâ

‘Beyaz el’ anlamına gelen yed-i beyzâ Hz. Musa’nın mucizelerinden biridir. Hz. Musa ellerini koynuna sokup geri çıkardığında bembeyaz ve ışıltılı bir hâl alır.¹⁴ Arap, Fars ve Türk edebiyatlarıyla Türk halk inanışlarında yer alan yed-i beyzâ Hz. Mûsâ’nın mucizeleriyle beraber şahsı etrafında gelişen ve şairlerin farklı yorumlarıyla zenginleşen bir edebî unsur, remiz ve mazmun haline gelmiş, ayrıca teşbih, telmih, iktibas, istiare, kinaye, tenâsüp gibi edebî sanatlara malzeme teşkil etmiştir. Sevgilinin elleri de bu bağlamda yed-i beyzâyâ benzetilegelmiştir (Uzun 2013: 377-378).

¹⁴ “Ve elini çıkardığı zaman, eli bakanlar için bembeyaz parlayıverdi.” (Kur’ân-ı Kerim, Araf: 7/108).

Şiirin makta beytinde şair elleri hem yed-i beyzâya hem de güneşe benzetmiştir. Yine hayal gücüne başvurarak bu güneşin her ışını bir dolunaya bitişik hilal olarak yorumlar. Böylece teşbihler iç içe geçmiş olur.

Ne mihr olur yed-i beyzâsı k'olmuş her şu'â'ınuñ

Ucı bir mâh-ı bedr Emrî aña bir mâh-ı nev mülhak

“Emrî, onun mucizeler gösteren eli nasıl bir güneştir ki her ışını bir dolunaya bitişmiş bir hilal gibidir.”

SONUÇ

Divan edebiyatının öne çıkan şairlerinden olan Emrî'nin en belirgin özelliği orijinalliği ve hayal gücündeki zenginliğidir. Ele aldığımız gazelinde Emrî sevgilinin baştan sona güzellik unsurlarından eli işlemiştir. Şairin diğer güzellik unsurlarına kıyasla biraz daha geri planda kalan el hakkında bir gazel yazması dikkate değer bir durumdur.

Eşair tespitlerimize göre kalem, mum, hilal, yed-i beyzâ gibi el ve parmaklar hakkındaki yaygın benzetmelerden faydalanmıştır. Ancak bu benzetmeleri hayal gücüyle zenginleştirerek orijinal denebilecek bir hüviyete kavuşturmuş; bunun yanı sıra elin ilahi kudretin bir eseri olduğunu dile getirmiştir. Şair bu tasvirleri yaparken kelime oyunları deyimlerden de istifade ederek gazelin anlam çerçevesini zenginleştirmiştir. Bu çalışmamızın ileride Emrî'nin sanatı hakkında yapılacak geniş çaplı incelemelere veya sevgilinin güzellik unsurlarına dair çalışmalara katkı sağlayacağını umuyoruz.

KAYNAKÇA

- Açıl, B. (2015). "Klasik Türk Şiirinde Estetik Bir Unsur Olarak Çiçekler". *FSM İlmî Araştırmalar İnsan ve Toplum Bilimleri Dergisi*, 5, 1-28.
- Akün, Ö. F. (1994). "Divan Edebiyatı". *TDV İslam Ansiklopedisi*, IX, İstanbul: 389-427.
- Alvan, T. (2015). *Emrî Dîvanının Nazım ve Belağat Bilgisi Yönünden İncelenmesi*. (Yayınlanmamış Doktora Tezi), İstanbul Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul.
- Bayram, Y. (2007). "Klasik Türk Şiirinde Duyguların Dili: Çiçekler", *Turkish Studies International Periodical For the Languages, Literature and History of Turkish or Turkic*, 2 (4), 209-219.
- Başoğlu, T. (2007). "Resim". *TDV İslam Ansiklopedisi*, XXXIV, İstanbul, 579-582.
- Canım, R. (2018) (Haz.). *Latîfî-Tezkiretü's-Şu'arâ ve Tabsiratü'n-Nuzamâ*.
<https://ekitap.ktb.gov.tr/TR-216998/latifi-tezkiretus-suara-ve-tabsiratun-nuzama.html> (Erişim Tarihi: 28.04.2023)
- Dobrez, P. (2013). "The Case for Hand Stencils and Prints as Proprio-Performative". *Arts*, 2, 273-327.
- Derman, M. U. (1997). "Hat". *TDV İslam Ansiklopedisi*, XVII, İstanbul, 427-437.
- Demir, H. (2021). "Zanbak" ve Klasik Türk Şiirindeki İzleri". *Divan Edebiyatı Araştırmaları Dergisi*, 27, 127-157.
- Dilçin, C. (1983), *Yeni Tarama Sözlüğü*, Ankara: Türk Dil Kurumu Yayınları.
- El, (2022, Kasım 5) Wikipedia içinde.
<https://tr.wikipedia.org/wiki/El>
- Erdoğan, M. (2013). *Güzellik Unsurlarıyla Divan Şiirinde Sevgili*. İstanbul: Kitabevi.
- Eyüpoğlu, E. K. (1973), *On Üçüncü Yüzyıldan Günümüze Kadar Şiirde ve Halk Dilinde Atasözleri ve Deyimler II, Deyimler-(Tâbirler)*, İstanbul: Doğan Kardeş Matbaacılık.
- Gital, B. D. (2017). "Yapılcan Köyü Hıdırlık Türbesindeki El Tasvirleri". *Akademik Sosyal Araştırmalar Dergisi*. 63, 615-634.
- Hoppál, M. (2015). *Şamanlar ve Semboller Kaya Resmi ve Göstergibilim*, (Çev. Fatih Sel), İstanbul: Yapı Kredi Yayınları.
- İsen, M. (2017) (Haz.). *Künhü'l-Ahbâr'ın Tezkire Kısmı*.
<https://ekitap.ktb.gov.tr/TR-194288/kunhul-ahbarin-tezkire-kismi.html> (Erişim Tarihi: 28.04.2023)
- Kandeler, R.; W. R. U. (2009). "Symbolism of Plants: Examples from European-Mediterranean Culture Presented with Biology and History of Art". *Journal of Experimental Botany*, 60/7, 1893-1895.
- Kaya, H. (2011). Emrî Divanı'nda Deyimler. *Divan Edebiyatı Araştırmaları Dergisi*, 6 (6) , 55-130.
- Kılıç, F. (2018) (Haz.). *Aşık Çelebi-Meşâ'irü's-Şu'arâ*.
<https://ekitap.ktb.gov.tr/TR-210485/asik-celebi-mesairus-suara.html>
(Erişim Tarihi: 28.04.2023)
- Kurnaz, C. (1998). "Hilal", *TDV İslam Ansiklopedisi*, XVIII, İstanbul: 11-13.
- Özönder, H. (2003). *Ansiklopedik Hat ve Tezhip Sanatları Deyimleri Terimleri Sözlüğü*. Konya: Uysal Kitabevi.
- Rızaei, M. (2022). "Hz. Ali ile Hristiyanlar Arasında İmzalanan Bir Antlaşma ve Bu Antlaşmanın Satırarası Türkçe Tercümesi". *Türk Kültürü ve Hacı Bektaş Veli Araştırma Dergisi*, 102, 391-404.
- Saraç, M. A. Y. (2002). *Emrî Divanı* (Haz.), İstanbul: Eren Yayıncılık.
- Saraç, M. A. Y. (2014). "Emrî, Emrullah", *Türk Edebiyatı İsimler Sözlüğü*.
<https://teis.yesevi.edu.tr/madde-detay/emri-emrullah> (Erişim Tarihi: 01.05.2023)
- Sefercioğlu, N. (2012). "Yazı Ve Yazı İle İlgili Unsurların Divan Şiirinde Kullanılışı"
https://turkoloji.cu.edu.tr/ESK1%20TURK%20%20EDEBIYATI/nejat_sefercioglu_divan_siiri_Yazi.pdf (Erişim Tarihi: 01.05.2023)
- Şafak, Y. (1991). *Sürürî'nin Bahrî'l-Ma'ârifî ve Enîsü'l-Uşşâk ile Mukayesesi*. Atatürk Üniversitesi Sosyal Bilimler Enstitüsü: Erzurum.
- Şentürk, A. A. (2002). *XVI. Asra Kadar Anadolu Sahası Mesnevîlerinde Edebî Tasvirler*. İstanbul: Kitabevi.
- Uzun, M. İ. (2012). "Tübâ, Kültür ve Edebiyat", *TDV İslam Ansiklopedisi*, İstanbul, XLI, 317-319.
- Uzun, M. İ. (2013). "Yed-i Beyzâ", *TDV İslam Ansiklopedisi*, İstanbul, XLIII, 377-378.

DIGITAL LEADERS' PROMOTORS TO LEARNING AND DEVELOPMENT

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Abstract

Digital leaders have a clear understanding of how digital technologies can help their organization achieve its goals and are able to articulate this vision to their team and they recognize the importance of collaboration and are able to bring together diverse teams to work towards a common goal. In this paper we focus on digital leaders as promoters of learning and development within the organization and how essential is for the organizations looking to stay competitive and innovative in a rapidly changing digital landscape. Digital leaders understand the importance of continuous learning and development in today's rapidly evolving digital landscape. They recognize that technology is constantly changing, and they need to stay up-to-date with the latest trends and best practices to remain competitive. Continuous learning and development can take many forms, including attending conferences, taking online courses, participating in webinars, reading industry publications, and collaborating with colleagues. By prioritizing continuous learning and development, digital leaders are able to stay ahead of the curve and ensure that their organization is well-positioned to succeed in the digital age. We conclude that digital leaders empower their teams by providing them with the necessary tools and resources to succeed in a digital environment. This includes providing access to the latest technology, investing in training and development programs, and fostering a culture of innovation and collaboration.

Keywords: leaders, digital, learning, development, change

INTRODUCTION

Politics and digitalization are closely intertwined in today's world. Digitalization has transformed the way politics is conducted, from election campaigns and public opinion polling to governance and public service delivery.

One of the most significant impacts of digitalization on politics is the rise of social media. Social media platforms such as Twitter, Facebook, and Instagram have become essential tools for political campaigns, allowing politicians to reach out to voters directly and engage with them in real-time. Social media has also given rise to a new form of political activism, enabling citizens to organize and mobilize around issues and causes they care about.

Digitalization has also enabled new forms of citizen participation in politics, such as e-petitions, online consultations, and crowdsourcing. These tools have the potential to increase citizen engagement and participation in political decision-making processes.

In addition, digitalization has facilitated the creation of digital government services and e-government platforms, which enable citizens to access public services online, including filing taxes, applying for permits, and accessing public records. These platforms can help to improve the efficiency and transparency of government services and reduce bureaucracy and corruption.

However, the use of digital tools in politics also poses challenges, such as the spread of disinformation and fake news, cybersecurity threats, and concerns over privacy and data protection. Politicians and policymakers need to address these challenges to ensure that digitalization is used in a way that supports democratic processes and protects citizens' rights and freedoms.

Overall, digitalization has transformed politics in significant ways, and it will continue to shape the future of democracy and governance. It is crucial that policymakers and citizens work together to ensure that digitalization is used in a way that promotes transparency, accountability, and citizen participation in politics.

LITERATURE REVIEW

There are numerous authors who have written about digital leadership, including academics, practitioners, and consultants.

Kouzes and Posner's research focuses on identifying the behaviors and practices of effective leaders (Kouzes. J, Posner. B, 2022). They have developed a model of leadership called the Five Practices of Exemplary Leadership, which includes the following:

1. Model the Way
2. Inspire a Shared Vision
3. Challenge the Process
4. Enable Others to Act
5. Encourage the Heart

Ronald Heifetz and Marty Linsky are both scholars and practitioners in the field of leadership studies. They are best known for their work on adaptive leadership, which is a model of leadership that emphasizes the importance of adapting to changing circumstances and taking on difficult challenges. Together, Heifetz and Linsky have developed a powerful model of leadership that emphasizes the importance of adaptive work and the need for leaders to take risks, experiment, and learn from their mistakes. Their work has had a significant impact on the field of leadership studies and has helped to shape the way that many people think about leadership and its role in driving social and organizational change. (Heifetz A. R, Linsky M, 2014)

In her book "The Engaged Leader: A Strategy for Your Digital Transformation," Li argues that leaders need to embrace digital technologies and social media to engage with their employees, customers, and stakeholders. She provides a roadmap for leaders to become more digitally engaged, including developing a digital mindset, building a social media presence, and using social technologies to communicate and collaborate. (Li, 2014)

In his work, Kotter emphasizes the importance of leadership in driving successful change and the need for organizations to be agile and adaptable in today's rapidly changing business environment. He has developed a proven eight-step model for leading change, which has been widely adopted by organizations around the world. In "Accelerate," he expands on this model and introduces a new approach to building strategic agility that is designed to help organizations stay ahead of the curve in a world where change is constant and disruption is the norm. (Kotter, 2014)

Digital leaders are individuals who possess the skills, knowledge, and expertise to lead their organizations through the complexities of the digital landscape. The following literature review provides an overview of the key concepts, theories, and practices associated with digital leadership.

These scholars and many others have contributed to our understanding of political leadership and the challenges and opportunities of leading in today's complex and rapidly changing world.

PROMOTING LEARNING AND DEVELOPMENT

Digital leadership is a term used to describe the ability of leaders to leverage digital technologies to achieve strategic objectives (Heifetz A. R, Linsky M, 2014). Digital leaders possess a range of skills, including technical knowledge, data analysis, and communication skills. They must also be able to understand the impact of digital technologies on business models, customer experiences, and organizational culture and play a critical role in guiding their organizations through digital transformation. They are must be able to assess the digital maturity of their organizations, identify areas for improvement, and develop strategies to implement digital technologies. They must also be able to manage the cultural and organizational changes that come with digital transformation. As they possess a range of skills and competencies to be effective like technical knowledge, strategic thinking, data analysis, communication skills, and leadership abilities they must also be able to adapt to rapidly changing technology and business environments (Kouzes. J, Posner. B, 2022).

Digital leadership is not without its challenges. Digital leaders are be able to navigate the complexities of digital technologies, manage organizational resistance to change, and overcome cultural barriers to digital transformation (Li, 2014). They can also be able to balance the need for innovation with the need for security and compliance. There are several best practices associated with digital leadership. These include creating a digital culture, investing in digital skills development, fostering innovation and experimentation, and using data-driven decision-making. Digital leaders must also be able to communicate effectively with stakeholders, build cross-functional teams, and be agile in their approach to digital transformation.

The future of digital leadership is likely to be shaped by emerging technologies such as artificial intelligence, blockchain, and the internet of things. Digital leaders must be able to understand the potential impact of these technologies on their organizations and develop

strategies to leverage them. They must also be able to balance the need for with ethical considerations and societal impacts.

Promoting development refers to the deliberate efforts made to improve the economic, social, and political conditions of a community, region, or country. It involves a wide range of activities and interventions that are aimed at enhancing the well-being of individuals and communities (Kotter, 2014).

Promoting development can take various forms, including economic development, social development, and sustainable development. Economic development focuses on improving the economic conditions of a community, such as increasing employment opportunities, expanding access to markets, and attracting investment. Social development, on the other hand, focuses on improving the social conditions of a community, such as enhancing access to education, health care, and social services. Sustainable development aims to improve the economic, social, and environmental conditions of a community in a way that is sustainable over the long term. It requires collaboration and partnerships among different actors, including government, civil society organizations, private sector, and local communities.

Promoting learning refers to the deliberate efforts made to facilitate the acquisition of knowledge, skills, and attitudes by individuals or groups. It involves creating an environment that supports and encourages learning, providing resources and opportunities for learning, and ensuring that learners have access to quality education and training. Promoting learning can take various forms, including formal education, informal learning, and lifelong learning. Formal education refers to structured learning experiences that take place within educational institutions, such as schools, colleges, and universities. Informal learning, on the other hand, refers to learning that takes place outside of formal educational settings, such as through work experience, volunteering, or self-directed learning. Lifelong learning refers to the continuous acquisition of knowledge, skills, and attitudes throughout one's life.

Promoting learning is essential for personal and professional development, as well as for the development of societies and economies. It can help individuals to acquire the knowledge and skills they need to succeed in their careers and contribute to society. It can also help to promote innovation, creativity, and social cohesion, and contribute to economic growth and development.

Political leaders need to be digitalized because digitalization has transformed the way politics is conducted, and leaders need to be able to navigate this new terrain effectively to lead and govern effectively. Digitalization has had a significant impact on political communication, citizen engagement, and public service delivery, among other areas.

CONCLUSIONS

Digital Political leaders have a critical role to play in promoting learning and development, both at the individual level and at the societal level. They can invest *in education* by increasing funding for schools and universities, supporting programs that provide access to education for marginalized communities, and promoting innovative approaches to teaching and learning. By investing in education, political leaders can help individuals acquire the knowledge and skills they need to succeed in life and contribute to society.

Political leaders can *support lifelong learning* by promoting adult education and training programs, providing incentives for employers to invest in employee training and development, and creating opportunities for individuals to acquire new skills and knowledge throughout their lives. By supporting lifelong learning, political leaders can help individuals adapt to changing economic and technological conditions and remain competitive in the workforce. They can *encourage innovation and creativity* by supporting research and development, promoting entrepreneurship, and investing in science and technology. By fostering an environment that encourages innovation and creativity, political leaders can help to drive economic growth and development.

Digital leaders can lead by example by engaging in their own learning and development and by promoting a culture of continuous learning within their organizations and communities. By demonstrating a commitment to learning and development, political leaders can inspire others to do the same.

References

- (SHETOS), S. O. (1942). Nazim Ibrahim Frakulla from Berati. *Kultura Islame*, No. 5-6-7, 159.
- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*. Retrieved from <https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953>
- (1939). *Kultura Islame*, No. 6-7, 228-229.
- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), pp. 1-20.
- AFAD. (2022). *Açıklamalı Afet Yönetimi Terimleri Sözlüğü*. Retrieved from Açıklamalı Afet Yönetimi Terimleri Sözlüğü Web Sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Web sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Afet Türleri Web sitesi: <https://www.afad.gov.tr/afet-turleri>
- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 16(1), pp. 17-35. doi:<https://doi.org/10.17130/ijmeh.700812>
- AKSOĞAN , M., & ÇALIŞ DUMAN, M. (2018, Aralık 7-9). Akıllı Şehir Uygulamaları; Malatya Örneği. 1. *Uluslararası Battalgazi Multi Disipliner Çalışmalar Kongresi Tam Metin Kitabı Cilt 1, 1*, pp. 183-202.
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(2).
- AKYEL, R. (2007). *Afet Yönetim Sistemi: Türk Afet Yönetiminde Karşılaşılan Sorunların Tespit ve Çözümüne İlişkin Bir Araştırma*. Adana: Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Doktora Tezi.
- ALAVİ, A., PENGCHENG, J., WILLİAM, G., & NİZAR, L. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. *Measurement*, 129, pp. 589-606.
- Albuquerque, R. (2003). The composition of international capital flows: risk sharing through foreign direct investment. *Journal of International Economics*, 61(2), 353-383.
- Ali, H. (1944). Hasan Zyko Kamberi 200 years ago. *Kultura Islame*, No. 7-8, 201.
- ARMAĞAN, V. (2018). Dijital Dönüşüm Sürecinde Akıllı Şehirler ve E-Devlet Platformu. *İletişim Kuram ve Araştırma Dergisi*(46), pp. 387-414.
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Baetens, F. (2013). *Investment law within international law: integrationist perspectives*. Cambridge University Press.
- Bala, M. (1942). Do we have a modern Albanian drama. *Kultura Islame*, No. 5-6-7, 214.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. Retrieved from <https://www.bbc.com/news/world-europe-17776876>
- Beqiri, G. (2017). Marketinguindërmarrjeve në Kosovë përmes aplikimit të mediave sociale. Tiranë

- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development*, 62, pp. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>
- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from <https://berkeleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>
- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Beurden, S. V. (2022, 4 30). *A New Congo Crisis?* Retrieved from https://origins.osu.edu/article/new-congo-crisis?language_content_entity=en
- Beylikdüzü Belediyesi. (2017). *ABİS (Afet Bilgi Sistemi)*. Retrieved from ABİS (Afet Bilgi Sistemi) Web sitesi: <http://www.beylikduzuhazir.com/Abis>
- Beylikdüzü Belediyesi. (2017). *Beylikdüzü Hazır*. Retrieved from Beylikdüzü Hazır Web Sitesi: <http://www.beylikduzuhazir.com/BeylikduzuHazir>
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri. *International Peace Information Service*, 2-50.
- Britannica. (2021, 12 24). *Romania*. Retrieved from <https://www.britannica.com/place/Romania>
- Britannica. (2022, 01 03). *Security*. Retrieved from <https://www.britannica.com/place/Romania/Political-process>
- Carey, B. (2021, April 1). *What's the Social Media Impact on Tourism?* Retrieved from CheckFront: <https://www.checkfront.com/blog/social-media-impact-on-tourism/>
- Çelik, H. (2022). Türkiye'de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), pp. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- ÇELİK, İ. H., USTA, G., YILMAZ, G., & YAKUPOĞLU, M. (2020). Türkiye'de Yaşanan Teknolojik Afetler (2000-2020) Üzerine Bir Değerlendirme. *AÇÜ Uluslararası Sosyal Bilimler Dergisi*, 6(2), pp. 49-57.
- CENTER for ECONOMIC and SOCIAL RIGHTS. (2022, 04 14). Retrieved from Key Concepts: Human Rights and the Economy: <https://cesr.org/key-concepts/>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*. Retrieved from <https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/>
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania's social strata in the past 30 years*. Retrieved from <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/>
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*. Retrieved from https://www.constituteproject.org/constitution/Romania_2003?lang=en
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*. Retrieved from <https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604.>
- Critic and criticism. (1941). *Kultura Islame, No.20-21*, 179.
- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- Dave Evans with Jake McKee. (2010). *Social Media Marketing: The Next Generation of Business Engagement*. Canada: Wiley Publishing, Inc., Indianapolis, Indiana.
- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf

- De Schutter, O., Swinnen, J., & Wouters, J. (2012). *Foreign direct investment and human development: the law and economics of international investment agreements*. Routledge.
- Deloitte Vodafone. (2016, 12). *Akıllı Şehir Yol Haritası*. DeloitteTürkiye.
- DHI Worldwide. (2018). Improved Flood Control and Water Quality With A Smart Water Solution See How The City Of Vejle In Denmark Protects Its Streets From Flooding. *The Expert In Water Environments*.
- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- DİLER, G. (2012, 04 30). Avrupa Birliği'nin İlk Yeşil Başkenti Stockholm. *Ekoyapı*.
- Dolzer, R., & Stevens, M. (1995). *Bilateral investment treaties*. Martinus Nijhoff Publishers.
- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. Retrieved from <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153>
- ELMAN. (2023). *Elman Sel Erken Uyarı Sistemi*. Retrieved from Elman Sel Erken Uyarı Sistemi Web Sistesi:
<https://elmantech.com/ehs/#:~:text=Ta%C5%9Fk%C4%B1n%20erken%20uyar%C4%B1%20sistemi%20nehir,olarak%20uyar%C4%B1lar%20olu%C5%9Fturmas%C4%B1%20esas%C4%B1na%20dayan%C4%B1r>.
- ERSOY YILMAZ , A. (2020). *Afet Yönetimi*. Acil Durum ve Afet Yönetimi Uzaktan Eğitim Önlisans Programı.
- EU. (2022, 1 2). *History of the European Union 1960-69*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- EU. (2022, 1 02). *History of the European Union 2000-19*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en
- EU. (2022, 01 03). *Romania*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022>
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. Retrieved from https://europa.eu/ecsc/index_en.htm
- Europa.eu. (2021, 12 30). *Romania*. Retrieved from <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx>
- European Commission . (2022, 1 2). *From 6 to 27 members*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en
- European Commission. (2022, 01 02). *Accession criteria*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union: Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. Retrieved from https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf
- European Commission D G C. (2022, 01 02). *Bulgaria*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en
- European Union. (2022, 1 2). *Country profiles*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles_en
- European Union. (2022, 01 01). *History of the European Union 1945-59*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en
- European Union law. (2021, 01 04). *Accession Treaties*. Retrieved from <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html>

- Foldrejt. (2019). *Çfarë nënkuptojmë me sjelljen konsumatore?* Retrieved from Foldrejt: <https://foldrejt.com/cfare-nenkuptojme-me-sjelljen-konsumatore/>
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Gallagher, K., & Zarsky, L. (2007). *The enclave economy: foreign investment and sustainable development in Mexico's Silicon Valley*. MIT Press.
- GIORDANO, V., GANGALE, F., FULLÌ, G., & JIMENEZ, M. S. (2011). *Smart Grid projects in Europe: Lessons Learned And Current Developments*. Joint Research Centre Institute for Energy European Commission.
- Global Edge. (2021, 12 30). *Romania: Government*. Retrieved from <https://globaledge.msu.edu/countries/romania/government>
- Global Witness. (2009). NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- Goodale, M. (2018, 04). *The UNESCO Courier Seventy-year-old views that remain contemporary*. Retrieved from UNESCO: <https://en.unesco.org/courier/2018-4/seventy-year-old-views-remain-contemporary>
- Heifetz A. R, Linsky M. (2014). *Leadership on the line*. Boston: Harvard Business School Publishing.
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* . Retrieved from <https://www.heritage.org/index/country/romania>
- Hosts. (2023). *What's the Social Media Impact on Tourism?* Retrieved from Hosts: <https://hotspot.earth/blog/whats-the-social-media-impact-on-tourism#:~:text=One%20of%20the%20greatest%20ways,and%20accommodations%20they%20can%20use.>
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>
- ILGAZ, E. (2018). *Akıllı Şehirler ve Akıllı Şehirlerin Kurulmasında Rüzgar Enerjisinin Yönetimi ve Organizasyonu*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yönetim Organizasyon Bilim Dalı Yüksek Lisans Tezi.
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romania-foreign-policy-after-nato-and-eu-accession>
- INSARAG. (2017). *International Search and Rescue Advisory Group (INSARAG)*. Retrieved from International Search and Rescue Advisory Group (INSARAG) Web sitesi: <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response>
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-overview>
- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- İstanbul Büyükşehir Belediyesi AKOM. (2022). *İstanbul Büyükşehir Belediyesi AKOM*. Retrieved from İstanbul Büyükşehir Belediyesi AKOM Web Sitesi: <https://akom.ibb.istanbul/hazirlik-planlama-calismalari/>
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-challenges>
- İzmir Büyükşehir Belediyesi. (2021, 03 12). *Acil İzmir*. İzmir: Bilgi İşlem Dairesi Başkanlığı Harita ve CBS Dairesi Başkanlığı.
- İzmir Büyükşehir Belediyesi. (2022 , 10 3). *İzmir Akıllı İhbar Sistemi ile daha güvende*. Retrieved from İzmir Akıllı İhbar Sistemi ile daha güvende Web Sitesi: <https://www.izmir.bel.tr/tr/Haberler/izmir-akilli-ihbar-sistemi-ile-daha-guvende/47318/156>

- Japan Experience . (2014, 11 10). *Japan Experience*. Retrieved from Kasukabe Underground Flood Protection Tank Web Sitesi: <https://www.japan-experience.com/all-about-japan/saitama/attractions-excursions/kasukabe-underground-flood-protection-tank>
- Jashi, C. (2013). Significance of Social Media Marketing in Tourism. *ResearchGate*, 36-40.
- JESUS, I., MACHADO, J. A., carvalho, J. L., FERREIRA, J. R., & FIGUEIREDO, L. (2001). Towards the Development of Intelligent Transportation Systems. *Intelligent Transportation Systems Conference Proceedings - Oakland (CA) USA(81)*, pp. 1-6.
- KADIOĞLU, M. (2008). *Afet Zararlarını Azaltmanın Temel İlkeleri*. (M. KADIOĞLU, & E. ÖZDAMAR, Eds.) Ankara: JİCA (Japonya Uluslararası İşbirliği Ajansı) Türkiye Ofisi, Yayın No:2.
- KADIOĞLU, M. (2019). *Kent Selleri Yönetim ve Kontrol Rehberi*. Kültür Yayınları.
- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Developmen*, 6(4), pp. 91-102.
- Kotter, J. (2014). *Accelerate: Building strategic agility for a faster moving world*. Boston: Harvard Business Review Press.
- Kouzes, J, Posner. B. (2022). *The leadership challenge* (Vol. Seventh edition). USA.
- Krajewski, M. (2018). Human rights in international investment law: recent trends in arbitration and treaty-making practice. Available at SSRN 3133529, 1-10.
- Kultura Islame. (1939). 228-229.
- Langevin, L., Lamarche , N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- Leaders Mag. (2022, 01 04). *Romania's Recovery*. Retrieved from http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html
- Li, C. (2014). *The engaged leader; A strategy for your digital transformation*. Philadelphia: Wharton School Press.
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*. Retrieved from <https://www.macrotrends.net/countries/ROU/romania/population>
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- MARCO, A. D., MANGANO, G., SCORRANO, F., NEIROTTI, P., & CAGLIANO, A. C. (2014). Current Trends In Smart City Initiatives: Some Stylised Facts. *Cities*, 38, pp. 25-36.
- Mayfield, A. (2008). *What is Social Media?* iCrossing.
- McKinsey. (2018). *Smart Cities: Digital Solutions For A More Livable Future*. McKinsey & Company.
- Md Yusuf Hossein Khan and Tanvir Abir. (2022). *The Role of Social Media Marketing in the Tourism and Hospitality Industry*. IGI Global.
- MEDAK. (2022). *MEDAK*. Retrieved from MEDAK Web sitesi: <https://www.medak.org.tr/faydali-bilgiler/faydali-bilgiler/>
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>
- MONUSCO. (2022, 4 20). *UNITED NATIONS ORGANIZATION STABILIZATION MISSION IN THE DR CONGO*. Retrieved from <https://monusco.unmissions.org/en/drc-attacks-adfarmed-group-may-amount-crimes-against-humanity-and-war-crimes>
- Mosley, L. (2010). *Labor rights and multinational production*. Cambridge University Press.

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*. Retrieved from <https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants>
- Mustafa, M. (1945). Gjuha amtare, Native language. *Kultura Islame, No. 3-4* , 72.
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- NAM, T., & PARDO, T. (2011, Haziran 12). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, pp. 282-291. doi:<https://doi.org/10.1145/2037556.2037602>
- Nations, D. (2021, January 26). *What Is Social Media?* Retrieved from Lifewire: <https://www.lifewire.com/what-is-social-media-explaining-the-big-trend-3486616>
- NATO. (2022, 01 04). *NATO-Russia relations: the facts*. Retrieved from https://www.nato.int/cps/en/natohq/topics_111767.htm
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME* . Retrieved from <https://netaffair.org/documents/1957-rome-treaty.pdf>
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- ÖZMEN, M. (2013). *Deprem ve Antalya*. Antalya: Kutlu&Avcı Ofset.
- ÖZMEN, M. (2015). *Sel-Taşkın Türkiye ve Antalya*. Antalya: Kutlu&Avcı Ofset Ltd. Şti.
- Pcweb. (2022, October 22). *Tourism industry meaning*. Retrieved from Pcweb.info: <https://pcweb.info/tourism-industry-meaning/?lang=en>
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Petras, J., & Veltmeyer, H. (2007). *Multinationals on trial: Foreign investment matters*. Ashgate Publishing, Ltd.
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- PLUS. (1940). About Albania literary production. *Kultura Islame, No. 10*, 396.
- PLUS. (1940). The poet of "Bagëti e Bujqësi". *Kultura Islame, No. 13-14*, 28.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102. Retrieved from https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.
- POSER, K., & DRANSCH, D. (2010). Volunteered Geographic Information For Disaster Management With Application To Rapid Flood Damage Estimation. *Geomatica*, 64(1), pp. 89-98.

- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Resilient Vejle. (2016). *Vejle's Resilience Strategy*. Resilient Vejle.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. Retrieved from <https://www.romania-insider.com/1918-great-union-historical-events-romania>
- Rufanges , J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.
- ŞAHİN, N. (2007). Afet Yönetimi ve Acil Yardım Planları. *TMMOB İzmir Kent Sempozyumu*, pp. 131-142.
- ŞAHİN, Ş. (2019). The Disaster Management in Turkey and Goals of 2023. *Turkish Journal of Earthquake Research*, 1(2), pp. 180-196.
- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*. Retrieved from <https://www.schengenvisainfo.com/countries-in-europe/eu-countries/>
- Scott, C. (2001). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia. *Torture As Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, Craig Scott, Ed, 3-44.
- Scott, C. (2011). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *TORTURE AS TORT: COMPARATIVE PERSPECTIVES ON THE DEVELOPMENT OF TRANSNATIONAL HUMAN RIGHTS LITIGATION*, Craig Scott, 3-44.
- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- SHROPSHIRE, A. (2019). Stories from the World of Municipal Analytics. *Towards Data Science*.
- Simma, B. (2011). Foreign investment arbitration: a place for human rights? *International & Comparative Law Quarterly*, 60(3), 573-596.
- SOLANAS, A., VLACHOS, I., RAMOS, V., FALCONE, F., POSTOLACHE, O., PERREA, D., . . . MARTINEZ-BALLESTE, A. (2014). Smart Health: A Context-Aware Health Paradigm within Smart Cities. *IEEE Communications Magazine*, pp. 74-81.
- Spar, D. (1999). Foreign investment and human rights. *Challenge*, 42(1), 50-80.
- Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* Retrieved from <https://www.statista.com/statistics/1109873/challenges-romania/>
- Statistics, G. S. (Jan 2023). *The world's most used social platforms* .
- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*-, 2-9.
- T.C. Çevre ve Şehircilik Bakanlığı. (2019). *Akıllı Şehirler Beyaz Bülteni*. Retrieved from https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), pp. 2816-2820.
- TAŞTAN, M. (2018). IoT Based Wearable Smart Health Monitoring System. *Celal Bayar University Journal of Science*, 14(3), pp. 343-350.
- TDK. (2022). *Türk Dil Kurumu Sözlükleri*. Retrieved from Türk Dil Kurumu Sözlükleri Web Sitesi: <https://sozluk.gov.tr/>
- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>

- The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF*. Retrieved from <https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html>
- The World Bank. (2021, 12 25). *The World Bank in Romania*. Retrieved from <https://www.worldbank.org/en/country/romania/overview#1>
- Tjoe, K. (2022, February 28). *The vital role of social media in tourism marketing*. Retrieved from Rezdy blog: <https://rezdy.com/blog/the-vital-role-of-social-media-in-tourism-marketing/#:~:text=Social%20media%20can%20be%20a,up%20in%20the%20area%2C%20and>
- Toral, M., & Schultz, T. (2010). The state, a perpetual respondent in investment arbitration? Some unorthodox considerations. *The backlash against investment arbitration: Perceptions and reality*, 577-602.
- TÖRENCİ, H. E. (2015). *Afet Yönetimi ve Bursa'da Sağlık Sektöründe Afet Yönetimi*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yüksek Lisans Tezi.
- Trading Economic. (2022, 01 03). *Romania GDP*. Retrieved from <https://tradingeconomics.com/romania/gdp>
- Truyols, M. (n.d.). *POSITIVE AND NEGATIVE EFFECTS OF SOCIAL MEDIA ON THE TOURISM INDUSTRY*. Retrieved from Hotelmize: <https://www.hotelmize.com/blog/positive-and-negative-effects-of-social-media-on-the-tourism-industry/>
- Tudor, I. (2008). *The Fair and Equitable Treatment Standard, in the International*. Oxford University Press on Demand.
- Türkiye Bilişim Vakfı (TBV). (2016). *Türkiye Akıllı Şehirler Değerlendirme Raporu*. Türkiye Bilişim Vakfı (TBV).
- Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı. (2014). *Onuncu Kalkınma Planı Afet Yönetiminde Etkinlik Özel İhtisas Komisyonu Raporu*. Ankara: T.C. Kalkınma Bakanlığı.
- TÜRKOĞLU, H. (2014). *İSMEP Rehber Kitaplar Afete Dirençli Şehir Planlama ve Yapılaşma*. İstanbul: İstanbul Valiliği, İstanbul İl Afet ve Acil Durum Müdürlüğü (İstanbul AFAD), İstanbul Proje Koordinasyon Birimi (İPKB).
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Washington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from <https://www.unhcr.org/558c0e039.pdf>
- United Nations. (2023, 04 18). Retrieved from United Nations Human rights office of the high commissioner : <https://www.ohchr.org/en/human-rights/economic-social-cultural-rights>
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- Valarm. (2022). *Valarm*. Retrieved from Valarm Web Sitesi: <https://www.valarm.net/blog/monitoring-water-levels-flood-detection-early-warning-systems-virginia-smart-cities/>
- Voineagu , V. (2022, 01 02). *ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING I.I-28.II.2007 PERIOD*. *IDEAS*, 48-72. Retrieved from <https://plagiarism.repec.org/socol-socol/socol-socol2.pdf>
- World Bank. (2021, 12 29). *Gross domestic product 2020*. Retrieved from <https://databank.worldbank.org/data/download/GDP.pdf>
- World Bank. (2023, 04 10). Retrieved from World Development Indicators: <https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#>

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from <https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>
- YAMAN KOCADAĞLI, A. (2017). *Beylikdüzü'nün Coğrafi Özellikleri*.
- YAMAN, M., & ÇAKIR, E. (2018). Dijitalleşen Dünyada Akıllı Afet ve Acil Durum Uygulamaları. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 7(2), pp. 1124-1138.
- YILDIRIM, A. M. (2022). *Akıllı Şehirlerde Trafik Yönetimi İçin Bir Dinamik Rotalama Yöntemi ve Cupcarbon Gerçekleşmesi*. Kocaeli: Kocaeli Üniversitesi Fen Bilimler Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı Yüksek Lisans Tezi.
- YILDIZ, D. (2013, 03 22). Ekolojik Kentsel Dönüşümde Örnek Kent : Stockholm. *Stockholm Winner 2010 European Green Capital*, pp. 1-9.
- ZHANG, K., YANG, K., REN, J., SHEN, X. S., NI, J., & LIANG, X. (2017). Security and Privacy in Smart City Applications: Challenges and Solutions. *IEEE Communications Magazine*, pp. 122-129.

**THE ROLE OF SOCIAL MEDIA MARKETING IN CONSUMER BEHAVIOR
IN THE TOURISM INDUSTRY**

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Abstract

Through the studies, the variables of the role of social media marketing and consumer behavior have been analyzed. The purpose of this case study is to better inform and understand the importance of social media in the tourism industry and consumer activity. From the results it appears that 88% of businesses actively use social media and 70% can trust the opinion given by social networks. Social media and tourism are linked together because they both focus on their sharing. As highlighted by the statistics of the global tourism industry, the influence of social media on tourism is likely to be dangerous for the younger demographic 46%. Effective social media marketing can focus not only on inspiring content about their travels but also on highlighting the truly amazing aspects of your particular corner of the world. Finally, our study provides relevant information that will help the readers of the field to understand more about the role of marketing and social media in consumer changes in the tourism industry.

Keywords: marketing, social media, consumers, the tourism industry

1. Introduction

Over the last few years we have seen a huge growth in social media which is due to the increase in the number of internet users and different platforms around the world. Social media marketing has made a huge difference in consumer behavior in the tourism industry. Nowadays, many consumers use social networks to search for information and advice on tourist destinations, hotels, and restaurants. Social media marketing helps tourism companies connect with consumers in new ways and create long-term relationships with them.

As a consequence of this, social media marketing is essential for success and greater inclusiveness of clients or consumers, as well as the most innovative way of influencing contemporary global tourism.

The purpose of this case study is to inform and understand the importance of social media in the tourism industry and consumer behavior. This paper contains and elaborates on the concepts of social media marketing, consumer behavior, the tourism industry, statistics of their users, the impact of social media on tourism, disadvantages, etc.

The data has been provided through the use of contemporary literature and existing scientific works in the field of marketing through social media, statistical data, international empirical works and verified websites.

Literature review

Social media marketing, consumer behavior, and the tourism industry

Social media marketing has fundamentally changed the way many companies communicate and advertise to their target demographic. The growing spread of the Internet and social media, on the other hand, transformed the marketing paradigm with multiple perspectives and newly created horizons in the tourism and hospitality industries. (Md Yusuf Hossein Khan and Tanvir Abir, 2022).

The 'social' part: refers to interacting with other people by sharing information with them and receiving information from them. The 'media' part: refers to a communication instrument, such as the Internet. From these two separate terms, we can derive a basic definition:

"Social media are web-based communication tools that enable people to interact with each other by sharing and consuming information." (Nations, 2021).

Social media marketing is in many ways a precursor to social business. Social media marketing is most effective when the entire business is responsible for marketing

experiences, operations, and communication, and everyone within the organization is accountable for the overall product or service (Dave Evans with Jake McKee, 2010).

Social media is best understood as a group of new types of Internet media that share most or all of the following characteristics:

- Participation
- Opening
- Conversation
- Community
- Connection

(Mayfield, 2008)

A definition of consumer behavior would be that it studies individuals, groups, or organizations, and the processes they use to select, secure, use, and purchase products, services, experiences, or ideas to satisfy needs, and the effects these processes have on the consumer and society, including their causes and motives, of individuals and groups about the orientation, purchase, use, maintenance, disposal, and self-production (Foldrejt, 2019).

The tourism industry includes all the activities that take place during the movement of people during their tour. These tours don't just cover leisure travel; but also business trips and additional trips for social reasons. The tourism industry includes all businesses and organizations that provide services to tourists and visitors. This industry covers several businesses such as hotels, restaurants, accommodation, food and beverage, transport, and travel agencies. From buying a flight ticket to staying at a hotel, exploring the destination, and buying food, all activities are involved in the tourism industry (Pcweb, 2022).

Statistics of social media users

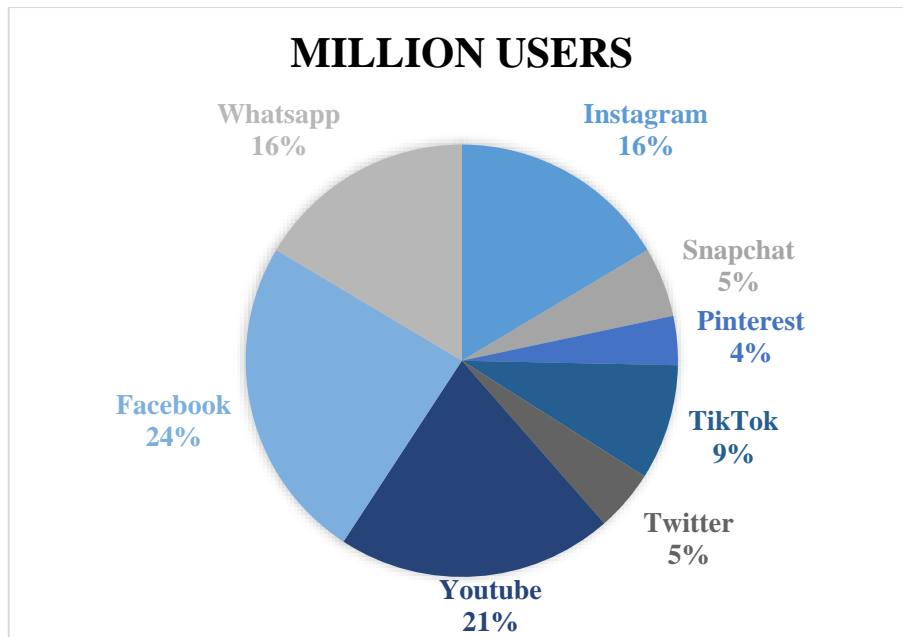


Table 1: Statistics of social media users in the world
(Statistics, Jan 2023)

According to statistics, the number of people who use social media in their daily life is observed. As a consequence of this, the role of social media in everyday life is always growing.

According to the International Tourism Research Centers, 88% of tourism business representatives actively use social media and 70% of consumers trust recommendations from social networks (Jashi, 2013).

2. How does social media affect tourism?

Social media and tourism fit beautifully together because they both focus on sharing experiences. As highlighted by global tourism industry statistics, the impact of social media on tourism can be particularly powerful for the younger 46% demographic (Tjoe, 2022). Effective social media marketing can focus not only on inspiring content about your travels or activities but also on highlighting the truly amazing aspects of your particular corner of the world.

Every social post can contribute to building awareness, trust, and anticipation. Social media marketing has been highly influential in the way companies communicate with their

customers and market products. This has been particularly felt in the hospitality and tourism industry.

Moreover, the introduction of the Internet has also helped the trending nature of these social media networks:

- Transforming the travel search- They can check the possible hotels, restaurants, and accommodations they can use. These social media channels help with good pictures, ratings, and reviews of places where tourists and travelers can stay.
- Facilitate the booking process - Online bookings can come from various sources: from social networks to Large Online Travel Agents - so it helps to direct and dedicate the booking or program.
- Share the experience - The importance of social media in the tourism industry becomes clear when you consider how people want to share and share their tourism experiences online. Social posts can be very important.
- Increase in social sharing- What various social media marketing sites have done is to make it easy and amplify people's choice to share travel experiences. This helps in building good content. This trend has been noticed by some hotels and resorts that have started to run online campaigns that ensure they are compensated for displaying their activities online.
- Improves customer support- Social media has helped transform customer service and satisfaction at various companies. Many brands have a unique social media presence that they use to get customer feedback. These social media channels are avenues where they can ask their customers about their experiences and get instant feedback.
- Restructuring of travel agencies - Social media has had a positive impact on the restructuring of large travel agencies. With the easy flow of information and smooth booking, these travel agencies have undergone some restructuring. There are now many self-booking features that can eliminate the use of agents for future travel bookings.
- Loyalty Rewards System-Many markets know that keeping new customers is much more expensive than keeping old ones. This has made offering loyalty rewards to customers very important in the travel sector. Social media has played a major role in how various hotel loyalty promotions are designed to retain existing customers (Hosts, 2023).
- Increase brand awareness and exposure- Social media marketing helps increase brand awareness and exposure. Tourism companies can use social media to share photos and videos of tourist destinations and to share stories and experiences from previous customers.

- Increase customer involvement and engagement - Social media marketing can help increase customer involvement and engagement. Tourism companies can use social media to share different stories and experiences from previous consumers and to encourage consumer participation in discussions and debates about tourist destinations and their experiences.
- Driving bookings and sales- Social media marketing can help drive bookings and sales. Tourism companies can use social media to share special offers and vacation packages with consumers and help drive ticket purchases and hotel reservations.
- Reputation monitoring and crisis management - Social media marketing can help with reputation monitoring and crisis management. Tourism companies can use social media to track customer comments and feedback and react in time to resolve any problems or concerns the customer may have.

The impact of social media on the tourism industry cannot be quantified. It has increased the visibility of various tourism brands and attracted more customers to their services. More people online can now easily search for information on the most fun places with just a click of a button (Hosts, 2023).

Social media marketing helps tourism companies connect with consumers in new ways and create long-term relationships with them. If a tourism company has a good social media marketing strategy, it can have a positive impact on consumer behavior in the tourism sector. The mobile travel industry's presence has exploded compared to where it was even a few years ago. Social media are opening the way for people from different corners of the world to plan their trips and share their experiences abroad. No matter where you are in the world, social media has an impact on tourism, so you should include it in your digital marketing strategy.

**Advantages and disadvantages of using social media marketing in the
tourism industry**

Advantages	Disadvantages
The biggest audience reach	You may get negative feedback
Faster dissemination of information	It can be abusive
You have a direct connection with your audience	You have to spend a lot of time on your campaigns
You build your brand	You open up the potential for mistakes in higher transparency
You can create viral content	Confidential information may be disclosed
You can join social media networks for free	Only social media users are accessible
You can rate your performance	Fake information can also be distributed
Reduction of time cost	Addicted to the Internet
It's global	Transparency can cause confusion among consumers

Table 2: Advantages and disadvantages of using social media in the tourism industry

3. Conclusions

Social media is becoming more and more popular. It is experiencing a significant effect on a variety of social and economic issues. In the tourism industry, social networks are vital. The tourism industry deals with potential tourists, vacationers, and tourists who wish to share their experiences.

According to the report and those mentioned above in the paper, social media can be used to increase awareness of the destination, reach the masses, encourage travelers to plan their trip, strengthen the image of the destination as a destination favorite, target new or specific markets, increase the number of visitors, create buzz around the goal and increase the number of likes on social networks.

As a result, leading destination marketing companies have started using social media to promote tourism destinations and products. It would be a failure for any destination in today's corporate world to ignore the demands of social media marketing as it serves as a means to connect with consumers and share details about updates, purchases, and rewards.

At this point, the links between social media and the tourism industry have become inseparable. The impact of social media on tourism and hospitality is huge. Today we have tourism businesses of all sizes leveraging social media to raise awareness, engage with potential guests and improve bookings (Truyols).

4. References

- (SHETOS), S. O. (1942). Nazim Ibrahim Frakulla from Berati. *Kultura Islame*, No. 5-6-7, 159.
- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*. Retrieved from <https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953>
- (1939). *Kultura Islame*, No. 6-7, 228-229.
- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), pp. 1-20.
- AFAD. (2022). *Açıklamalı Afet Yönetimi Terimleri Sözlüğü*. Retrieved from Açıklamalı Afet Yönetimi Terimleri Sözlüğü Web Sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Web sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Afet Türleri Web sitesi: <https://www.afad.gov.tr/afet-turleri>
- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 16(1), pp. 17-35. doi:<https://doi.org/10.17130/ijmeh.700812>
- AKSOĞAN , M., & ÇALIŞ DUMAN, M. (2018, Aralık 7-9). Akıllı Şehir Uygulamaları; Malatya Örneği. 1. *Uluslararası Battalgazi Multi Disipliner Çalışmalar Kongresi Tam Metin Kitabı Cilt 1, 1*, pp. 183-202.
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(2).
- AKYEL, R. (2007). *Afet Yönetim Sistemi: Türk Afet Yönetiminde Karşılaşılan Sorunların Tespit ve Çözümüne İlişkin Bir Araştırma*. Adana: Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Doktora Tezi.
- ALAVİ, A., PENGCHENG, J., WILLIAM, G., & NİZAR, L. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. *Measurement*, 129, pp. 589-606.
- Albuquerque, R. (2003). The composition of international capital flows: risk sharing through foreign direct investment. *Journal of International Economics*, 61(2), 353-383.
- Ali, H. (1944). Hasan Zyko Kamberi 200 years ago. *Kultura Islame*, No. 7-8, 201.
- ARMAĞAN, V. (2018). Dijital Dönüşüm Sürecinde Akıllı Şehirler ve E-Devlet Platformu. *İletişim Kuram ve Araştırma Dergisi*(46), pp. 387-414.
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Baetens, F. (2013). *Investment law within international law: integrationist perspectives*. Cambridge University Press.
- Bala, M. (1942). Do we have a modern Albanian drama. *Kultura Islame*, No. 5-6-7, 214.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. Retrieved from <https://www.bbc.com/news/world-europe-17776876>

- Beqiri, G. (2017). Marketinguindërmarrjeve në Kosovë përmes aplikimit të mediave sociale. Tiranë
- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development*, 62, pp. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>
- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from <https://berkeleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>
- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Beurden, S. V. (2022, 4 30). *A New Congo Crisis?* Retrieved from https://origins.osu.edu/article/new-congo-crisis?language_content_entity=en
- Beylikdüzü Belediyesi. (2017). *ABİS (Afet Bilgi Sistemi)*. Retrieved from ABİS (Afet Bilgi Sistemi) Web sitesi: <http://www.beylikduzuhazir.com/Abis>
- Beylikdüzü Belediyesi. (2017). *Beylikdüzü Hazır*. Retrieved from Beylikdüzü Hazır Web Sitesi: <http://www.beylikduzuhazir.com/BeylikduzuHazir>
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri. *International Peace Information Service*, 2-50.
- Britannica. (2021, 12 24). *Romania*. Retrieved from <https://www.britannica.com/place/Romania>
- Britannica. (2022, 01 03). *Security*. Retrieved from <https://www.britannica.com/place/Romania/Political-process>
- Carey, B. (2021, April 1). *What's the Social Media Impact on Tourism?* Retrieved from CheckFront: <https://www.checkfront.com/blog/social-media-impact-on-tourism/>
- Çelik, H. (2022). Türkiye'de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), pp. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- ÇELİK, İ. H., USTA, G., YILMAZ, G., & YAKUPOĞLU, M. (2020). Türkiye'de Yaşanan Teknolojik Afetler (2000-2020) Üzerine Bir Değerlendirme. *AÇÜ Uluslararası Sosyal Bilimler Dergisi*, 6(2), pp. 49-57.
- CENTER for ECONOMIC and SOCIAL RIGHTS. (2022, 04 14). Retrieved from Key Concepts: Human Rights and the Economy: <https://cesr.org/key-concepts/>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*. Retrieved from <https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/>
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania's social strata in the past 30 years*. Retrieved from <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/>
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*. Retrieved from https://www.constituteproject.org/constitution/Romania_2003?lang=en
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*. Retrieved from <https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604.>
- Critic and criticism. (1941). *Kultura Islame, No.20-21*, 179.
- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- Dave Evans with Jake McKee. (2010). *Social Media Marketing: The Next Generation of Business Engagement*. Canada: Wiley Publishing, Inc., Indianapolis, Indiana.

- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf
- De Schutter, O., Swinnen, J., & Wouters, J. (2012). *Foreign direct investment and human development: the law and economics of international investment agreements*. Routledge.
- Deloitte Vodafone. (2016, 12). *Akıllı Şehir Yol Haritası*. DeloitteTürkiye.
- DHI Worldwide. (2018). Improved Flood Control and Water Quality With A Smart Water Solution See How The City Of Vejle In Denmark Protects Its Streets From Flooding. *The Expert In Water Environments*.
- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- DİLER, G. (2012, 04 30). Avrupa Birliği'nin İlk Yeşil Başkenti Stockholm. *Ekoyapı*.
- Dolzer, R., & Stevens, M. (1995). *Bilateral investment treaties*. Martinus Nijhoff Publishers.
- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. Retrieved from <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153>
- ELMAN. (2023). *Elman Sel Erken Uyarı Sistemi*. Retrieved from Elman Sel Erken Uyarı Sistemi Web Sistesi: <https://elmantech.com/ehs/#:~:text=Ta%C5%9Fk%C4%B1n%20erken%20uyar%C4%B1%20sistemi%20nehir,olarak%20uyar%C4%B1lar%20olu%C5%9Fturmas%C4%B1%20esas%C4%B1na%20dayan%C4%B1r>
- ERSOY YILMAZ , A. (2020). *Afet Yönetimi*. Acil Durum ve Afet Yönetimi Uzaktan Eğitim Önlisans Programı.
- EU. (2022, 1 2). *History of the European Union 1960-69*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- EU. (2022, 1 02). *History of the European Union 2000-19*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en
- EU. (2022, 01 03). *Romania*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022>
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. Retrieved from https://europa.eu/ecsc/index_en.htm
- Europa.eu. (2021, 12 30). *Romania*. Retrieved from <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx>
- European Commission . (2022, 1 2). *From 6 to 27 members*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en
- European Commission. (2022, 01 02). *Accession criteria*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union:Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. Retrieved from https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf
- European Commission D G C. (2022, 01 02). *Bulgaria*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en
- European Union. (2022, 1 2). *Country profiles*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles_en
- European Union. (2022, 01 01). *History of the European Union 1945-59*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en

- European Union law. (2021, 01 04). *Accession Treaties*. Retrieved from <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html>
- Foldrejt. (2019). *Çfarë nënkuptojmë me sjelljen konsumatore?* Retrieved from Foldrejt: <https://foldrejt.com/cfare-nenkuptojme-me-sjelljen-konsumatore/>
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Gallagher, K., & Zarsky, L. (2007). *The enclave economy: foreign investment and sustainable development in Mexico's Silicon Valley*. Mit Press.
- GIORDANO, V., GANGALE, F., FULLÌ, G., & JIMENEZ, M. S. (2011). *Smart Grid projects in Europe: Lessons Learned And Current Developments*. Joint Research Centre Institute for Energy European Commission.
- Global Edge. (2021, 12 30). *Romania: Government*. Retrieved from <https://globaledge.msu.edu/countries/romania/government>
- Global Witness. (2009). NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- Goodale, M. (2018, 04). *The UNESCO Courier Seventy-year-old views that remain contemporary*. Retrieved from UNESCO: <https://en.unesco.org/courier/2018-4/seventy-year-old-views-remain-contemporary>
- Heifetz A. R, Linsky M. (2014). *Leadership on the line*. Boston: Harvard Business School Publishing.
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* . Retrieved from <https://www.heritage.org/index/country/romania>
- Hosts. (2023). *What's the Social Media Impact on Tourism?* Retrieved from Hosts: <https://hotspot.earth/blog/whats-the-social-media-impact-on-tourism#:~:text=One%20of%20the%20greatest%20ways,and%20accommodations%20they%20can%20use.>
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>
- ILGAZ, E. (2018). *Akıllı Şehirler ve Akıllı Şehirlerin Kurulmasında Rüzgar Enerjisinin Yönetimi ve Organizasyonu*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yönetim Organizasyon Bilim Dalı Yüksek Lisans Tezi.
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romania-foreign-policy-after-nato-and-eu-accession>
- INSARAG. (2017). *International Search and Rescue Advisory Group (INSARAG)*. Retrieved from International Search and Rescue Advisory Group (INSARAG) Web sitesi: <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response>
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-overview>
- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- İstanbul Büyükşehir Belediyesi AKOM. (2022). *İstanbul Büyükşehir Belediyesi AKOM*. Retrieved from İstanbul Büyükşehir Belediyesi AKOM Web Sitesi: <https://akom.ibb.istanbul/hazirlik-planlama-calismalari/>
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-challenges>
- İzmir Büyükşehir Belediyesi. (2021, 03 12). *Acil İzmir*. İzmir: Bilgi İşlem Dairesi Başkanlığı Harita ve CBS Dairesi Başkanlığı.

- İzmir Büyükşehir Belediyesi. (2022 , 10 3). *İzmir Akıllı İhbar Sistemi ile daha güvende*. Retrieved from İzmir Akıllı İhbar Sistemi ile daha güvende Web Sitesi: <https://www.izmir.bel.tr/tr/Haberler/izmir-akilli-ihbar-sistemi-ile-daha-guvende/47318/156>
- Japan Experience . (2014, 11 10). *Japan Experience*. Retrieved from Kasukabe Underground Flood Protection Tank Web Sitesi: <https://www.japan-experience.com/all-about-japan/saitama/attractions-excursions/kasukabe-underground-flood-protection-tank>
- Jashi, C. (2013). Significance of Social Media Marketing in Tourism. *ResearchGate*, 36-40.
- JESUS, I., MACHADO, J. A., carvalho, J. L., FERREIRA, J. R., & FIGUEIREDO, L. (2001). Towards the Development of Intelligent Transportation Systems. *Intelligent Transportation Systems Conference Proceedings - Oakland (CA) USA(81)*, pp. 1-6.
- KADIOĞLU, M. (2008). *Afet Zararlarını Azaltmanın Temel İlkeleri*. (M. KADIOĞLU, & E. ÖZDAMAR, Eds.) Ankara: JİCA (Japonya Uluslararası İşbirliği Ajansı) Türkiye Ofisi, Yayın No:2.
- KADIOĞLU, M. (2019). *Kent Selleri Yönetim ve Kontrol Rehberi*. Kültür Yayınları.
- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Development*, 6(4), pp. 91-102.
- Kotter, J. (2014). *Accelerate: Building strategic agility for a faster moving world*. Boston: Harvard Business Review Press.
- Kouzes, J, Posner. B. (2022). *The leadership challenge* (Vol. Seventh edition). USA.
- Krajewski, M. (2018). Human rights in international investment law: recent trends in arbitration and treaty-making practice. Available at SSRN 3133529, 1-10.
- Kultura Islame. (1939). 228-229.
- Langevin, L., Lamarche , N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- Leaders Mag. (2022, 01 04). *Romania's Recovery*. Retrieved from http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html
- Li, C. (2014). *The engaged leader; A strategy for your digital transformation*. Philadelphia: Wharton School Press.
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*. Retrieved from <https://www.macrotrends.net/countries/ROU/romania/population>
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- MARCO, A. D., MANGANO, G., SCORRANO, F., NEIROTTI, P., & CAGLIANO, A. C. (2014). Current Trends In Smart City Initiatives: Some Stylised Facts. *Cities*, 38, pp. 25-36.
- Mayfield, A. (2008). *What is Social Media?* iCrossing.
- McKinsey. (2018). *Smart Cities: Digital Solutions For A More Livable Future*. McKinsey & Company.
- Md Yusuf Hossein Khan and Tanvir Abir. (2022). *The Role of Social Media Marketing in the Tourism and Hospitality Industry*. IGI Global.
- MEDAK. (2022). *MEDAK*. Retrieved from MEDAK Web sitesi: <https://www.medak.org.tr/faydali-bilgiler/faydali-bilgiler/>
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>

- MONUSCO. (2022, 4 20). *UNITED NATIONS ORGANIZATION STABILIZATION MISSION IN THE DR CONGO*. Retrieved from <https://monusco.unmissions.org/en/drc-attacks-adfarmed-group-may-amount-crimes-against-humanity-and-war-crimes>
- Mosley, L. (2010). *Labor rights and multinational production*. Cambridge University Press.
- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*. Retrieved from <https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants>
- Mustafa, M. (1945). Gjuha amtare, Native language. *Kultura Islame, No. 3-4*, 72.
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- NAM, T., & PARDO, T. (2011, Haziran 12). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, pp. 282-291. doi:<https://doi.org/10.1145/2037556.2037602>
- Nations, D. (2021, January 26). *What Is Social Media?* Retrieved from Lifewire: <https://www.lifewire.com/what-is-social-media-explaining-the-big-trend-3486616>
- NATO. (2022, 01 04). *NATO-Russia relations: the facts*. Retrieved from https://www.nato.int/cps/en/natohq/topics_111767.htm
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME*. Retrieved from <https://netaffair.org/documents/1957-rome-treaty.pdf>
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- ÖZMEN, M. (2013). *Deprem ve Antalya*. Antalya: Kutlu&Avcı Ofset.
- ÖZMEN, M. (2015). *Sel-Taşkın Türkiye ve Antalya*. Antalya: Kutlu&Avcı Ofset Ltd. Şti.
- Pcweb. (2022, October 22). *Tourism industry meaning*. Retrieved from Pcweb.info: <https://pcweb.info/tourism-industry-meaning/?lang=en>
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Petras, J., & Veltmeyer, H. (2007). *Multinationals on trial: Foreign investment matters*. Ashgate Publishing, Ltd.
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- PLUS. (1940). About Albania literary production. *Kultura Islame, No. 10*, 396.
- PLUS. (1940). The poet of "Bagëti e Bujqësi". *Kultura Islame, No. 13-14*, 28.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102. Retrieved from https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.

- POSER, K., & DRANSCH, D. (2010). Volunteered Geographic Information For Disaster Management With Application To Rapid Flood Damage Estimation. *Geomatica*, 64(1), pp. 89-98.
- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Resilient Vejle. (2016). *Vejle's Resilience Strategy*. Resilient Vejle.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. Retrieved from <https://www.romania-insider.com/1918-great-union-historical-events-romania>
- Rufanges , J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.
- ŞAHİN, N. (2007). Afet Yönetimi ve Acil Yardım Planları. *TMMOB İzmir Kent Sempozyumu*, pp. 131-142.
- ŞAHİN, Ş. (2019). The Disaster Management in Turkey and Goals of 2023. *Turkish Journal of Earthquake Research*, 1(2), pp. 180-196.
- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*. Retrieved from <https://www.schengenvisainfo.com/countries-in-europe/eu-countries/>
- Scott, C. (2001). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia. *Torture As Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, Craig Scott, Ed, 3-44.
- Scott, C. (2011). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *TORTURE AS TORT: COMPARATIVE PERSPECTIVES ON THE DEVELOPMENT OF TRANSNATIONAL HUMAN RIGHTS LITIGATION*, Craig Scott, 3-44.
- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- SHROPSHIRE, A. (2019). Stories from the World of Municipal Analytics. *Towards Data Science*.
- Simma, B. (2011). Foreign investment arbitration: a place for human rights? *International & Comparative Law Quarterly*, 60(3), 573-596.
- SOLANAS, A., VLACHOS, I., RAMOS, V., FALCONE, F., POSTOLACHE, O., PERREA, D., . . . MARTINEZ-BALLESTE, A. (2014). Smart Health: A Context-Aware Health Paradigm within Smart Cities. *IEEE Communications Magazine*, pp. 74-81.
- Spar, D. (1999). Foreign investment and human rights. *Challenge*, 42(1), 50-80.
- Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* Retrieved from <https://www.statista.com/statistics/1109873/challenges-romania/>
- Statistics, G. S. (Jan 2023). *The world's most used social platforms* .
- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*–, 2-9.
- T.C. Çevre ve Şehircilik Bakanlığı. (2019). *Akıllı Şehirler Beyaz Bülteni*. Retrieved from https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), pp. 2816-2820.
- TAŞTAN, M. (2018). IoT Based Wearable Smart Health Monitoring System. *Celal Bayar University Journal of Science*, 14(3), pp. 343-350.
- TDK. (2022). *Türk Dil Kurumu Sözlükleri*. Retrieved from Türk Dil Kurumu Sözlükleri Web Sitesi: <https://sozluk.gov.tr/>

- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>
- The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF*. Retrieved from <https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html>
- The World Bank. (2021, 12 25). *The World Bank in Romania*. Retrieved from <https://www.worldbank.org/en/country/romania/overview#1>
- Tjoe, K. (2022, February 28). *The vital role of social media in tourism marketing*. Retrieved from Rezdy blog: <https://rezdy.com/blog/the-vital-role-of-social-media-in-tourism-marketing/#:~:text=Social%20media%20can%20be%20a,up%20in%20the%20area%2C%20and>
- Toral, M., & Schultz, T. (2010). The state, a perpetual respondent in investment arbitration? Some unorthodox considerations. *The backlash against investment arbitration: Perceptions and reality*, 577-602.
- TÖRENCİ, H. E. (2015). *Afet Yönetimi ve Bursa'da Sağlık Sektöründe Afet Yönetimi*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yüksek Lisans Tezi.
- Trading Economic. (2022, 01 03). *Romania GDP*. Retrieved from <https://tradingeconomics.com/romania/gdp>
- Truyols, M. (n.d.). *POSITIVE AND NEGATIVE EFFECTS OF SOCIAL MEDIA ON THE TOURISM INDUSTRY*. Retrieved from Hotelmize: <https://www.hotelmize.com/blog/positive-and-negative-effects-of-social-media-on-the-tourism-industry/>
- Tudor, I. (2008). *The Fair and Equitable Treatment Standard, in the International*. Oxford University Press on Demand.
- Türkiye Bilişim Vakfı (TBV). (2016). *Türkiye Akıllı Şehirler Değerlendirme Raporu*. Türkiye Bilişim Vakfı (TBV).
- Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı. (2014). *Onuncu Kalkınma Planı Afet Yönetiminde Etkinlik Özel İhtisas Komisyonu Raporu*. Ankara: T.C. Kalkınma Bakanlığı.
- TÜRKOĞLU, H. (2014). *İSMEP Rehber Kitaplar Afete Dirençli Şehir Planlama ve Yapılaşma*. İstanbul: İstanbul Valiliği, İstanbul İl Afet ve Acil Durum Müdürlüğü (İstanbul AFAD), İstanbul Proje Koordinasyon Birimi (İPKB).
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Wahington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from <https://www.unhcr.org/558c0e039.pdf>
- United Nations. (2023, 04 18). Retrieved from United Nations Human rights office of the high commissioner : <https://www.ohchr.org/en/human-rights/economic-social-cultural-rights>
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- Valarm. (2022). *Valarm*. Retrieved from Valarm Web Sitesi: <https://www.valarm.net/blog/monitoring-water-levels-flood-detection-early-warning-systems-virginia-smart-cities/>
- Voineagu , V. (2022, 01 02). *ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING I.I-28.II.2007 PERIOD*. *IDEAS*, 48-72. Retrieved from <https://plagiarism.repec.org/socol-socol/socol-socol2.pdf>
- World Bank. (2021, 12 29). *Gross domestic product 2020*. Retrieved from <https://databank.worldbank.org/data/download/GDP.pdf>

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- World Bank. (2023, 04 10). Retrieved from World Development Indicators:
<https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#>
- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from
<https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>
- YAMAN KOCADAĞLI, A. (2017). *Beylikdüzü'nün Coğrafi Özellikleri*.
- YAMAN, M., & ÇAKIR, E. (2018). Dijitalleşen Dünyada Akıllı Afet ve Acil Durum Uygulamaları. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 7(2), pp. 1124-1138.
- YILDIRIM, A. M. (2022). *Akıllı Şehirlerde Trafik Yönetimi İçin Bir Dinamik Rotalama Yöntemi ve Cupcarbon Gerçekleşmesi*. Kocaeli: Kocaeli Üniversitesi Fen Bilimler Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı Yüksek Lisans Tezi.
- YILDIZ, D. (2013, 03 22). Ekolojik Kentsel Dönüşümde Örnek Kent : Stockholm. *Stockholm Winner 2010 European Green Capital*, pp. 1-9.
- ZHANG, K., YANG, K., REN, J., SHEN, X. S., NI, J., & LIANG, X. (2017). Security and Privacy in Smart City Applications: Challenges and Solutions. *IEEE Communications Magazine*, pp. 122-129.

**MIGRATION AND UNIMPLEMENTED HUMAN RIGHTS: CASE OF EASTERN
OF THE DEMOCRATIC REPUBLIC OF CONGO**

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ABSTRACT

Migration and human rights are usually connected each other due to the contexts of war conflicts in the Democratic Republic of Congo. Different analyses reveal a big number of Congolese who flee their homes because of gradual conflicts that exist from more than two decades. The reality is that Democratic Republic of the Congo is one of the most underlined country holding rebels and insurgents in East Africa. This situation gives result on violation of human right and uncontrollable trafficking due to human migration. This study analyzes the fundamental causes of migration in the Democratic Republic of Congo's eastern region, as well as the application of human right violation. In addition, it emphasizes the importance of regional and international actors in assisting in finding concrete solutions to problems. This research is conducted through qualitative research method which examines some documents related with migration and human rights as focus of data collection. The research results confirm that Congolese decide to leave from homeland due on the scarcity of peace and prevention of human right. From that perspective, war conflicts are increased under various reasons which have been analyzed. As there is lack of official judiciary instruments about human rights, migration is gradually increasing in Eastern of the Democratic Republic of Congo. Therefore, the existence of many rebels and army groups in the region contributes the violation of human right whose impacts are based on inciting migration to neighboring countries and other countries.

Keywords: Eastern Africa, Migration, Human Right, RDC, Impunity

INTRODUCTION

One of the key causes leading to the current deadlock in the violence in eastern DRC is poor mining governance. Hundreds of thousands of Congolese artisanal miners rely on minerals found in South Kivu and Ituri, but their trade and exploitation are plagued by largescale corruption and human rights atrocities done by armed groups, including undisciplined parts of the national army (Brier, 2021). Even if the level of the ferocity of the armed conflict that has plagued the Democratic Republic of Congo (DRC) for the past two decades has gradually decreased.

The situation of violence and instability in the east of the country, which began with Laurent Desiré Kabila's 1996 coup d'état against Mobutu Sese Seko and culminated in his surrender of power in 1997, persists. Following that, in 1998, the so-called 1st African World War began, in which Burundi, Rwanda, and Uganda, along with various armed groups, attempted to depose Kabila, who had received support from Angola, Chad, Namibia, Sudan, and Zimbabwe. This war was a result of deaths of nearly five million people, including at least 200.000 women, forced displacement of hundreds of thousands, and a long-term humanitarian disaster. The signing of a ceasefire in 1999, as well as various peace agreements between 2002 and 2003, resulted in the withdrawal of foreign troops and the formation of a transitional government led by Joseph Kabila, followed by an elected government in 2006, which was approved by referendum in 2011 elections amid allegations of fraud (Rufanges & Royo Aspa, 2016).

Nonetheless, due to Rwanda's role and the presence of non-demobilized militias like Les Forces Démocratiques pour la Libération du Rwanda (FDLR), which was responsible for the Rwandan genocide in 1994, this approach, did not end bloodshed in eastern DRC. Non-compliance with the peace agreements in 2009 prompted militants from the former CNDP to abandon the Congolese Army, which they had joined in 2012. According to Beswick, those who deserted formed the Mouvement du 23-Mars, which was sponsored by Rwanda (BESWICK, 2012). The insurrection was put down in 2013. At the same time, armed actors operating in the DRC, ranging from armed groups to the Armed Forces and other governmental agencies, have committed and continue to commit rapes and other acts of sexual violence as a war weapon. As a result, they contribute to the pervasive climate of insecurity and impunity that exists in the area. In the east of the country, there is ongoing instability and bloodshed, and the control and exploitation of natural resources has led to the

continuation of the DRC war and the deployment of foreign armed forces. As reported by the United Nations for the first time in April 2001, the Congolese Armed Forces (FARDC), local and international armed groups, local enterprises, several bordering countries, and Western and Asian multinationals have all been involved in this business. Even while considerable progress has been made in terms of the application of due diligence requirements to ensure that supply chains do not promote the mining of minerals from conflict-affected and high-risk areas, the mineral sector continues to ignore them, demonstrating the relevance of smuggling (Rufanges & Royo Aspa, 2016). According to the UN Group of Experts, Rwanda is where the majority of unlawfully exported resources are laundered and labeled (OCHA Services, 2001). However, there are a number of measures in place at the federal level.

In the end, the fact that the country experienced increased political instability, as Kabila's second presidential term draws to a close had to be emphasized. Political violence, suppression of the opposition, and the use of disproportionate force in mobilizations had all increased. Non-compliance with the electoral calendar had become a reality, which might lead to the postponement of elections and the extension of Joseph Kabila's presidential mandate, which was set to expire at the end of 2016, an issue that could spark a new cycle of instability (Rufanges & Royo Aspa, 2016). Finally, it is crucial to mention that the DRC has embarked on a new path of democratization following the arrival of new President Felix Tshisekedi. Soft-Power strategy has been seen as advocating for the construction of a new Eastern DRC devoid of war and turmoil. Felix Tshisekedi followed the same strategy with of the Burundian President Evariste Ndayishimiye as he presented his foreign policy to the international audience, inviting various leaders from other countries to discuss bilateral relations with the once-dubbed "enemy of the state" (Bigirimana, 2022). He made the decision to change DRC's fate in a different way than his fore fathers. He outlines the Congolese focus while dealing with other countries and ensures that Africa as a whole is liberalized in his foreign policy.

The main question of this study is how does Congolese government deal with regional actors and human right defenders in case of promoting security of people and decreasing the number of regional migration?. The design of this study of giving a brief presentation of region challenges on migration followed by the case of Eastern Congolese migration and rule of law in protecting people. After the brief introduction, the study will display the

conceptual framework and go around with analyzing the unimplemented human right in DRC and finally, searching and devotement of the solution to mixed migration challenges.

1.1. Brief Overview of Congolese refugees

1.1.1. Congolese Refugees: A Portrait

Congolese refugees in Burundi are mostly from Katanga and South Kivu Provinces, but Congolese refugees in Rwanda are virtually entirely from North Kivu. The majority of people in Tanzania come from South Kivu, while the majority of people in Uganda come from North Kivu. The majority of the refugees in Rwanda and Tanzania today left in 1996, with a second peak in 1999 in Tanzania (UNHCR, 2022). Between 2002 and 2005, there was a steady but significant increase in immigration in all four countries, with Uganda seeing the most growth Banyarwanda people make up the majority of Congolese refugees. The remaining Congolese refugee populations come from a wide range of ethnic groups. The bulk of the refugees in the DRC are under the age of 18. For the prolonged population, the average household size is expected to be five people. A large majority of Congolese refugees do not have access to formal schooling. They speak a variety of languages, the most common of which are Kinyarwanda and Kiswahili (UNHCR, 2022). Although French is more widely spoken than English, French skills are vanishing in English-speaking host nations. Moreover, agriculture is where the bulk of Congolese refugees labor.

The majority of Congolese refugees from eastern DRC live in camps or settlements in the Great Lakes and Southern Africa region, most of who have been there for many years. The 45,124 Congolese refugees registered in Burundi as of January 1, 2014 reside in the city of Bujumbura. The 72,988 Congolese refugees registered in Rwanda dwell in different camps of the country (Ibid). In addition, the 64,569 Congolese refugees in Tanzania are housed in Nyarugusu camp; eighty-eight percent of Uganda's 155,742 Congolese refugees live in settlements, while twelve percent live in Kampala. The goal of this research is to better understand the fundamental causes of migration in the Democratic Republic of Congo's eastern region, as well as the application and violation of human rights against Congolese residing there. This research will also reveal how these infractions affect the country's sociopolitical and economic circumstances, as well as what may be done to improve things. To do this, the focus of this research will be on other researchers and articles on the subject. The following are the research objectives, which have been designed to achieve the above-mentioned goal: Understanding the causes and consequences of migration and human rights

violations in the Eastern region of the DRC, to address the underlying cause of relocation in this socially polarized region of the DRC. Demonstrating how education and democratic values may be utilized to combat all forms of evil in the global environment and finally, to emphasize the importance of regional and international actors in assisting in the development of concrete solutions to problems.

CONCEPTUAL FRAMEWORK

The humanitarian, human rights, and security situation in the DRC have been deteriorating, its effects have been disastrous for the Congolese people, with 4.5 million people uprooted from their homes, the highest number in Africa, and 2 million children facing famine. In recent months, tens of thousands of refugees have fled to Uganda, Angola, Tanzania, and Zambia (Sewenet, 2019). The 2006 general elections, which saw incumbent president Joseph Kabila win re-election, signaled the end of the transition phase and solidified the control of the national institutions by a democratically elected president and his patronage network (ibid). As the affirmation of Kabila's power hampered the chances of significant changes in the national power balance, numerous factions that had already expressed dissatisfaction with the transitional process refused to integrate their men into the national army (Verweijen & Vlanssenroot, 2017). Since 2015, security forces have killed nearly 300 individuals amid mostly peaceful rallies. As a result, since August 2016, an outbreak of violence between Congolese security forces, government-backed militias, and local armed groups has killed up to 5,000 people in the country's central Kasi area.

Furthermore, government officials and security forces perpetrated widespread repression and grave human rights crimes against political opposition leaders and sympathizers, pro-democracy and human rights activists, journalists, and peaceful protestors throughout 2018. Widespread irregularities, voter suppression, and violence marred the December 30 elections. When voting in three pro-opposition districts was postponed until March 2019, more than a million Congolese were unable to vote (World Report, 2019). Several armed groups, as well as government security personnel, attacked residents in central and eastern Congo, murdering and injuring many innocent people. With 4.5 million people uprooted from their homes and over 130,000 refugees fleeing to neighboring nations, the humanitarian situation remained dire (World Report).

1.2. Driver of Displacement in Eastern DRC

Large numbers of people have been displaced from their homes in the DRC for nearly two decades, frequently repeatedly, because of ongoing war. Over the years, the waves of violence have become so common that they have developed a culture of displacement that has affected practically every resident of the eastern provinces. In September 2014, the DRC had an estimated 2.7 million internally displaced persons (OCHA Services, 2014). The number of internally displaced persons (IDPs) has generally remained around two million for over a decade, despite fluctuations. The highest number of internally displaced persons (IDPs) ever reported in Congo was 3.4 million at the end of 2003 (IDMC, 2022), the number of internally displaced persons (IDPs) increased again at the end of 2013 (to 2.9 million), but has since decreased to 2.6 million. To put the enormity of the crisis in context, the DRC has the world's fifth biggest IDP population, behind Syria (7.6 million), Colombia (5.7 million), Sudan (3.4 million), and Nigeria (3.4 million) (Médecins Sans Frontières, 2014). Inter-ethnic tensions, power battles over natural resources and territory, the development of armed organizations, many of which are foreign, and the meddling of DRC's neighbors in the situation in the east have all contributed to the ongoing war in eastern Congo. Multiple armed groups and militias operating in the eastern provinces, including FARDC, have never made a clear difference between civilians and combatants during the DRC conflict. Furthermore, they have preyed on civilian communities on a regular basis, carrying out arbitrary killings, rapping and kidnapping women, pillaging villages, and forcibly recruiting youngsters into their army. Abuse and harassment of civilians is a common occurrence. People are forced to carry supplies for armed groups and are billed for protection and transportation (Médecins Sans Frontières, 2014).

UNIMPLEMENTED HUMAN RIGHTS

1.1. Human Rights Violation Patterns

In eastern DRC, human rights violations can be classified into three categories:

A. Abuse of human rights by state and non-state actors in the pursuit of physical control over resource-rich areas, as well as trade routes, border checkpoints, and economic hubs. These atrocities were most serious in places touched by the armed conflict in eastern DRC, although they also happened elsewhere;

B. These groups perpetrated human rights violations after conquering these areas in order to maintain control. Most of these were done by fighting sides in the midst of an armed conflict;

C. Systematic violations of economic rights resulting from large-scale looting, theft, and corruption, both in conflict and non-conflict areas, were a motivation for these parties to keep fighting; a major source of finance that sustained their activities and enabled them to continue perpetrating acts of violence against civilians; and a factor that prolonged the conflict (Global Witness, 2009).

Perpetrators and Protection from Discrimination

The Congolese government and security forces, as well as a variety of Congolese non-state armed groups, including the Rassemblement congolais pour la démocratie (RCD) and its three factions RCD-Goma, RCD-Mouvement de libération (RCD-ML), and RCD National, and the Mouvement de la libération du Congo (MLC), have all been perpetrators of all three categories of abuses (MLC) according to many sources. The Union des patriotes congolais (UPC), the Front des nationalistes et intégrationnistes (FNI), the Forces armées du peuple congolais (FAPC), the Forces de résistance patriotique d'Ituri (FRPI), and a host of mai-mai and other groups have all brought chaos to this part of DR Congo (Global Witness, 2009). In addition, companies and individual traders who were willing to trade in natural resources produced under these conditions, or with communities with a history of poor human rights, can be deemed to have contributed to these unfortunate circumstances.

The DRC continues to be plagued by conflict-related sexual and gender-based violence (UN Team of Experts, 2017). Ongoing insecurity, internal displacement, and political tensions pose a threat to progress in combating sexual violence as a weapon of conflict (UN Security Council, 2018). Sexual assault is on the rise in conflict-affected provinces, perpetrated by both armed groups and security officials (UN Security Council, 2018). Moreover, violence against women and girls is on the rise in both social and domestic settings (United States Department of State, 2017). Women and girls have experienced an increase in sexual and gender-based violence in conflict-affected areas as a result of this climate.

The United Nations Population Fund (UNFPA) reported 5,783 occurrences of sexual violence in conflict-affected provinces in 2017, more than double the number in 2016 (UN Team of Experts, 2017). In 2017, conflict-related sexual violence spread to the three Kasai

provinces in the center of the DRC, but the eastern provinces of Tanganyika and Ituri accounted for 72 percent of the instances (Stearns & Vogel, 2015). Armed groups have also been responsible for conflict-related sexual violence in North and South Kivu, with the number of armed organizations increasing from around 70 in 2015¹⁸ to up to 120 in late 2017 (Stearns & Vogel, 2017). This surge in Sexual and Gender based violence (SGBV) incidents in conflict-affected areas is not just due to armed groups, but also to Congolese security forces. In 2017, the number of sexual violence occurrences ascribed to the Congolese army (FARDC) and the Congolese National Police (PNC) increased by 28% and 109%, respectively, when compared to 2016 (UN Peace Keeping, 2018). The victim was in police custody for more than a third of the events (Ibid).

According to the Demographic Health Survey conducted in 2013-2014, 27 percent of women in the DRC had experienced sexual violence at some time in their life, up from 22 percent in 2007 (United States Department of State, 2017); (Promundo, 2014). According to a survey done in North Kivu region in 2013, roughly 65 percent of male participants thought, "Women should accept partner violence to keep the family together." Around 27% of men agreed with the statement "a male can force a woman to have sex, and she may love it" in the same study, indicating a significant level of discriminating views among men (Ibid).

Legal Framework

According the article 8, 12 and 13 of the 2015 Democratic Republic of the Congo Constitution: *The human person is sacred and has the right to life*. The State has the obligation to respect it and to protect it. Each citizen has the right to the full development of his person within respect for the rights of others, of the public order, of ethics and of morals.

The penalty of death is abolished (Article 8)

War crimes, crimes against humanity, the crime of genocide, are punished within the conditions determined by the law, as they are imprescriptible (Article 12). Any propaganda or any incitement to ethnic hatred, to insurrection, to violence or to civil war constitutes a crime punished by the law (Article 13).

1.2. Regional and International Actors

Eastern Neighbors of the DRC

Uganda, Rwanda, and Burundi's rivalries, as well as their internal difficulties, pose a threat to the DRC. These countries have used militias in the DRC to fight proxy wars between themselves. The FDLR, for example, is tied to Uganda and Burundi in their fight against Rwanda. 64 In exchange, Rwanda is linked to assisting rebel organizations fighting Burundi in South Kivu and rebels like the ADF fighting Ugandan President Yoweri Museveni (French, 2009). President Tshisekedi intends to settle this dynamic diplomatically, hence the quadrature framework for rapprochement between Rwanda, Uganda, and Burundi.

The UN Mission in the Democratic Republic of the Congo (MONUSCO)

Since the creation of MONUC in 1999, the United Nations (UN) has been the dominant Inter Governmental Institution (IGI) in the DRC war. The United Nations Security Council (UNSC) established MONUSCO in 2010 as an upgrade to MONUC, with two strategic priorities: civilian protection and support for the stabilization and strengthening of state institutions in the DRC, as well as key governance and security reforms. The United Nations contributes 57 personnel from various member states (UN). Because of MONUSCO's poor response to reported attacks against civilians, the inhabitants of Beni demanded its departure in February 2020. The lack of success was attributed to a lack of financial, people, and logistical capabilities, as well as engagement rules that do not allow for quick involvement when needed (Minani, 2020). Despite these setbacks, MONUSCO's collaboration with the FARDC and the Congolese National Police (PNC) allowed for the safe return of displaced people. The situation of late October 2020 in Pinga, Walikale territory of North Kivu, is a recent example (MAGURU & BA, 2022).

Civil Society

The Catholic Church in the DRC is the most powerful civil society organization with a membership that exceeds 50% of the population. It participates in the DRC's peace process as a neutral party (mediator), facilitating political involvement (mobiliser) (Berkley Center for Religion, 2020). The postponed election and repression sparked actions that went beyond mediation (The Africa Center for Strategic Studies, 2027). Under Kabila's administration, human rights breaches and democratic inadequacies shaped his mobilizer's role, while

Tshisekedi's administration takes a different approach. Furthermore, Actions et Initiatives de Développement Pour la Protection de la Femme et de l'Enfant (AIDPROFEN), which focuses on women and children and receives support from INGOs and the US Embassy, among others, focuses on women and children. In Goma, North Kivu, an equal education initiative for abandoned girls and boys has managed to prevent many from joining armed organizations (AIDPROFEN, 2022).

SOLUTION TO MIXED MIGRATION CHALLENGES

The Government of the DRC has difficulties in central, and the national government that pushed on the lacks of dynamism to fill the void. As a result, the government should lead a structural shift away from overburdening the central government and toward empowering provinces to manage their own affairs. In terms of the economy and security, this entails decentralization. As a result, legitimate authorities at the local level will lead to conflict prevention and resolution. This will inspire grassroots ownership of governance, peace, and security infrastructures. The load on the central government will be decreased as a result of this decentralization process. This will help to strengthen institutions, which is one of the African Charter on Democracy, Elections, and Governance's top priorities (ACDEG) (African Union, 2007). In this vein, more initiatives with political will to work, such as the Inter-provincial Commission to Support the Awareness, Disarmament, Demobilization, and Community Reintegration Process (CIAP-DDRC), which was launched in South Kivu in 2019, are needed in eastern DRC, and the context specificity of the CIAP-DDRC should be emphasized.

This would facilitate the following: the transition of armed groups with ties to local communities into provincial security forces capable of receiving adequate professional training; political participation by focusing citizens' and civil society's attention on appointing suitable leaders to manage the affairs of the provinces. Furthermore, the formulation, implementation, monitoring, and evaluation of policies tailored to the realities of each province rather than the national average. It would also create a climate in which inter-provincial competitiveness might be shifted away from violent confrontation and toward development.

1.3. To Interstate Organization

The timely restructuring of FIB requires the support and facilitation of UN member states (ISS, 2020). Following its triumph over the M-23 movement, it has shown to be the only effective force against armed groups, necessitating SADC's call for FIB reorganization. However, the focus should be on improving its ability to defend civilians. There is also a need to concentrate on local grievances and ties with local communities, which are exploited by armed organizations. These criticisms might readily be construed to MOUNUSCO's harm, jeopardizing the much-needed public trust and support in local communities. As a result, managing and avoiding further attacks would include UN MONUSCO finding a mechanism to avert retaliation and increasing public diplomacy operations. To the ICGLR, the AU, and the RECs to begin, technical and capacity-building assistance for institutions at the grassroots level is needed to help them develop a sense of ownership of governance, peace, and security infrastructures. This is important for peacebuilding because broken institutions are one of the reasons why the conflict in eastern DRC has lasted so long. In addition, the African Union needs to strengthen its presence in the DRC in order to comply with UNSCR 2250, the African Youth Charter, the African Union Continental Framework on Youth Peace and Security, and other similar normative frameworks (s). This is important for conflict prevention and peacebuilding because it will help to occupy and distract the attention of the young population, allowing them to see beyond the use of violence as a means of survival.

The AU PSC may also be required to intervene in international terrorism and violent extremism, establish measures to prevent genocide and other crimes, and become more involved in human rights concerns, particularly to rein in the FARDC's excesses (African Union, 1993). On the youth agenda in the DRC, RECs and the International Conference of the Great Lakes Region (ICGLR) should collaborate with the AU. RECs and member states must also expand their support for President Tshisekedi and his diplomatic strategy in order to boost regional security cooperation. Finally, the AU and RECs should prioritize maintaining peace and facilitating constructive conversation between Pro-Kabila and Pro-Tshisekedi. This would result in a healthy opposition, as is required in a democracy that does not fuel conflict or undermine governmental institutions.

CONCLUSION

Despite significant progress in the DRC's, fight against impunity for human rights violators must be reviewed and making in action new policies to deal with it. Such as the President of the Republic's promulgation of legislation on the implementation of the Rome Statute of the International Criminal Court on December 31, 2015, or the law n°15/013 of August 1, 2015 on rules for implementing women's rights and gender parity, several malfunctions negatively impact the Congolese justice system and impede progress in the effect. During the time under review, the President and Congolese authorities, with the backing of the international community, spearheaded initiatives and public campaigning that resulted in the conviction of at least 231 State agents for conflict-related sexual violence.

Furthermore, according to UNJHRO data, at least 447 FARDC soldiers and PNC operatives were convicted of human rights breaches during the same time. In comparison to the large number of reported human rights breaches, this remains a low figure. The low number of security agents successfully convicted, particularly high-ranking officers, and the difficulty in prosecuting armed group combatants as they physically evade justice. In other word or are rather targeted by military operations, are concerning considerations, especially given that United Nations bodies frequently emphasize the importance of bringing perpetrators of serious human rights and international humanitarian law to justice in order to effectively combat impunity. The percentage of human rights breaches committed by government agents (54, 5%) is alarming. It exposes major institutional flaws as well as a lack of criminal prosecution of human rights violations, particularly by high-ranking officers. This situation must be rectified immediately, especially given the country's current electoral setting, in which security forces are viewed as a tool of the state used to achieve political ends, namely to suppress political opponents, civil society, and the media. Prosecution of armed group combatants for crimes including human rights violations is extremely rare, with only 28 convictions recorded over the time period under consideration.

Amnesty or absorption into the FARDC ranks are frequently offered to armed group combatants. Indirectly, this de facto impunity encourages the commission of violations, which has a negative impact on the victims. The National State of Justice held in Kinshasa from April 27 to May 2, 2015, and coordinated by the Ministry of Justice and Human Rights and the *Conseil supérieur de la magistrature* conveyed a strong message about the government's intention to strengthen the Congolese legal system. The Ministry of Justice

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

and Human Rights' efforts to institutionalize judicial changes are admirable; nevertheless, aggressive prosecutions of human rights violators, legislative reforms, and enough resources supplied by the government and its foreign partners must back them. The East African migration is underlined with a big number of Congolese who abandoned their mother in search of freedom and care of human rights values. The region of eastern RDC is the main in the case of national migration index influenced by several repletion of war and human right violation. Non-respect of principal human right value in the rule of power and well-being of people sourced from government staffs and non-government groups has negative impacts on forming national peace and stability aimed to develop the country.

REFERENCES

- (SHETOS), S. O. (1942). Nazim Ibrahim Frakulla from Berati. *Kultura Islame*, No. 5-6-7, 159.
- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*. Retrieved from <https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953>
- (1939). *Kultura Islame*, No. 6-7, 228-229.
- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), pp. 1-20.
- AFAD. (2022). *Açıklamalı Afet Yönetimi Terimleri Sözlüğü*. Retrieved from Açıklamalı Afet Yönetimi Terimleri Sözlüğü Web Sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Web sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Afet Türleri Web sitesi: <https://www.afad.gov.tr/afet-turleri>
- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 16(1), pp. 17-35. doi:<https://doi.org/10.17130/ijmeh.700812>
- AKSOĞAN , M., & ÇALIŞ DUMAN, M. (2018, Aralık 7-9). Akıllı Şehir Uygulamaları; Malatya Örneği. 1. *Uluslararası Battalgazi Multi Disipliner Çalışmalar Kongresi Tam Metin Kitabı Cilt 1, 1*, pp. 183-202.
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(2).
- AKYEL, R. (2007). *Afet Yönetim Sistemi: Türk Afet Yönetiminde Karşılaşılan Sorunların Tespit ve Çözümüne İlişkin Bir Araştırma*. Adana: Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Doktora Tezi.
- ALAVİ, A., PENGCHENG, J., WILLİAM, G., & NİZAR, L. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. *Measurement*, 129, pp. 589-606.
- Albuquerque, R. (2003). The composition of international capital flows: risk sharing through foreign direct investment. *Journal of International Economics*, 61(2), 353-383.
- Ali, H. (1944). Hasan Zyko Kamberi 200 years ago. *Kultura Islame*, No. 7-8, 201.
- ARMAĞAN, V. (2018). Dijital Dönüşüm Sürecinde Akıllı Şehirler ve E-Devlet Platformu. *İletişim Kuram ve Araştırma Dergisi*(46), pp. 387-414.
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Baetens, F. (2013). *Investment law within international law: integrationist perspectives*. Cambridge University Press.
- Bala, M. (1942). Do we have a modern Albanian drama. *Kultura Islame*, No. 5-6-7, 214.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. Retrieved from <https://www.bbc.com/news/world-europe-17776876>
- Beqiri, G. (2017). Marketinguindërmarrjeve në Kosovë përmes aplikimit të mediave sociale. Tiranë

- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development*, 62, pp. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>
- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from <https://berkeleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>
- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Beurden, S. V. (2022, 4 30). *A New Congo Crisis?* Retrieved from https://origins.osu.edu/article/new-congo-crisis?language_content_entity=en
- Beylikdüzü Belediyesi. (2017). *ABİS (Afet Bilgi Sistemi)*. Retrieved from ABİS (Afet Bilgi Sistemi) Web sitesi: <http://www.beylikduzuhazir.com/Abis>
- Beylikdüzü Belediyesi. (2017). *Beylikdüzü Hazır*. Retrieved from Beylikdüzü Hazır Web Sitesi: <http://www.beylikduzuhazir.com/BeylikduzuHazir>
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri. *International Peace Information Service*, 2-50.
- Britannica. (2021, 12 24). *Romania*. Retrieved from <https://www.britannica.com/place/Romania>
- Britannica. (2022, 01 03). *Security*. Retrieved from <https://www.britannica.com/place/Romania/Political-process>
- Carey, B. (2021, April 1). *What's the Social Media Impact on Tourism?* Retrieved from CheckFront: <https://www.checkfront.com/blog/social-media-impact-on-tourism/>
- Çelik, H. (2022). Türkiye'de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), pp. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- ÇELİK, İ. H., USTA, G., YILMAZ, G., & YAKUPOĞLU, M. (2020). Türkiye'de Yaşanan Teknolojik Afetler (2000-2020) Üzerine Bir Değerlendirme. *AÇÜ Uluslararası Sosyal Bilimler Dergisi*, 6(2), pp. 49-57.
- CENTER for ECONOMIC and SOCIAL RIGHTS. (2022, 04 14). Retrieved from Key Concepts: Human Rights and the Economy: <https://cesr.org/key-concepts/>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*. Retrieved from <https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/>
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania's social strata in the past 30 years*. Retrieved from <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/>
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*. Retrieved from https://www.constituteproject.org/constitution/Romania_2003?lang=en
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*. Retrieved from <https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604.>
- Critic and criticism. (1941). *Kultura Islame, No.20-21*, 179.
- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- Dave Evans with Jake McKee. (2010). *Social Media Marketing: The Next Generation of Business Engagement*. Canada: Wiley Publishing, Inc., Indianapolis, Indiana.
- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf

- De Schutter, O., Swinnen, J., & Wouters, J. (2012). *Foreign direct investment and human development: the law and economics of international investment agreements*. Routledge.
- Deloitte Vodafone. (2016, 12). *Akıllı Şehir Yol Haritası*. DeloitteTürkiye.
- DHI Worldwide. (2018). Improved Flood Control and Water Quality With A Smart Water Solution See How The City Of Vejle In Denmark Protects Its Streets From Flooding. *The Expert In Water Environments*.
- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- DİLER, G. (2012, 04 30). Avrupa Birliği'nin İlk Yeşil Başkenti Stockholm. *Ekoyapı*.
- Dolzer, R., & Stevens, M. (1995). *Bilateral investment treaties*. Martinus Nijhoff Publishers.
- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. Retrieved from <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153>
- ELMAN. (2023). *Elman Sel Erken Uyarı Sistemi*. Retrieved from Elman Sel Erken Uyarı Sistemi Web Sistesini:
<https://elmantech.com/ehs/#:~:text=Ta%C5%9Fk%C4%B1n%20erken%20uyar%C4%B1%20sistemi%20nehir,olarak%20uyar%C4%B1lar%20olu%C5%9Fturmas%C4%B1%20esas%C4%B1na%20dayan%C4%B1r>
- ERSOY YILMAZ , A. (2020). *Afet Yönetimi*. Acil Durum ve Afet Yönetimi Uzaktan Eğitim Önlisans Programı.
- EU. (2022, 1 2). *History of the European Union 1960-69*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- EU. (2022, 1 02). *History of the European Union 2000-19*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en
- EU. (2022, 01 03). *Romania*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022>
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. Retrieved from https://europa.eu/ecsc/index_en.htm
- Europa.eu. (2021, 12 30). *Romania*. Retrieved from <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx>
- European Commission . (2022, 1 2). *From 6 to 27 members*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en
- European Commission. (2022, 01 02). *Accession criteria*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union: Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. Retrieved from https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf
- European Commission D G C. (2022, 01 02). *Bulgaria*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en
- European Union. (2022, 1 2). *Country profiles*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles_en
- European Union. (2022, 01 01). *History of the European Union 1945-59*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en
- European Union law. (2021, 01 04). *Accession Treaties*. Retrieved from <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html>

- Foldrejt. (2019). *Çfarë nënkuptojmë me sjelljen konsumatore?* Retrieved from Foldrejt: <https://foldrejt.com/cfare-nenkuptojme-me-sjelljen-konsumatore/>
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Gallagher, K., & Zarsky, L. (2007). *The enclave economy: foreign investment and sustainable development in Mexico's Silicon Valley*. MIT Press.
- GIORDANO, V., GANGALE, F., FULLÌ, G., & JIMENEZ, M. S. (2011). *Smart Grid projects in Europe: Lessons Learned And Current Developments*. Joint Research Centre Institute for Energy European Commission.
- Global Edge. (2021, 12 30). *Romania: Government*. Retrieved from <https://globaledge.msu.edu/countries/romania/government>
- Global Witness. (2009). NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- Goodale, M. (2018, 04). *The UNESCO Courier Seventy-year-old views that remain contemporary*. Retrieved from UNESCO: <https://en.unesco.org/courier/2018-4/seventy-year-old-views-remain-contemporary>
- Heifetz A. R, Linsky M. (2014). *Leadership on the line*. Boston: Harvard Business School Publishing.
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* . Retrieved from <https://www.heritage.org/index/country/romania>
- Hosts. (2023). *What's the Social Media Impact on Tourism?* Retrieved from Hosts: <https://hotspot.earth/blog/whats-the-social-media-impact-on-tourism#:~:text=One%20of%20the%20greatest%20ways,and%20accommodations%20they%20can%20use.>
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>
- ILGAZ, E. (2018). *Akıllı Şehirler ve Akıllı Şehirlerin Kurulmasında Rüzgar Enerjisinin Yönetimi ve Organizasyonu*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yönetim Organizasyon Bilim Dalı Yüksek Lisans Tezi.
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romania-foreign-policy-after-nato-and-eu-accession>
- INSARAG. (2017). *International Search and Rescue Advisory Group (INSARAG)*. Retrieved from International Search and Rescue Advisory Group (INSARAG) Web sitesi: <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response>
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-overview>
- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- İstanbul Büyükşehir Belediyesi AKOM. (2022). *İstanbul Büyükşehir Belediyesi AKOM*. Retrieved from İstanbul Büyükşehir Belediyesi AKOM Web Sitesi: <https://akom.ibb.istanbul/hazirlik-planlama-calismalari/>
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-challenges>
- İzmir Büyükşehir Belediyesi. (2021, 03 12). *Acil İzmir*. İzmir: Bilgi İşlem Dairesi Başkanlığı Harita ve CBS Dairesi Başkanlığı.
- İzmir Büyükşehir Belediyesi. (2022 , 10 3). *İzmir Akıllı İhbar Sistemi ile daha güvende*. Retrieved from İzmir Akıllı İhbar Sistemi ile daha güvende Web Sitesi: <https://www.izmir.bel.tr/tr/Haberler/izmir-akilli-ihbar-sistemi-ile-daha-guvende/47318/156>

- Japan Experience . (2014, 11 10). *Japan Experience*. Retrieved from Kasukabe Underground Flood Protection Tank Web Sitesi: <https://www.japan-experience.com/all-about-japan/saitama/attractions-excursions/kasukabe-underground-flood-protection-tank>
- Jashi, C. (2013). Significance of Social Media Marketing in Tourism. *ResearchGate*, 36-40.
- JESUS, I., MACHADO, J. A., carvalho, J. L., FERREIRA, J. R., & FIGUEIREDO, L. (2001). Towards the Development of Intelligent Transportation Systems. *Intelligent Transportation Systems Conference Proceedings - Oakland (CA) USA*(81), pp. 1-6.
- KADIOĞLU, M. (2008). *Afet Zararlarını Azaltmanın Temel İlkeleri*. (M. KADIOĞLU, & E. ÖZDAMAR, Eds.) Ankara: JİCA (Japonya Uluslararası İşbirliği Ajansı) Türkiye Ofisi, Yayın No:2.
- KADIOĞLU, M. (2019). *Kent Selleri Yönetim ve Kontrol Rehberi*. Kültür Yayınları.
- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Developmen*, 6(4), pp. 91-102.
- Kotter, J. (2014). *Accelerate: Building strategic agility for a faster moving world*. Boston: Harvard Business Review Press.
- Kouzes, J, Posner. B. (2022). *The leadership challenge* (Vol. Seventh edition). USA.
- Krajewski, M. (2018). Human rights in international investment law: recent trends in arbitration and treaty-making practice. Available at SSRN 3133529, 1-10.
- Kultura Islame. (1939). 228-229.
- Langevin, L., Lamarche , N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- Leaders Mag. (2022, 01 04). *Romania's Recovery*. Retrieved from http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html
- Li, C. (2014). *The engaged leader; A strategy for your digital transformation*. Philadelphia: Wharton School Press.
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*. Retrieved from <https://www.macrotrends.net/countries/ROU/romania/population>
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- MARCO, A. D., MANGANO, G., SCORRANO, F., NEIROTTI, P., & CAGLIANO, A. C. (2014). Current Trends In Smart City Initiatives: Some Stylised Facts. *Cities*, 38, pp. 25-36.
- Mayfield, A. (2008). *What is Social Media?* iCrossing.
- McKinsey. (2018). *Smart Cities: Digital Solutions For A More Livable Future*. McKinsey & Company.
- Md Yusuf Hossein Khan and Tanvir Abir. (2022). *The Role of Social Media Marketing in the Tourism and Hospitality Industry*. IGI Global.
- MEDAK. (2022). *MEDAK*. Retrieved from MEDAK Web sitesi: <https://www.medak.org.tr/faydali-bilgiler/faydali-bilgiler/>
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>
- MONUSCO. (2022, 4 20). *UNITED NATIONS ORGANIZATION STABILIZATION MISSION IN THE DR CONGO*. Retrieved from <https://monusco.unmissions.org/en/drc-attacks-adfarmed-group-may-amount-crimes-against-humanity-and-war-crimes>
- Mosley, L. (2010). *Labor rights and multinational production*. Cambridge University Press.

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*. Retrieved from <https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants>
- Mustafa, M. (1945). Gjuha amtare, Native language. *Kultura Islame, No. 3-4* , 72.
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- NAM, T., & PARDO, T. (2011, Haziran 12). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, pp. 282-291. doi:<https://doi.org/10.1145/2037556.2037602>
- Nations, D. (2021, January 26). *What Is Social Media?* Retrieved from Lifewire: <https://www.lifewire.com/what-is-social-media-explaining-the-big-trend-3486616>
- NATO. (2022, 01 04). *NATO-Russia relations: the facts*. Retrieved from https://www.nato.int/cps/en/natohq/topics_111767.htm
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME* . Retrieved from <https://netaffair.org/documents/1957-rome-treaty.pdf>
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- ÖZMEN, M. (2013). *Deprem ve Antalya*. Antalya: Kutlu&Avcı Ofset.
- ÖZMEN, M. (2015). *Sel-Taşkın Türkiye ve Antalya*. Antalya: Kutlu&Avcı Ofset Ltd. Şti.
- Pcweb. (2022, October 22). *Tourism industry meaning*. Retrieved from Pcweb.info: <https://pcweb.info/tourism-industry-meaning/?lang=en>
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Petras, J., & Veltmeyer, H. (2007). *Multinationals on trial: Foreign investment matters*. Ashgate Publishing, Ltd.
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- PLUS. (1940). About Albania literary production. *Kultura Islame, No. 10*, 396.
- PLUS. (1940). The poet of "Bagëti e Bujqësi". *Kultura Islame, No. 13-14*, 28.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102. Retrieved from https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.
- POSER, K., & DRANSCH, D. (2010). Volunteered Geographic Information For Disaster Management With Application To Rapid Flood Damage Estimation. *Geomatica*, 64(1), pp. 89-98.

- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Resilient Vejle. (2016). *Vejle's Resilience Strategy*. Resilient Vejle.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. Retrieved from <https://www.romania-insider.com/1918-great-union-historical-events-romania>
- Rufanges , J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.
- ŞAHİN, N. (2007). Afet Yönetimi ve Acil Yardım Planları. *TMMOB İzmir Kent Sempozyumu*, pp. 131-142.
- ŞAHİN, Ş. (2019). The Disaster Management in Turkey and Goals of 2023. *Turkish Journal of Earthquake Research*, 1(2), pp. 180-196.
- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*. Retrieved from <https://www.schengenvisainfo.com/countries-in-europe/eu-countries/>
- Scott, C. (2001). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *Torture As Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, Craig Scott, Ed, 3-44.
- Scott, C. (2011). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *TORTURE AS TORT: COMPARATIVE PERSPECTIVES ON THE DEVELOPMENT OF TRANSNATIONAL HUMAN RIGHTS LITIGATION*, Craig Scott, 3-44.
- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- SHROPSHIRE, A. (2019). Stories from the World of Municipal Analytics. *Towards Data Science*.
- Simma, B. (2011). Foreign investment arbitration: a place for human rights? *International & Comparative Law Quarterly*, 60(3), 573-596.
- SOLANAS, A., VLACHOS, I., RAMOS, V., FALCONE, F., POSTOLACHE, O., PERREA, D., . . . MARTINEZ-BALLESTE, A. (2014). Smart Health: A Context-Aware Health Paradigm within Smart Cities. *IEEE Communications Magazine*, pp. 74-81.
- Spar, D. (1999). Foreign investment and human rights. *Challenge*, 42(1), 50-80.
- Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* Retrieved from <https://www.statista.com/statistics/1109873/challenges-romania/>
- Statistics, G. S. (Jan 2023). *The world's most used social platforms* .
- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*–, 2-9.
- T.C. Çevre ve Şehircilik Bakanlığı. (2019). *Akıllı Şehirler Beyaz Bülteni*. Retrieved from https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), pp. 2816-2820.
- TAŞTAN, M. (2018). IoT Based Wearable Smart Health Monitoring System. *Celal Bayar University Journal of Science*, 14(3), pp. 343-350.
- TDK. (2022). *Türk Dil Kurumu Sözlükleri*. Retrieved from Türk Dil Kurumu Sözlükleri Web Sitesi: <https://sozluk.gov.tr/>
- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>

- The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF*. Retrieved from <https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html>
- The World Bank. (2021, 12 25). *The World Bank in Romania*. Retrieved from <https://www.worldbank.org/en/country/romania/overview#1>
- Tjoe, K. (2022, February 28). *The vital role of social media in tourism marketing*. Retrieved from Rezdy blog: <https://rezdy.com/blog/the-vital-role-of-social-media-in-tourism-marketing/#:~:text=Social%20media%20can%20be%20a,up%20in%20the%20area%2C%20and>
- Toral, M., & Schultz, T. (2010). The state, a perpetual respondent in investment arbitration? Some unorthodox considerations. *The backlash against investment arbitration: Perceptions and reality*, 577-602.
- TÖRENCİ, H. E. (2015). *Afet Yönetimi ve Bursa'da Sağlık Sektöründe Afet Yönetimi*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yüksek Lisans Tezi.
- Trading Economic. (2022, 01 03). *Romania GDP*. Retrieved from <https://tradingeconomics.com/romania/gdp>
- Truyols, M. (n.d.). *POSITIVE AND NEGATIVE EFFECTS OF SOCIAL MEDIA ON THE TOURISM INDUSTRY*. Retrieved from Hotelmize: <https://www.hotelmize.com/blog/positive-and-negative-effects-of-social-media-on-the-tourism-industry/>
- Tudor, I. (2008). *The Fair and Equitable Treatment Standard, in the International*. Oxford University Press on Demand.
- Türkiye Bilişim Vakfı (TBV). (2016). *Türkiye Akıllı Şehirler Değerlendirme Raporu*. Türkiye Bilişim Vakfı (TBV).
- Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı. (2014). *Onuncu Kalkınma Planı Afet Yönetiminde Etkinlik Özel İhtisas Komisyonu Raporu*. Ankara: T.C. Kalkınma Bakanlığı.
- TÜRKOĞLU, H. (2014). *İSMEP Rehber Kitaplar Afete Dirençli Şehir Planlama ve Yapılaşma*. İstanbul: İstanbul Valiliği, İstanbul İl Afet ve Acil Durum Müdürlüğü (İstanbul AFAD), İstanbul Proje Koordinasyon Birimi (İPKB).
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Washington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from <https://www.unhcr.org/558c0e039.pdf>
- United Nations. (2023, 04 18). Retrieved from United Nations Human rights office of the high commissioner : <https://www.ohchr.org/en/human-rights/economic-social-cultural-rights>
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- Valarm. (2022). *Valarm*. Retrieved from Valarm Web Sitesi: <https://www.valarm.net/blog/monitoring-water-levels-flood-detection-early-warning-systems-virginia-smart-cities/>
- Voineagu , V. (2022, 01 02). *ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING I.I-28.II.2007 PERIOD*. *IDEAS*, 48-72. Retrieved from <https://plagiarism.repec.org/socol-socol/socol-socol2.pdf>
- World Bank. (2021, 12 29). *Gross domestic product 2020*. Retrieved from <https://databank.worldbank.org/data/download/GDP.pdf>
- World Bank. (2023, 04 10). Retrieved from World Development Indicators: <https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#>

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from <https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>
- YAMAN KOCADAĞLI, A. (2017). *Beylikdüzü'nün Coğrafi Özellikleri*.
- YAMAN, M., & ÇAKIR, E. (2018). Dijitalleşen Dünyada Akıllı Afet ve Acil Durum Uygulamaları. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 7(2), pp. 1124-1138.
- YILDIRIM, A. M. (2022). *Akıllı Şehirlerde Trafik Yönetimi İçin Bir Dinamik Rotalama Yöntemi ve Cupcarbon Gerçekleşmesi*. Kocaeli: Kocaeli Üniversitesi Fen Bilimler Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı Yüksek Lisans Tezi.
- YILDIZ, D. (2013, 03 22). Ekolojik Kentsel Dönüşümde Örnek Kent : Stockholm. *Stockholm Winner 2010 European Green Capital*, pp. 1-9.
- ZHANG, K., YANG, K., REN, J., SHEN, X. S., NI, J., & LIANG, X. (2017). Security and Privacy in Smart City Applications: Challenges and Solutions. *IEEE Communications Magazine*, pp. 122-129.

ROMANIA-EU RELATIONS FROM FULL MEMBERSHIP TO THE PRESENT

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ABSTRACT

The political and economic interdependency pushes several states to come under cooperation and establishes strong partnership in many aspects of life. The development and foundation of European Union promoted economic and welfare of European countries and decreases political instability in the region. This study focus on the Romanian EU relation from full membership to the present, analyses the regional relation under economic and political dimension. This study displayed the Romanian interest on EU, the process and political dimension applied by Romania and it advantages of full integration. The research demonstrated that Romania gained much more advantages than consequences in his membership in the EU member states. In its conclusion, this paper confirmed that the integration of Romania in European Union contributed in setting policies of ameliorating social, economic, and political structures. The relationship between Romania and the EU from its full membership to the present is examined in this article using the content analysis method of qualitative research.

Keywords: Romania, EU, Full Membership, Social Mobility, Integration, Diplomatic Relation.

1. Introduction

The foundation of European Union as an intergovernmental organization in 1993 promoted much more European countries to be collective and work under a policy of partnerships in several issues. Since its foundation, many countries of Europe gate chance to move from a bad style of life to a precious one. Due on this policy of welfare of European countries, many states established several policy toward the EU integration and worked with dignity in order to gain membership.

The foundation based on promoting economy in the region, did not limit his affection on trade cooperation but it outmoded the main point and development many other branches to push over stability and economy in the region. EU seems to be one of the most successful intergovernmental organization in the globe, it power of application still pushing other states to take example from it. The economy interdependency pushes some states to follow the line of integration in the EU, starting from forming strong partnership to a membership status, are timeline exerted by countries in dealing with the incorporation in EU. Romania is one of country who tried and succeed in taking party in EU since 20007. As it was before and after it, Romania is taking place of one of the most important country doing business with EU member states from long.

This study took a while on displaying the demographic structure of Romania followed by its socio-politic structure, give a brief understand of the time line of Romanian policy toward European Union and its diplomatic aspect of progression. Moreover, the study will present advantages and consequence of the integration of Romania in the EU. After the official integration of Romania in the EU many aspect seem to change in the country and the new policy have been established toward the standard of EU member countries. From 2007 to the ongoing time, Romania developed his intern politic and economic. The influence of being member of EU help on state reconstruction and resized the political situation that was facing the country from long. National industry and trade capacity upsized and pushed the stability of development in several aspect of life in the region.

1.1. PRESENTATION OF ROMANIA

1.1.1. Demographique Presentation of Romania

Romania is a state situated in the Southeastern Europe with a total of 238 391 km², it has border with Bulgaria in South, Ukraine in North, the West part there is Hungary and

Serbia in the Southwest followed by Moldova in the East and the Black Sea in the Southeast (Britannica, 2021). The county is very popular and know depend on its forest region of Transylvanian. The country's official language is Romanian and its currency is Romanian Leu, the population of the state is 19.29 million (Macrotrends LLC, 12), (The World Bank, 2021). The report of World Bank demonstrated that in Romania population range is decreasing instead of increasing.

1.1.2. Socio Politic and Economic Structure of Romania

The socio politic situation of Romania changed several times due on politic played in the region and the change rule in the country. In this party starting from social reform to political changes, brief analyze will be done in order to compare the polity of Romania before the membership and how it changes after his integration in the European Union in 2007. According to the historical background of the country, the change of socio political views took place while it started to pursue the participation in NATO. Romania started the movement of taking way to democracy in 20003 with the target of entering NATO and European Union (Constitutional Court of Romania, 2003). The policy toward EU integration pushed the proclamation of Social republic where people derived sovereignty. From the full membership in the European Union, Romania established several policies and developed many factors of promoting social life style followed by economy and political structures.

1.1.2.1. Social

In the past of Romania, the republic was well known as a Social Republic of Romania; during the era of 1947 until 1989 Marxist-Leninist and one party communist dominated the country. The long of 1989 to 1965 the country was recognized as the Romanian People's Republic (Bachman, Romania: A Country Study, 1991).

After the reform of social class in the country, social mobility took place in the region and pushed several changes to be in application. The social mobility was founded by maintaining the evolution of family law, changes of family structure and family life. In other side Break out of women organization, education system was promoted. People of Romania even the political influence of religion in the region is punched principally on Orthodox and Catholics; other religions are not taking important place as the two on top. Finally, the social mobility seems to increase amelioration of social condition, case of Housing, public health and state welfare assistance (Bachman, 1989). The transformation of social class in Romania built a schema of social class under 10 classified groups (Pop, 2013). Staring from

Employers, Managers, Professionals, Supervisors, Self-employed, Technicians and officer workers, skilled manual workers, service and trade workers, unskilled manual works and farmers (peasants). This classification was designed by the report done by Pop while analyzing the new class schema in the Republic of Romania.

After a brief passage dating from the past of Romania in social mobility, Romania established policies to act in accordance with the EU integration and helped on developing several sectors of social life. The Romanian policy toward EU integration was characterized by changing its social status and put in place some amelioration of citizen's life. Creating occupation, establishing a policy to face social income and welfare of householders seem to be in priority of change in social structure in the last decades (China-cee.eu, 2021). The social life of Romanian changed its views after its full integration in the European Union, benefiting from EU social policy and social development toward welfare of people gives change to Romanian to develop its skills and promote much more social security.

1.1.2.2. Economic

As it was in the social structure of Romania before its integration in the EU, the economic average was at the same time under a shot. The country was full of people living in rural economic power, people of the region was much influenced by law economy depended on agriculture. It was underlined by several study that the economic situation of Romania took reform after 2007; its integration to EU promoted the reconstruction of economy and helped on developing his industrial sectors. The world economical rank demonstrated that, in 2020 Romania occupied 45th place of Gross Domestic product globally (World Bank, 2021), the index of economic freedom in 2021 demonstrated that Romania is occupying 43th place with a score of 69.5 in the globe. At the sometime Romania, appear at the 26th class of 45 European countries (Heritage.Org, 2021).

Out of economic change of Romania, one of the most important factor of production that promote education in the region is rentable land. Romania is rich of naturel resources, local industry utilize the prosperity of and contribute in national economic and development (123Helpme, 2021). I should argue that Romania is one of the European states that has adequate suppliers of nature gas and petroleum; it has iron, ore, timbre, coal and salt. By analyzing the result of commercial evolution of Romania, it has high income that is mixing economy and high Human development index and organized labor force. It concluded the

12th place of Europe in total nominal DDP and occupied the seventh largest by sup up power equivalence (International Trade Administration, 2021).

1.1.3. Political Structure

Romania is a democratic republic with has a semi presidential rule, in the state the Prime Minister is at top of government and the president is taking representation of the country at international level. The president has authority of signing some decree and ratify laws announced by the parliament (Europa.eu, 2021). The republic of Romania is an independent sovereign and unitary, the president of Romania is coming to power from a direct election with a term of five years and renewable only two times. The body is government is compose by 329 deputies the government under control of Parliament and 136 senator directly elected (Europa.eu, 2021). Executive, judicial and legislative, forms the Romanian main power (Global Edge, 2021)

2. HISTORICAL BACKGROUND OF THE EU

European Union is an intergovernmental organization established on 1993, it took existence from the European Coal and Steel Community (ECSC) founded in July 23 1952 in Paris (Europa, 2022) followed by the European Economic Community founded under the treaty of Paris in 1951 and the Treaty of Rome in 1957. The movement was influenced by the cooperation of six countries that come together to establish an economic organization with aims to facilitate trade and market between then, the up listed members of the organization at the beginning were: *Belgium, France, West Germany, Italy, the Netherlands, and finally Luxembourg* (EUR-LEX, 2022). By analyzing, the main reasons of creating the European Union seem to stop war among neighbors, establishment of supranational organization to deal with enforcement of democracy and making war unthinkable (European Union, 2022).

2.1. Development of EU Over Decades and Important Events

The periodical analyses of European Union starts with the era of 1945 just after the end of the second WW. Taking point from this time to 1993 is period-characterized changes and development of EU from beginning of cooperation between European countries to the foundation of the intergovernmental and supranational organization.

- Period between 1945 and 1959

This period defined as the post war era, is characterized by the break out of cooperation in Europe, which gives result of foundation of several organization and treaties.

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

The break out of the period are as bellow: 1945, end of WW II in Europe followed by the establishment of the ECSC in 1951. The first treaty in Europe after the WW II took place in 1957 well known as Treaty of Rome that played an important role in bringing together European states (Netaffair.org, 2022). Many European bodies were established just after the WW II as determined in the EU country history: On 4 April 1949 the establishment of NATO, 5 May 1949 the Council of Europe, 9 May 1950 New political Cooperation in Europe and on 18 April 1951 the European Coal and Steel Community (EU, 2022).

- Period between 1960 and 1969

An important remark point named “Period of Economic growth” characterized the era between 1960 and 1969. Some of major activities and events realized in this period was 1960 creation of European Free Trade Association, 1961 construction of Berlin Wall, 1962 Common Agriculture policy, 1963 first international Agreement signed by EEC, 1965 Merger Treaty, 1968 Student riot in Paris, 1968 Break out of Customs Union and finally in 1968 the crush of Prague spring (EU, 2022).

- Period between 1970 and 1979

The fill out of European Community characterized this period, some of predominant events of the era are: the Environmental protection in 1970, up size the member of EU from six to nine in 1973, oil crisis in Europe 1973. During 1974, there was a reduction of disparities among region, new democracy in three country in 1975 and the direct election in the European Parliament in 1979 (EU, 2022).

- Period between 1980 and 1989

During this period in Europe, there has been a change of the views of Europe and the give way from communist. Some events of this term are, rights of worker established in 1980, set up of the initial European research program in 1981, maintaining the policy on the road of single market in 1986, in 1987 the starts of Erasmus program and finally in 1989 the drop down of Berlin wall (EU, 2022).

- Period between 1990 and 1999

This era is the promoted first decade just after the foundation of European Union, during this period in Europe various changes have been remarked, the main aspect of the period is that Europe passed to "*no border system*". All countries member of the organization gained a privilege of free travel. The remarked changes and events of this decade are the first event took place in 1991 that was the break-up of Yugoslavia, 1992 the Maastricht Treaty. the put in place of single market in 1993, creation of European Economic area in 1994, establishment of free border in 7 countries, the treaty of Amsterdam in 1997, and finally the nascent of the Euro in 1998 (EU, 2022).

- Period between 2000 and 2009

This period recognized as the period of "*Further expansion*", during this period extend of Europe influenced by new members occupied the reality of Europe. Some of event and important activities of the decade are the Treaty of Nice in 2001, break out of Euro notes and coins in twelve states in 2002, the first peacekeeping operation of Balkans in 2003. In 2005 the establishment of EU constitution followed by Lisbon treaty in 2007 and finally the global crisis based on economy in 2008 (European Union, 2022).

- Period between 2010 and 2019

This decade was announced as the *challenging* era of EU, in this term the European Union played mayor role in setting policies toward welfare of people and the respect of human right. Underlined that this decade gives conclusion on the decrease of member stated resulted from the referendum of 2016. Displayed events and activities of the decades were listed as bellow; in 2010 the Europe windless the financial crisis, in 2012 Nobel peace prize, 2015 terrorism in Europe followed by the Paris agreement of climate change. After 2015 Europe faced a problem of asylum seeker, in 2016 the United Kingdom elected to be away from the EU and in 2019 the establishment of process to face climate change (EU, 2022).

- The ongoing period from 2020 until present

The most import issues influencing the ongoing era of Europe is the global crises pushed by the Pandemic Covid-19. In the history of EU, this era is called the period

of "Covid-19 and the road to recovery". The main event of the ongoing situation is the Covid-19 pandemic and the fight of human health (European Union, 2022).

2.2. Timeline of European Union Member States

The EU founded in 1993, was promoted by the starting of ECSC under membership of six countries. From this promotion in 1952, the line of change seem to lake progression over time and gives the result of founding the EU in 1993. Since its creation to 2020, the organization has 28 member states. At the end of January 2020, the UK abdicated the organization and given the result of member states of EU to become 27 (European Union, 2022). The timeline of member states of EU is; at the first time, the organization commenced with six countries that established the ECSC in 1951, in 1957 the EEC and the EAEC. The six countries are Belgium, Germany, France, Italy, Luxembourg and the Netherlands (European Commision , 2022).

Timeline of countries that joined the union after the six (Schengen Visa Info, 2022):

1973: Denmark and Ireland

1981: Greece

1986: Portugal and Spain

1995: Australia, Finland, Sweden

2004: Cyprus, Czech Republic, Estonia, Hungry, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

2007: Bulgaria and Romania.

2013: Croatia

The study displayed that many European states joined the Union after the demolishment of Yugoslavia. Romania is one of the recent states to join the European Union comparing with other countries in the timeline of the EU member states (De Munter, 2021).

2.3. Romania's Journey towards Integration into the European Union

2.3.1. Process

The process of Romania to join the EU started long time even before the official idea of founding the European Union, after the Romanian revolution in 1989; the countries started by participate in the EC. After this era, the government of Romania and all political parties manifested the important of it integration in the European Union. In other sources, the regional interest pushed the government of Romania to follow the line of integration, as the

Republic of Bulgaria seem to follow the line in the same time (European Commission D G C, 2022). The first process of Romania to integrate in the European Union started with its first application of membership in 1995, this application take place of decision of the Council of Ministers on 17 July 1995 and provided its consultation under the commission (European Commission, 2022). During his process to join the EU, the government of Romania demonstrated with high competence his capability of dealing with all realizations and norms, obligations of EU member states, at his stage the government promised to upgrade and realizes the obligation under cited.

Some of principal criteria expressed by the Romanian government toward EU are:

- Development of the implementation law and Consolidation,
 - Access of pluralism in politic
 - To separate power
 - Freedom in election
 - Priority and respect of human rights
- Establish the market and capability of economy in accord with EU. All this criteria, are taking reference from the EU enlargement criteria well defined as "*the Copenhagen Criteria*" (European Commission, 2022).

The change of government of Romania in 1966 promoted much more the way to reach the integration in the EU, the president of the term starting by saying that the policy of the country must work hard to make reform in the economic structure of the country (Popescu, 1997).

By analyzing the timeline and process of Romania integration to EU, even there was no any problem remarked during it wait for accordance there have been a hold up of years before it official recognition. The research released that scarcity of reform in administration and slow-moving economy seem to be the main reason of the delay in passing on full agreement (European Commission, 2022). It was remarked that Romania applied its EU membership with too many other countries that have been accepted as countries member of EU in 2004, but the accord of Romania and Bulgaria joined in 2007. According to the register of EU the two states integration is recognized as the *fifth enlargement of the European Union* **Invalid source specified..** On the road to EU, the government of Romania updated it intern policy in order to arrive at the accomplishment of Copenhagen criteria, several changes were realized by the government include the change of government. Romania participated in many

cooperation with other European states. In 1990s, Romania and EU countries signed an agreement on trade cooperation (Phinnemore, 2008).

2.3.2. Diplomatic Relationship

After the deterioration of Romania and Russia in 2000, Romania started to push its foreign policy in the west power (IMEMO, 2022). The accession of the country in NATO promoted its relation with the United States. After 2007 Romania played a major role of increasing its relation with European states due to its full membership in the European Union (Pridham, 2007). The summary of diplomatic relations of Romania and European Union was not founded by the full membership in the organization but since the regional cooperation between European countries, the government of Romania was influenced by western cooperation more than the other side of Soviet priority. The views of Romanian foreign policy changed just after it got the occasion of joining NATO in 2004 and the EU in 2007 (OLTEANU, 2020).

3. ADVANTAGES AND CHALLENGES OF ROMANIA IN THE EUROPEAN UNION

3.1. ADVANTAGES

3.1.1. Social-economic

In this passage we will try to take away to analyze the socio-economic changes in Romania before its membership to EU and compare with its situation after the integration in the European Union. Comment on the reality of change and the influence of EU on the socio-economic changes of Romania.

3.1.1.1. Social

During the process of Romania to access the EU, several developments took place and influenced extraordinary changes in all aspects of life and social evolution. As the government played an important role in promoting and achieving the request of membership of EU, at the same time welfare of people and upsizing social criteria were at the first place.

The timeline of social change of Romania started with the end of the communist regime in 1989 **Invalid source specified.**, that promoted his way regarding democracy and capitalist system. The long of communist era, Romanian people's life was set with successful policy from the communist rule; all rights and needs of people were fulfilled. The situation of Romania seems to change and passed in mediocre situation just after its social structure changes from Communist to road of democracy **Invalid source specified.** It was argued

with Friedlmier and his colleagues that, after the social change in 1989 in social life the role of women changed its views and women were taking role in the care of family and jobs. Young and adolescent were the most challenged by the changes due on the non-adaptation on work **Invalid source specified..**

With the success of Romania to integrate in the European Union, countless social changes break out, with the power of democracy the social class of Romania changed and women participation in much aspect of life took place. Democratic liberation pushes political parties to act with guaranty of existence and freedom. With the contribution of the EU, established policies to maintain welfare of Romanian and durability of social structure are mentioned as bellow **Invalid source specified.:**

- *Employment:* it is policy established in order to decrease the economic situation in the region and promote the increase of social income in the society. In additional this policy promoted active labour and market policies, facing the take forward of working mass and skill inadequacy.

- *Poverty and income inequity:* this policy was established in 2015 with the aim of resizing the average of poverty in the country and make stability on income issues. This policy pushed the integration of social income, education, labour market, health, housing and social participation policies for people of countryside.

- *Social inclusion of downsides category:* this policy faces women places in society and the principle right of children.

- *Migration policy:* this policy was established to deal with "*Diaspora start-up*" influenced by people who emigrant back to Romania.

Out of those policies putted in place by the EU, many other programs have been organized by the organization in order to promote the development of social structures of Romania. From it full membership in the EU Romania benefited from the EU more package of setting is socio economic progress **Invalid source specified..** The republic of Romania has 15 representative in the European Economic and social committee (EESC) working in the advisory of the countries and deal with changes and social situation (EU, 2022).

3.1.1.2. Economic

Statistical result of several research's done in 2007 demonstrated that Romania upsized it socio-economic style just after its integration in EU. Economically, the country developed much more all sectors of production. Starting from industry, foreign trade,

tourism, trade and services, Earning, labour force and marketing, unemployment (Voineagu , 2022). According to the many found of realized studies, the full membership of Romania promoted the sectoral development followed by increasing welfare of people and guaranty of work.

The sectorial index of development realized after the full membership of Romania in the EU are briefly demonstrated as bellow (Voineagu , 2022): This average are given by comparing February 2006 and February 2007, economy of Romania changes followed this line. Source *Sectoral evolution of Romania*.

- Industry 5.6%
- Resource of primary energy 80.3%
- Construction 27.9%
- Trade and services 71.3% (wholesaler)
- Foreign trade 73.3% Export and 71% Import
- Tourism 16.6%
- Earning 2.5 %
- Unemployment (decreased women 1.3% and men 4.5%)

Out of the brief statistical result of Romania just after a sort moment of its integration in the EU, depends on the economic development of European Union and the implementation of its policy over member states, Romania get chance to upsize it economy and occupied a good rank among European counties even globally.

Global ranking of Romania during time changes;

In 2006, Romania was 48th ranking in GDP of 195 countries published globally; it figured \$122.024 million in 2006 (Country Economy, 2022). In 2020, the World Bank denounced the GDP of Romania with a number of 248.75 billion \$. The World Bank argue that in 2020 Romanian GDP was 0.22 % of global economy (Trading Economic, 2022).

3.1.2. Politics and Security

The political structure of roman seem to move to from another aspect just after if route to democracy, it separation from the communist movement promoted much pore political change in Romania. The political construction of Romania before 1989 was founded under one political party that was the *Communist party of Romania*, it was the only one party officially recognized and acting as the main force in Romanian society (Britannica, 2022). Political change in Romania stated in 1991 under push of constitution of that year, the

adopted constitution of 1991 delated the single party in politics and adopted the rule of democracy and plurality in political parties. It was underlined by the Britannica that, after the adoption of new law in the 1991 constitution political parties revived from WW II come back in activity after this new adoption of law (Britannica, 2022). Security and peace process was not that easy in Romania before it joined NATO in 2004, even before its acceptance as member of NATO Romania seem to be the first Eastern Europe state to join the North Atlantic Treaty Organization (Britannica, 2022). It was argue that the *military force of Romania played an important role in Afghanistan in 2002 where they was representing international security assistance*, confirmed by the Britannica. The body of Romania security is under control of the Ministry of Administration and Interior (MAI). Three divided groups NPF, NG, and BPF form police force.¹⁵

3.1.2.1. Record of event in Romania outline

The time line of Romania profile from its path to EU until now was collected from the BBC news channels in comparison with the Romanian official web and EU reports (BBC, 2022), (Romania-Insider, 2022).

Right way to EU membership

On his way to EU membership in 2004 Romania joined NATO, the presidency of Trian Basescu voted in 2004, Ally Calin Tariceanu took power of prime ministry with plan of stimulating EU oriented changes. In 2005, Romania adopted EU joining treaty (European Union law, 2021).

Full member ship

Romania joined the EU in 2007; this period was characterized by several changes in Romania politic along with the EC notification over Romania prominent corruption in 2008 (CSIS, 2021). The financial crisis in Romania pushed the IMF to fund a package of 20 billion euros to redeem Romania's situation (The New York Times, 2022).

Other political events over time

Here are some political events that took place between 2012 and 2020. In 2012, the government started confrontation over self-denial and corruption and the push of Victor Ponta on the rule of prime ministry (Leaders Mag, 2022). The out pointed event of 2015 was

¹⁵ **NPF:** National Police Force

NG: National Gendarmerie (Military branch of the National police)

BPF: Border Police Force

the resign of Victor Ponta in his previous position after the misconduct that resulted in died of citizens in fire (Chandler, 2015). In 2016, NATO installed a system of defense in the views of Russian opposition (NATO, 2022). The first political event of 2017 was the formation of government by social democrats after the win of December 2016 election and the posttest over government due on corruption process. It was remarked that since the change of political structure in Romania from the communist regime in 1989 the huge demonstration was manifested in 2017 (DW, 2022). 2019 was remarked by the misplace of social democracy that given priority to Centrist Ludovic Orban on the place of prime minister, one year later the defense minister become prime minister in action at the place of Orban (Balkan Insight, 2022).

3.2. CHALLENGES

3.2.1. Copenhagen Criteria

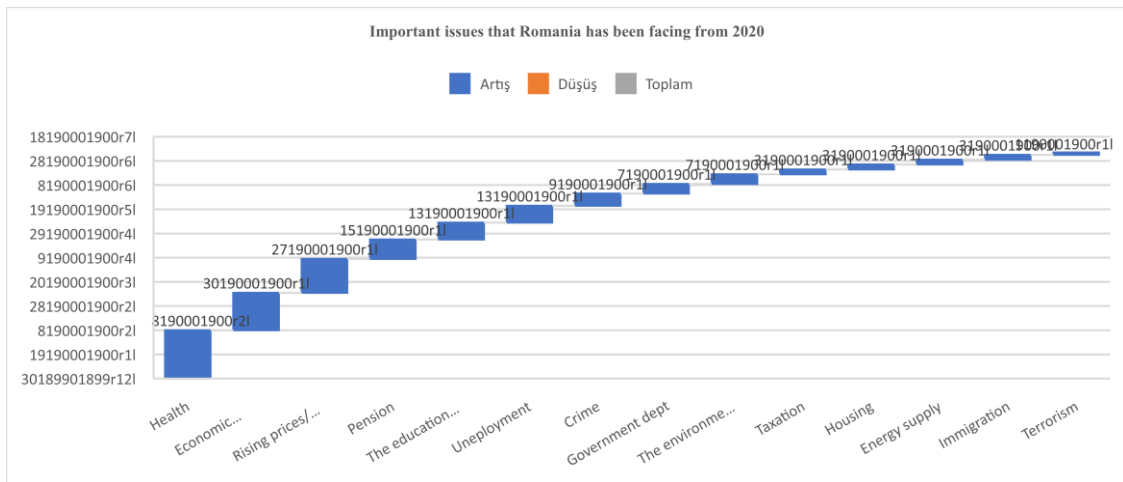
As required to all country that apply membership to the EU, Romania faced the challenge of completing the Copenhagen criteria while starting it road to the EU. At this act, Romania played important role of dealing with the EU requirement. Romania was challenged by establishing an institution of dealing with democracy, implementation of law, promoting human rights and protecting minorities (OECD, 2022). With the work toward integration to EU Romania's incapability on facing integration, criteria seem to result on the delay of Roman to being accepted in the European Union member states.

3.2.2. Socio-economic

After the full membership of Romania there, have been a break out of migration in Romania changes the social status of the country and promoted the fair of EU member states to do not react directly on the issues of Romania. These issues contributed in border instability between EU countries (MPI, 2022). It was underlined that a big number of immigrant who moved from a region to region were under search of labour, in social case one of the most remarked challenge of Romania was of dealing with the decreasing of number of unemployment. Rebuilt economy of Romania was observed as main challenge of the country in completing the criteria of integration, even the government tried why high stage in pushing national economy the reality of corruption seem to increase and pushed the late of country's opportunity to integrate (Statista, 2022). Challenges faced by Romania toward EU membership were characterized by the scarcity of economy and social structure, from its way to EU integration the country worked hard in promoting the power of stability

and complete all needs from the EU. Away from challenges faced by Romania toward EU, the ongoing situation of Romania demonstrate that as all country in globe are suffering from global crisis resulted from the Pandemic Covid-19, at the same level Romania is surviving that challenges (ITA, 2021).

3.2.3. Current important issues that Romania is facing



Source: Statista 2022. <https://www.statista.com/statistics/1109873/challenges-romania/>

CONCLUSION

Starting from the full membership of Romania in EU, the relation of the two actors seem fruitful due on the policies of EU toward member states and the contribution of Romania in the EU. A back analyses of the collected data demonstrated that the EU did not give that much priority on Romania integration due on several challenges faced the country as determined in the timeline. Even Roman applied to join the organization since long time, being out of those states that joined the organization in 2004 displayed how Romania was not that much attractive in the join of the organization at same case of Bulgaria. The join of Romania was not easy depend on that the country was not eligible to complete all the required criteria case of Copenhagen.

The relation of EU and Romania was founded under the EU member states policies toward development and welfare of EU people. Out relation based in organization, Romania has a strong relation with other EU member states due on its power of energy supply. The development of industry in Romanian promoted the increase of bilateral relation between the EU and Romania. With its strong cooperation and integration to EU Romania upsized it economy globally and pushed the change of social structure of the region. The relation

between EU and Romania seem to resize the case in racism in the countries and promoted much social development in the region, at the sometime Romania faced several problem before even after its full membership in the region. Even the relation of Romania and EU appeared in several aspect of development still Romania is facing much many challenges. The most important challenges that is facing Romania are at the top al all there are Heath problems, economic instability followed by the rise of price influenced by inflation. At other side education, system, housing, and environment are underlined in the list of the post important issues of that are facing the country.

In conclusion, the two actor's relation is built under the EU's membership relation followed by the regional influence that are resulted from geopolitical aspect of Romania and the European Union. Even Romania faced more challenges toward EU integration his participation in the intergovernmental organotin displayed this good will in the road of development and cooperation.

REFERENCES

- (SHETOS), S. O. (1942). Nazim Ibrahim Frakulla from Berati. *Kultura Islame*, No. 5-6-7, 159.
- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*. Retrieved from <https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953>
- (1939). *Kultura Islame*, No. 6-7, 228-229.
- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), pp. 1-20.
- AFAD. (2022). *Açıklamalı Afet Yönetimi Terimleri Sözlüğü*. Retrieved from Açıklamalı Afet Yönetimi Terimleri Sözlüğü Web Sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Web sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu>
- AFAD. (2022). *AFAD*. Retrieved from AFAD Afet Türleri Web sitesi: <https://www.afad.gov.tr/afet-turleri>
- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 16(1), pp. 17-35. doi:<https://doi.org/10.17130/ijmeh.700812>
- AKSOĞAN , M., & ÇALIŞ DUMAN, M. (2018, Aralık 7-9). Akıllı Şehir Uygulamaları; Malatya Örneği. *1. Uluslararası Battalgazi Multi Disipliner Çalışmalar Kongresi Tam Metin Kitabı Cilt 1, 1*, pp. 183-202.
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(2).
- AKYEL, R. (2007). *Afet Yönetim Sistemi: Türk Afet Yönetiminde Karşılaşılan Sorunların Tespit ve Çözümüne İlişkin Bir Araştırma*. Adana: Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Doktora Tezi.
- ALAVİ, A., PENGCHENG, J., WILLIAM, G., & NİZAR, L. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. *Measurement*, 129, pp. 589-606.
- Albuquerque, R. (2003). The composition of international capital flows: risk sharing through foreign direct investment. *Journal of International Economics*, 61(2), 353-383.
- Ali, H. (1944). Hasan Zyko Kamberi 200 years ago. *Kultura Islame*, No. 7-8, 201.
- ARMAĞAN, V. (2018). Dijital Dönüşüm Sürecinde Akıllı Şehirler ve E-Devlet Platformu. *İletişim Kuram ve Araştırma Dergisi*(46), pp. 387-414.
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Baetens, F. (2013). *Investment law within international law: integrationist perspectives*. Cambridge University Press.
- Bala, M. (1942). Do we have a modern Albanian drama. *Kultura Islame*, No. 5-6-7, 214.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. Retrieved from <https://www.bbc.com/news/world-europe-17776876>
- Beqiri, G. (2017). Marketinguindërmarrjeve në Kosovë përmes aplikimit të mediave sociale. Tiranë

- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development*, 62, pp. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>
- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from <https://berkeleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>
- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Beurden, S. V. (2022, 4 30). *A New Congo Crisis?* Retrieved from https://origins.osu.edu/article/new-congo-crisis?language_content_entity=en
- Beylikdüzü Belediyesi. (2017). *ABİS (Afet Bilgi Sistemi)*. Retrieved from ABİS (Afet Bilgi Sistemi) Web sitesi: <http://www.beylikduzuhazir.com/Abis>
- Beylikdüzü Belediyesi. (2017). *Beylikdüzü Hazır*. Retrieved from Beylikdüzü Hazır Web Sitesi: <http://www.beylikduzuhazir.com/BeylikduzuHazir>
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri. *International Peace Information Service*, 2-50.
- Britannica. (2021, 12 24). *Romania*. Retrieved from <https://www.britannica.com/place/Romania>
- Britannica. (2022, 01 03). *Security*. Retrieved from <https://www.britannica.com/place/Romania/Political-process>
- Carey, B. (2021, April 1). *What's the Social Media Impact on Tourism?* Retrieved from CheckFront: <https://www.checkfront.com/blog/social-media-impact-on-tourism/>
- Çelik, H. (2022). Türkiye'de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), pp. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- ÇELİK, İ. H., USTA, G., YILMAZ, G., & YAKUPOĞLU, M. (2020). Türkiye'de Yaşanan Teknolojik Afetler (2000-2020) Üzerine Bir Değerlendirme. *AÇÜ Uluslararası Sosyal Bilimler Dergisi*, 6(2), pp. 49-57.
- CENTER for ECONOMIC and SOCIAL RIGHTS. (2022, 04 14). Retrieved from Key Concepts: Human Rights and the Economy: <https://cesr.org/key-concepts/>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*. Retrieved from <https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/>
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania's social strata in the past 30 years*. Retrieved from <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/>
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*. Retrieved from https://www.constituteproject.org/constitution/Romania_2003?lang=en
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*. Retrieved from <https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604.>
- Critic and criticism. (1941). *Kultura Islame, No.20-21*, 179.
- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- Dave Evans with Jake McKee. (2010). *Social Media Marketing: The Next Generation of Business Engagement*. Canada: Wiley Publishing, Inc., Indianapolis, Indiana.
- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf

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- De Schutter, O., Swinnen, J., & Wouters, J. (2012). *Foreign direct investment and human development: the law and economics of international investment agreements*. Routledge.
- Deloitte Vodafone. (2016, 12). *Akıllı Şehir Yol Haritası*. DeloitteTürkiye.
- DHI Worldwide. (2018). Improved Flood Control and Water Quality With A Smart Water Solution See How The City Of Vejle In Denmark Protects Its Streets From Flooding. *The Expert In Water Environments*.
- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- DİLER, G. (2012, 04 30). Avrupa Birliği'nin İlk Yeşil Başkenti Stockholm. *Ekoyapı*.
- Dolzer, R., & Stevens, M. (1995). *Bilateral investment treaties*. Martinus Nijhoff Publishers.
- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. Retrieved from <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153>
- ELMAN. (2023). *Elman Sel Erken Uyarı Sistemi*. Retrieved from Elman Sel Erken Uyarı Sistemi Web Sistesini:
<https://elmantech.com/ehs/#:~:text=Ta%C5%9Fk%C4%B1n%20erken%20uyar%C4%B1%20sistemi%20nehir,olarak%20uyar%C4%B1lar%20olu%C5%9Fturmas%C4%B1%20esas%C4%B1na%20dayan%C4%B1r>
- ERSOY YILMAZ , A. (2020). *Afet Yönetimi*. Acil Durum ve Afet Yönetimi Uzaktan Eğitim Önlisans Programı.
- EU. (2022, 1 2). *History of the European Union 1960-69*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- EU. (2022, 1 02). *History of the European Union 2000-19*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en
- EU. (2022, 01 03). *Romania*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022>
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. Retrieved from https://europa.eu/ecsc/index_en.htm
- Europa.eu. (2021, 12 30). *Romania*. Retrieved from <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx>
- European Commission . (2022, 1 2). *From 6 to 27 members*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en
- European Commission. (2022, 01 02). *Accession criteria*. Retrieved from https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union: Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. Retrieved from https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf
- European Commission D G C. (2022, 01 02). *Bulgaria*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en
- European Union. (2022, 1 2). *Country profiles*. Retrieved from https://european-union.europa.eu/principles-countries-history/country-profiles_en
- European Union. (2022, 01 01). *History of the European Union 1945-59*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. Retrieved from https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en
- European Union law. (2021, 01 04). *Accession Treaties*. Retrieved from <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html>

- Foldrejt. (2019). *Çfarë nënkuptojmë me sjelljen konsumatore?* Retrieved from Foldrejt: <https://foldrejt.com/cfare-nenkuptojme-me-sjelljen-konsumatore/>
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Gallagher, K., & Zarsky, L. (2007). *The enclave economy: foreign investment and sustainable development in Mexico's Silicon Valley*. MIT Press.
- GIORDANO, V., GANGALE, F., FULLÌ, G., & JIMENEZ, M. S. (2011). *Smart Grid projects in Europe: Lessons Learned And Current Developments*. Joint Research Centre Institute for Energy European Commission.
- Global Edge. (2021, 12 30). *Romania: Government*. Retrieved from <https://globaledge.msu.edu/countries/romania/government>
- Global Witness. (2009). NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- Goodale, M. (2018, 04). *The UNESCO Courier Seventy-year-old views that remain contemporary*. Retrieved from UNESCO: <https://en.unesco.org/courier/2018-4/seventy-year-old-views-remain-contemporary>
- Heifetz A. R, Linsky M. (2014). *Leadership on the line*. Boston: Harvard Business School Publishing.
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* . Retrieved from <https://www.heritage.org/index/country/romania>
- Hosts. (2023). *What's the Social Media Impact on Tourism?* Retrieved from Hosts: <https://hotspot.earth/blog/whats-the-social-media-impact-on-tourism#:~:text=One%20of%20the%20greatest%20ways,and%20accommodations%20they%20can%20use.>
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>
- ILGAZ, E. (2018). *Akıllı Şehirler ve Akıllı Şehirlerin Kurulmasında Rüzgar Enerjisinin Yönetimi ve Organizasyonu*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yönetim Organizasyon Bilim Dalı Yüksek Lisans Tezi.
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romania-foreign-policy-after-nato-and-eu-accession>
- INSARAG. (2017). *International Search and Rescue Advisory Group (INSARAG)*. Retrieved from International Search and Rescue Advisory Group (INSARAG) Web sitesi: <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response>
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-overview>
- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- İstanbul Büyükşehir Belediyesi AKOM. (2022). *İstanbul Büyükşehir Belediyesi AKOM*. Retrieved from İstanbul Büyükşehir Belediyesi AKOM Web Sitesi: <https://akom.ibb.istanbul/hazirlik-planlama-calismalari/>
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. Retrieved from <https://www.trade.gov/country-commercial-guides/romania-market-challenges>
- İzmir Büyükşehir Belediyesi. (2021, 03 12). *Acil İzmir*. İzmir: Bilgi İşlem Dairesi Başkanlığı Harita ve CBS Dairesi Başkanlığı.
- İzmir Büyükşehir Belediyesi. (2022 , 10 3). *İzmir Akıllı İhbar Sistemi ile daha güvende*. Retrieved from İzmir Akıllı İhbar Sistemi ile daha güvende Web Sitesi: <https://www.izmir.bel.tr/tr/Haberler/izmir-akilli-ihbar-sistemi-ile-daha-guvende/47318/156>

- Japan Experience . (2014, 11 10). *Japan Experience*. Retrieved from Kasukabe Underground Flood Protection Tank Web Sitesi: <https://www.japan-experience.com/all-about-japan/saitama/attractions-excursions/kasukabe-underground-flood-protection-tank>
- Jashi, C. (2013). Significance of Social Media Marketing in Tourism. *ResearchGate*, 36-40.
- JESUS, I., MACHADO, J. A., carvalho, J. L., FERREIRA, J. R., & FIGUEIREDO, L. (2001). Towards the Development of Intelligent Transportation Systems. *Intelligent Transportation Systems Conference Proceedings - Oakland (CA) USA(81)*, pp. 1-6.
- KADIOĞLU, M. (2008). *Afet Zararlarını Azaltmanın Temel İlkeleri*. (M. KADIOĞLU, & E. ÖZDAMAR, Eds.) Ankara: JİCA (Japonya Uluslararası İşbirliği Ajansı) Türkiye Ofisi, Yayın No:2.
- KADIOĞLU, M. (2019). *Kent Selleri Yönetim ve Kontrol Rehberi*. Kültür Yayınları.
- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Developmen*, 6(4), pp. 91-102.
- Kotter, J. (2014). *Accelerate: Building strategic agility for a faster moving world*. Boston: Harvard Business Review Press.
- Kouzes, J, Posner. B. (2022). *The leadership challenge* (Vol. Seventh edition). USA.
- Krajewski, M. (2018). Human rights in international investment law: recent trends in arbitration and treaty-making practice. Available at SSRN 3133529, 1-10.
- Kultura Islame. (1939). 228-229.
- Langevin, L., Lamarche , N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- Leaders Mag. (2022, 01 04). *Romania's Recovery*. Retrieved from http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html
- Li, C. (2014). *The engaged leader; A strategy for your digital transformation*. Philadelphia: Wharton School Press.
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*. Retrieved from <https://www.macrotrends.net/countries/ROU/romania/population>
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- MARCO, A. D., MANGANO, G., SCORRANO, F., NEIROTTI, P., & CAGLIANO, A. C. (2014). Current Trends In Smart City Initiatives: Some Stylised Facts. *Cities*, 38, pp. 25-36.
- Mayfield, A. (2008). *What is Social Media?* iCrossing.
- McKinsey. (2018). *Smart Cities: Digital Solutions For A More Livable Future*. McKinsey & Company.
- Md Yusuf Hossein Khan and Tanvir Abir. (2022). *The Role of Social Media Marketing in the Tourism and Hospitality Industry*. IGI Global.
- MEDAK. (2022). *MEDAK*. Retrieved from MEDAK Web sitesi: <https://www.medak.org.tr/faydali-bilgiler/faydali-bilgiler/>
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>
- MONUSCO. (2022, 4 20). *UNITED NATIONS ORGANIZATION STABILIZATION MISSION IN THE DR CONGO*. Retrieved from <https://monusco.unmissions.org/en/drc-attacks-adfarmed-group-may-amount-crimes-against-humanity-and-war-crimes>
- Mosley, L. (2010). *Labor rights and multinational production*. Cambridge University Press.

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*. Retrieved from <https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants>
- Mustafa, M. (1945). Gjuha amtare, Native language. *Kultura Islame, No. 3-4* , 72.
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- NAM, T., & PARDO, T. (2011, Haziran 12). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, pp. 282-291. doi:<https://doi.org/10.1145/2037556.2037602>
- Nations, D. (2021, January 26). *What Is Social Media?* Retrieved from Lifewire: <https://www.lifewire.com/what-is-social-media-explaining-the-big-trend-3486616>
- NATO. (2022, 01 04). *NATO-Russia relations: the facts*. Retrieved from https://www.nato.int/cps/en/natohq/topics_111767.htm
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME* . Retrieved from <https://netaffair.org/documents/1957-rome-treaty.pdf>
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- ÖZMEN, M. (2013). *Deprem ve Antalya*. Antalya: Kutlu&Avcı Ofset.
- ÖZMEN, M. (2015). *Sel-Taşkın Türkiye ve Antalya*. Antalya: Kutlu&Avcı Ofset Ltd. Şti.
- Pcweb. (2022, October 22). *Tourism industry meaning*. Retrieved from Pcweb.info: <https://pcweb.info/tourism-industry-meaning/?lang=en>
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Petras, J., & Veltmeyer, H. (2007). *Multinationals on trial: Foreign investment matters*. Ashgate Publishing, Ltd.
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- PLUS. (1940). About Albania literary production. *Kultura Islame, No. 10*, 396.
- PLUS. (1940). The poet of "Bagëti e Bujqësi". *Kultura Islame, No. 13-14*, 28.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102. Retrieved from https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.
- POSER, K., & DRANSCH, D. (2010). Volunteered Geographic Information For Disaster Management With Application To Rapid Flood Damage Estimation. *Geomatica*, 64(1), pp. 89-98.

- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Resilient Vejle. (2016). *Vejle's Resilience Strategy*. Resilient Vejle.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. Retrieved from <https://www.romania-insider.com/1918-great-union-historical-events-romania>
- Rufanges , J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.
- ŞAHİN, N. (2007). Afet Yönetimi ve Acil Yardım Planları. *TMMOB İzmir Kent Sempozyumu*, pp. 131-142.
- ŞAHİN, Ş. (2019). The Disaster Management in Turkey and Goals of 2023. *Turkish Journal of Earthquake Research*, 1(2), pp. 180-196.
- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*. Retrieved from <https://www.schengenvisainfo.com/countries-in-europe/eu-countries/>
- Scott, C. (2001). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *Torture As Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, Craig Scott, Ed, 3-44.
- Scott, C. (2011). Introduction to 'Torture as Tort: From Sudan to Canada to Somalia'. *TORTURE AS TORT: COMPARATIVE PERSPECTIVES ON THE DEVELOPMENT OF TRANSNATIONAL HUMAN RIGHTS LITIGATION*, Craig Scott, 3-44.
- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- SHROPSHIRE, A. (2019). Stories from the World of Municipal Analytics. *Towards Data Science*.
- Simma, B. (2011). Foreign investment arbitration: a place for human rights? *International & Comparative Law Quarterly*, 60(3), 573-596.
- SOLANAS, A., VLACHOS, I., RAMOS, V., FALCONE, F., POSTOLACHE, O., PERREA, D., . . . MARTINEZ-BALLESTE, A. (2014). Smart Health: A Context-Aware Health Paradigm within Smart Cities. *IEEE Communications Magazine*, pp. 74-81.
- Spar, D. (1999). Foreign investment and human rights. *Challenge*, 42(1), 50-80.
- Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* Retrieved from <https://www.statista.com/statistics/1109873/challenges-romania/>
- Statistics, G. S. (Jan 2023). *The world's most used social platforms* .
- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*-, 2-9.
- T.C. Çevre ve Şehircilik Bakanlığı. (2019). *Akıllı Şehirler Beyaz Bülteni*. Retrieved from https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), pp. 2816-2820.
- TAŞTAN, M. (2018). IoT Based Wearable Smart Health Monitoring System. *Celal Bayar University Journal of Science*, 14(3), pp. 343-350.
- TDK. (2022). *Türk Dil Kurumu Sözlükleri*. Retrieved from Türk Dil Kurumu Sözlükleri Web Sitesi: <https://sozluk.gov.tr/>
- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>

- The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF*. Retrieved from <https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html>
- The World Bank. (2021, 12 25). *The World Bank in Romania*. Retrieved from <https://www.worldbank.org/en/country/romania/overview#1>
- Tjoe, K. (2022, February 28). *The vital role of social media in tourism marketing*. Retrieved from Rezdy blog: <https://rezdy.com/blog/the-vital-role-of-social-media-in-tourism-marketing/#:~:text=Social%20media%20can%20be%20a,up%20in%20the%20area%2C%20and>
- Toral, M., & Schultz, T. (2010). The state, a perpetual respondent in investment arbitration? Some unorthodox considerations. *The backlash against investment arbitration: Perceptions and reality*, 577-602.
- TÖRENCİ, H. E. (2015). *Afet Yönetimi ve Bursa'da Sağlık Sektöründe Afet Yönetimi*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yüksek Lisans Tezi.
- Trading Economic. (2022, 01 03). *Romania GDP*. Retrieved from <https://tradingeconomics.com/romania/gdp>
- Truyols, M. (n.d.). *POSITIVE AND NEGATIVE EFFECTS OF SOCIAL MEDIA ON THE TOURISM INDUSTRY*. Retrieved from Hotelmize: <https://www.hotelmize.com/blog/positive-and-negative-effects-of-social-media-on-the-tourism-industry/>
- Tudor, I. (2008). *The Fair and Equitable Treatment Standard, in the International*. Oxford University Press on Demand.
- Türkiye Bilişim Vakfı (TBV). (2016). *Türkiye Akıllı Şehirler Değerlendirme Raporu*. Türkiye Bilişim Vakfı (TBV).
- Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı. (2014). *Onuncu Kalkınma Planı Afet Yönetiminde Etkinlik Özel İhtisas Komisyonu Raporu*. Ankara: T.C. Kalkınma Bakanlığı.
- TÜRKOĞLU, H. (2014). *İSMEP Rehber Kitaplar Afete Dirençli Şehir Planlama ve Yapılaşma*. İstanbul: İstanbul Valiliği, İstanbul İl Afet ve Acil Durum Müdürlüğü (İstanbul AFAD), İstanbul Proje Koordinasyon Birimi (İPKB).
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Washington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from <https://www.unhcr.org/558c0e039.pdf>
- United Nations. (2023, 04 18). Retrieved from United Nations Human rights office of the high commissioner : <https://www.ohchr.org/en/human-rights/economic-social-cultural-rights>
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- Valarm. (2022). *Valarm*. Retrieved from Valarm Web Sitesi: <https://www.valarm.net/blog/monitoring-water-levels-flood-detection-early-warning-systems-virginia-smart-cities/>
- Voineagu , V. (2022, 01 02). *ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING I.I-28.II.2007 PERIOD*. *IDEAS*, 48-72. Retrieved from <https://plagiarism.repec.org/socol-socol/socol-socol2.pdf>
- World Bank. (2021, 12 29). *Gross domestic product 2020*. Retrieved from <https://databank.worldbank.org/data/download/GDP.pdf>
- World Bank. (2023, 04 10). Retrieved from World Development Indicators: <https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#>

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from <https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>
- YAMAN KOCADAĞLI, A. (2017). *Beylikdüzü'nün Coğrafi Özellikleri*.
- YAMAN, M., & ÇAKIR, E. (2018). Dijitalleşen Dünyada Akıllı Afet ve Acil Durum Uygulamaları. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 7(2), pp. 1124-1138.
- YILDIRIM, A. M. (2022). *Akıllı Şehirlerde Trafik Yönetimi İçin Bir Dinamik Rotalama Yöntemi ve Cupcarbon Gerçekleşmesi*. Kocaeli: Kocaeli Üniversitesi Fen Bilimler Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı Yüksek Lisans Tezi.
- YILDIZ, D. (2013, 03 22). Ekolojik Kentsel Dönüşümde Örnek Kent : Stockholm. *Stockholm Winner 2010 European Green Capital*, pp. 1-9.
- ZHANG, K., YANG, K., REN, J., SHEN, X. S., NI, J., & LIANG, X. (2017). Security and Privacy in Smart City Applications: Challenges and Solutions. *IEEE Communications Magazine*, pp. 122-129.

**THE REFLECTIONS OF JANUARY 24, 1980 DECISIONS ON EDUCATION
POLICIES**

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ABSTRACT

The 1970s were quite difficult for the world economies; Bretton Woods' gold and dollar-centered fixed exchange rate system disintegrated and Keynesian policies began abandoned thus neoliberal economy policies took the stage. The minority government led by Süleyman Demirel put forward a series of economic decisions on January 24, 1980. In the first period of the January 24 decisions, all the main problems continued to exist, but it was agreed that a period of five years should be waited in order to overcome these ongoing problems and to get the significant results of the January 24 measures. The five years following the January 24 decisions were the years in which some changes began to be seen in the education policies of the country. The commercialization of public schools and the increase in attempts to open private education institutions since the 1980s have significantly weakened the egalitarian character of the education offered by the state in the previous period since the beginning of Republic of Türkiye. In this article, using the document analysis method, the three newspapers with the highest circulation of the period between 1980-1984 were analyzed. Cumhuriyet, Milliyet and Hürriyet newspapers were examined in the context of news and columns on education in this period. The reflections of January 24 decisions on Türkiye's education policies were analyzed in the context of these three newspapers between 1980-1984. Findings were subjected to content analysis through the codes to be created. While analyzing the results of the January 24 decisions on education policies, the themes were grouped separately as primary, secondary and higher education levels.

Keywords: January 24 1980 Decisions, Neoliberalism, Education Policies

Introduction

The 1970s were quite difficult for the world economy, and Bretton Woods' gold and dollar-centered fixed exchange rate system disintegrated, Keynesian policies began to be abandoned one by one. The most striking aspect of Keynesian policies was the idea that the state could fix the economy by directing effective demand. Since the economy was not coming to equilibrium by itself in the inflationary deficit problem, the state was intervening by reducing public expenditures and/or increasing tax rates. In order to eliminate the deficit problem, the government's intervention in the economy was required by directing demand (Aktan, 2000). Thatcher in England and then Reagan in the USA decided to abandon Keynesian policies and turn to economic policies that focused on market mechanisms; the privatization of state-owned enterprises by emphasizing neoliberal economic policies and reducing public expenditures constituted the basic steps of this orientation (Pamuk, 2022, p.242). The 1970s were also very difficult for Türkiye. Difficulties were experienced in the field of imports and production, and inflation increased considerably. In the face of factors such as increases in oil prices, conflicts such as the Vietnam War, and the 1974 Cyprus Peace Operation in which Türkiye was involved, the Turkish economy was severely damaged and that increased social tensions, led to a high rise in social conflicts. The minority government, under the premiership of Süleyman Demirel, put forward a series of economic decisions on January 24, 1980 in this regard. Turgut Özal, who served as the Undersecretary of the State Planning Organization during the Demirel government, was responsible for the implementation of the new economy program as the undersecretary of the Prime Ministry. The restrictive monetary policy included elements such as reducing taxes, encouraging investments with fiscal policies, reducing government interventions, creating conditions for the free functioning of the market, reducing social expenditures, taming unions and lowering wages (Başkaya, 2015, p.209). Nevertheless, the January 24 decisions taken by the Justice Party (AP) government, which contained various provisions proposed by the liberal economic doctrine, were related to the fact that the provision of external resources necessary for the exit from the economic crisis was conditional on the taking of these decisions, rather than the party's sympathy for economic liberalism. Taking these decisions was an example of the pragmatism of the AP rather than being an indicator of convergence with economic liberalism (Demirel, 2018, p.576).

At that time, the Demirel government did not have the necessary political support to carry out the new program, but the military administration established after the coup in September of the same year also adopted this program and appointed Özal as the deputy prime minister responsible for the economy. According to Pamuk (2022), the main objectives of the January 24 decisions were to provide stability by improving the balance of payments and reducing inflation in the short term, and to create an economy that places more weight on the market, oriented towards foreign, especially exports, in the long run. However, in order to ensure competition in the international markets, reduction of wages and the income of agricultural producers caused the resistance of the workers' organizations, but these resistances were suppressed to a large extent with the military coup, the bans on strikes and union organizing. It was a fully neoliberal restructuring plan that has been put into practice and the problem of political actor was still not resolved as none of the existing political parties had the capacity to implement the policies proposed by the IMF and the World Bank; at this point, the army, which took over the administration with the coup on September 12, 1980, carried out the second non-political intervention (Bekmen, 2018, p.74). According to Boratav (2011), the "model of January 24", presented to the masses and the public with the slogan "There is no alternative" from beginning to end and with a very intense ideological campaign; it was not an original package of measures for neither Türkiye nor the world; these resolutions included all the familiar elements of a typical structural adjustment program developed by the World Bank, with the standard stabilization policy imposed by the IMF in the 1970s on many underdeveloped countries that were overwhelmed by external stagnation. In those years, there was no other solution but to lean on the door of the IMF (Kozanoğlu, 2001). According to Kazgan (2006, p.123), the January 24 package came with structuring that went far beyond being a package containing economic policies aimed at returning to stability and repaying debts in a short time; this liberal ideology turned into a campaign to instill a kind of "vulgarized liberal ideology" on people, to change their value judgments accordingly, to create a new type of person and to reconstruct the economy with this vulgarized ideology, which turned into a campaign to spread the "opportunistic-cunning little man" mentality.

According to Çavdar (1983, p.1076), after January 24, 1980, the implemented economic policy had a great impact especially on some faculty members, and it was necessary to change the economic views they had defended until that day. Today, the

concepts derived from the January 24 Decisions constitute the focus of the discussions on economy in Turkey. The debate focused and still focuses on the dilemma of "stability first, then growth" or "growth as a condition of stability", and whether structural reforms, which were accepted by almost everyone, should be done with market mechanisms or whether they require state intervention (Çavdar, 1983, p. 1076). In the first period of the January 24 decisions, all the main chronic problems continued to exist, but it was agreed that a period of 5 years should be waited in order to overcome these chronic problems and to get the "positive" results of the January 24 measures (Sönmez, 1980). The 5 years following the January 24 decisions were the years in which some changes began to be seen in the education policies of the country. The commercialization of public schools and the increase in attempts to open private education institutions since the 1980s have significantly weakened the egalitarian character of the education offered by the state in the previous period (Özden, 2018, p.222).

In the tenth education meeting held in 1981, it was stated that the structure of the school system in the new period should be prepared by taking into account the needs of developing Türkiye, because Türkiye entered the industrial period and it was necessary to focus on vocational and technical education from kindergarten to university in an industry-oriented education system. The principles and policies regarding education determined in the Fourth Five-Year Development Plan covering the years 1979-1983 were pointing that education should be considered as a whole with other systems and an institutional structure consistent with the technological and economic structure should be achieved and formal and non-formal education should be developed in a way that complements each other (Tenth Education Council. , 23-26 June 1981). In the eleventh education council held in 1982, the continuation of the principles and policies regarding education determined in the Fourth Five-Year Development Plan was foreseen, and the speech of the head of state, Kenan Evren, was important in terms of shedding light on the education policies of the period. According to Evren, before September 12, teachers and students joined hands to write banners, manufactured bombs, went to the streets together and chanted slogans together; such people have been purged from society and after September 12, teachers walked through the the footsteps of Atatürk (Eleventh National Education Council, 8-11 June, 1982). In the plan of the government of 1983, after the Özal government was established (ANAP), it was stated that they should try to eliminate anarchy by having fight it and all legitimate powers would

join hands on this issue and it was obligatory for the state to take the necessary measures for religious education and training in primary and secondary education institutions in order to raise a well-equipped and balanced generation (T.B.M.M. Record Journal, 1983).

Method

In this article, using the document analysis/analysis method on the basis of qualitative research design, the three newspapers with the highest circulation of the period, Cumhuriyet, Milliyet and Hürriyet and the years 1980-1984 were examined in the context of news and columns on education. Findings were subjected to content analysis through the codes that were created. News that were not related to neoliberal education policies were excluded from the analysis. While analyzing the effects of the January 24 decisions on education policies, how they affect entry to higher education, secondary education and higher education were analyzed separately.

Findings And Comment

Tablo

Theme	Sub-Theme
The Impact of Neoliberal Policies on Higher Education	Commercialization of Education
	Inequality in education
	Politization of education
The Impact of Neoliberal Policies on the Transition to Higher Education	Commercialization pf Education
	Inequality in education
	Politization of education
The Impact of Neoliberal Policies on Secondary Education'	Commercialization of Education
	Inequality in education
	Politization of education

Three themes emerged in our analysis of the newspapers Cumhuriyet, Milliyet and Hürriyet covering the years 1980-1984 regarding the reflection of the January 24 decisions on education policies; these are the impact of neoliberal policies on higher education, the

impact of neoliberal policies on higher education entry, and the impact of neoliberal policies on secondary education. Each theme has three sub-themes; these are inequality in education, politization of education, and commercialization of education. There are codes that caters to sub-themes and themes.

For example, under the theme of the effect of neoliberal policies on higher education entry, we see the sub-theme of commercialization of education and the codes such as education expenses, tax immunity, prevention of education, tuition fees, contradictory social realities, financial autonomy, human value, staff swelling, private practice and dormitory. Two examples of this kind are as follows:

"Prof. Dr. Metin Şengonca wrote that equipments of newly opened higher education institutions were built by their own foundation companies benefiting from tax immunity and their employees were benefited from the state purse; the paid supplementary course application further encouraged the opening of new universities and the quality of education thus tended to decline" (Cumhuriyet, 28.3.1981) (Code: Tax immunity, Sub Theme: paid education, Theme: Higher Education). "Medical students will pay 340 thousand liras per year; it has been stated that if 100 students who are entitled to study at Anadolu Medical Faculty come together and stop paying the fees they will pay for 6 years and save up, they will have a capital of 790 million TL within this period and they can open a private practice" (Cumhuriyet, 27.9.1982).

The sub-theme of inequality in education, which is under the theme of the impact of neoliberal policies on higher education, has codes such as includes negative social contribution, perfect worker, attendance obligation, favoritism method, higher education projects, student loans, wealthy students, open education faculty, intermediate profession, unemployed student, earning money, compulsory service, graduate unemployed, housing problem, attendance obligation, financial difficulties, private teaching institutions. The examples we can look at from this point of view are as follows: "About the students who are asked to choose either a job or a school due to the attendance requirement stipulated in the Higher Education Law, the Undersecretary of the Ministry of National Education Cezmi Biren stated that many students will have to drop out of school due to the obligation to attend." (Milliyet, 11.12.1981). "Higher Education Council Advisory Council member Prof. Dr. Selçuk Kantarcıoğlu stated that with YÖK, equality of opportunity was abolished, those who have money were given the opportunity to pursue an academic career, that the method

of favoritism would find an area of application with this law, and evasion from duty would increase. Kantarcıoğlu also claimed that the inventors of the universities that grew like mushrooms were included in the Council of Higher Education"(Cumhuriyet, 25.1.1982).

Under the theme of the impact of neoliberal policies on higher education, the sub-theme of politization of education includes codes such as punishment, students involved in anarchy, expelled faculty members, union membership, coffeeshouses, Turkish ancestry, information slips, dismissal of faculty members, civil service, apprehension, intelligence bill, fear of being expelled, deficient disciplines. In this context, the following example can be examined: "The expulsion and punishment of both the teacher and the student dealing with politics has been determined" (Hürriyet, 9.6.1981). "With the new university law, credit will not be given to students involved in anarchy". "With the new YOK law, education in all branches of science cannot be provided in Open Education Faculties, so students who have to work in an unequal situation" (Cumhuriyet, 14.2.1984).

The theme of the impact of neoliberal policies on the transition to higher education's sub-theme commercialization of education has codes such as private schools, private teaching institutions. The example is as follows:

"İlhan Açıkgöz, Chairman of the Executive Board of Private Murat Dershanesi, stated the function of private courses as follows: "The first outstanding task of private courses today is to prepare students who are not sufficiently trained in secondary education for the university entrance exam. But our mission does not stop there. We are trying to give the student the right to enter a good school, as well as the infrastructure to continue their education in the school they have won. There are students who have not had a physics lesson for a year due to the absence of a teacher, and they do not like this lesson. But you see, he won a department about physics. This kind of student can gain his/her background in physics with us. Another benefit of classrooms is social aspect. There is a change in the culture and social environment of the incoming student." (Milliyet, 2.2.1983).

The theme of the impact of neoliberal policies on the transition to higher education's sub-theme inequality in education has codes such as financial opportunities, special education, social justice, chance of settlement, socioeconomic level, wealthy people, private teaching institutions, wealthy students, school enrollment rate, youth growing up with exams. Some examples are as follows:

"Due to the differences observed in the quality of education between secondary education institutions at university entrance, families with good financial means want to send their children to private teaching institutions in big cities from the countryside to increase their chances of success in exams (Milliyet, 13.6.1980). "The doors of higher education are closing every year for the children of poor families, deprived areas, impossible schools, and moreover, the existing inequality in benefiting from higher education is getting worse with private teaching institutions, various courses, expensive test books (Cumhuriyet, 9.5.1980). In the theme of the impact of neoliberal policies on the transition to higher education, codes such as difference between regions, country conditions, selection and placement tests, social justice have been found to meet the sub-themes of politization of education. The example is as follows:

"University students who mentioned that poor students' chances of higher education were hindered also stated that paid education would bring a great economic burden to their families; according to the country's conditions, they claimed that many students would be left out due to lack of quota, and this time they would be faced with the danger of not being able to study because they did not have enough money" (Hürriyet, 28.9.1983). "Lecturer Pakize Türkoğlu stated that no matter how technically advanced the selection and placement exams applied at the entrance to higher education are, they were not prepared with a concern that includes the inequality of opportunity that exists in our society. She also stated that some of the students were able to pass these exams by learning the exam techniques and even the questions by obtaining compressed information through private teaching institutions" (Cumhuriyet, 9.2.1984). "In Turkey, the people of Eastern and Southeastern origin compared to those of Western origin, villagers compared to urban residents, girls compared to boys, and the poor compared to the wealthy have less chance to enter the university, which is against the basic principle of "social justice" in Constitution, It is also diametrically opposed to "equality of opportunity and possibility" " (Milliyet, 23.8.1980).

Codes such as private courses, private schools, Anatolian high schools appeared in the sub-theme of commercialization of education under the theme of the effects of neoliberal policies on secondary education. Examples in this regard are as follows:

"The special courses that the Ministry of National Education envisaged to be opened in primary and secondary schools could not be realized, especially in big cities, due to insufficient demands of students and parents, and teachers find additional course fees

insufficient (Cumhuriyet, 22.1.1982). "Minister of National Education, Youth and Sports, Vehbi Dinçerler, stated that Anatolian high schools would be paid as of 1985, and suggested that those who want to educate their children in Anatolian high schools should establish companies and foundations (Milliyet, 283.1984).

Under the theme of the effects of neoliberal policies on secondary education, the sub-theme of inequality in education has codes such as special preparatory courses, student expenses, private school, Anatolian high schools. The following example can be given in this regard: "College entrance exams disrupt the psychology of students, special preparatory courses given in schools have brought up failures due to income inequality, as well as problems such as eating money / irregularities" (Cumhuriyet, 8.3.1980).

The sub-theme of politization of education under the theme of the effects of neoliberal policies on secondary education includes codes such as the right to unionize and the intelligence draft. The following examples can be examined:

"Teachers who tried to express their opinions and participated in actions in this way were dismissed from their duties and applied to the Council of State; It has been demanded that the raises be withdrawn and the salaries increased, TÖB-DER should be opened, and the right to unionize with strikers and collective agreements" (Cumhuriyet, 13.2.1980). "The draft law regulating the National Education was prepared and the "intelligence bill" was issued" (Cumhuriyet, 2.6.1982)

Conclusion

Nussbaum (2018, p.37), in her work titled *Creating Capabilities*, uses this important sentence: "If you don't have an idea about it one way or another, you won't be able to find what you're looking for." Instead of "development" indicators such as Gross National Product, Nussbaum particularly recommends considering internal capabilities. She defines learned, equipped and developed skills as a result of interaction with the social, economic and political environment. For her, if a society wish to expand the capabilities of individuals, it should devote its resources especially to the improvement of education. It can be argued that the emergence of the Higher Education Council, the politicization of education, the mercenary of education were related with manipulating the internal capabilities and alienate the individual from himself/ herself in the first place and turn him/ her into a cogwheel of neoliberal economic policies. In fact, an inspiration can be taken from Berlin (2016); the

possibility to ask the question “How many doors are open to me?” was prevented by these neoliberal policies in education so the negative freedom was hindered.

The economic policy implemented in Turkey after January 24, 1980, had a great impact especially on some faculty members - those who prefer/could stay in universities - that they felt the need to change their economic views they have defended until that day. As Walker (2019) stated, due to neoliberal policies, inequality could take its place in education decisions as a political choice. The five years following the January 24 Decisions were the years in which some changes began to be seen in the education policies of the country. The commercialization of public schools, the increase in attempts to open private education institutions since the 1980s, the establishment of private universities, the orientation of working students to the open education option and their victimization with limited branch opportunities significantly weakened the egalitarian feature of education. It was also in contradiction with social realities; human values were gradually lost because of the character of the neoliberal economic policies (Kumar and Hill, 2009). Starting from the first year, 1980, teachers who tried to express their views and participated in actions were dismissed from their duties. Equality of opportunity was abolished with Higher Education Council (YÖK); those who had money have given the opportunity to pursue an academic career, the method of favoritism found its application area. An environment arised where high-level executives such as the rector and dean could be dismissed before their term of office expires, and academic members could be dismissed if desired; higher education institution officials entered to "the civil service process".

As Doğan and Selenica (2022) stated, the pressure on academic staff was as a result of neoliberal policies in Turkey and it has been observable until today. By 1982, it was revealed that the students who took the first three places in the university exam were studying in special education schools; the transition to higher education emerged as an area where the consequences of inequality in education could be observed. Private schools and private teaching institutions have increased the social inequalities. Unemployed graduates increased, the necessity of earning money prevented education, financial difficulties increased the level of anxiety among students. These findings are consistent with Hedegaard-Soerensen and Gruomlaese's findings that neoliberal education policies reduce social inclusion and pluralism, and increase social exclusion and collective indifference mechanisms (Hedegaard-Soerensen and Gruomlaese, 2020). Higher education entry success

was also negatively affected by regional disadvantages; the children of the underdeveloped region, who suffered from economic poverty, started to fail the exams due to the lack of private teaching institutions and private schools. This result is in line with the findings of Lipman (2011) that neoliberal education policies, when combined with undemocratic management mechanisms, bend capital accumulation for the benefit of the rich and construct social capital to the advantage of the rich. Since working students were obliged to attend universities, open education was demanded - about 45,000 people enrolled - but young people already realized that graduating from open education meant falling far beyond from being visible in the sector. It was decided that the student who was involved in "anarchy" in the university would not be given credit, and the teachers who think differently would get their share from this punishment. Because, as Attick (2017) argues, neoliberal education policies demand homogenized, standardized and measurable associations and outcomes from students and teachers.

Althusser (2002) argued that every ideology, in its necessary imaginary distortion, shows not the existing relations of production (and other relations deriving from them), but above all, the imaginary relation of individuals to the production and relations that derive from it. The argument that Turkish society was a classless society was included to the founding process of Kemalist ideology of the Republic, and the corporatist policies were driven from this belief by trying to provide an anti-liberal theoretical-moral rationale for capitalism (Parla, 2011). It can be argued that the normalization of labor exploitation in society appeared over time and after the decisions of January 24, 1980, this exploitation increased gradually.

Güllüpcinar (2015) states that in Türkiye, the encouragement of private universities to entrepreneurship since the 1990s exceeds simply by supporting the privatization of private universities and this situation causes the information to be commodified and recontextualized for the market; the policies for the marketization of educational services have become widespread since the early 2000s which has reduced the entire education process to "performance". As Sipahioğlu (2020) stated, the education process in Türkiye has been compressed into a function that produces affordable values with the effect of neoliberal policies. İnal and Akkaymak (2012) read the economic decisions of January 24, 1980 by combining the establishment and progress strategies of the contemporary politics in terms of education policies; contemporary politics supported a structural reform that would enable a

transition to a liberal and constructivist education model, and implemented a plan (both financially and intellectually) in 2004 with the guidance and support of the World Bank (WB), IMF and European Union.

The education reform initiated in 2004 was in line with the report of TUSIAD, which argued that the education system should aim to produce the workforce needed by the market economy. This has left educational processes under the control of neoliberal ideology and contemporary policies rearranged the education system to train students/citizens as required by the market economy, so the social justice in education has been overlooked (İnal and Akkaymak, p.15). It can be argued that the way to re-establish social justice and equality of opportunity in educational policies in the upcoming period is to redesign the educational processes.

Resources

- Aktan, C.A. (2000) *Politik İktisat*. İzmir: Anadolu Publishing
- Althusser, L. (2002), *İdeoloji ve Devletin İdeolojik Aygıtları*, Translator: Yusuf Alp, Mahmut Özışık, 5. print, İletişim Publishing.
- Attick, D. (2017). *Homo Economicus at Schools: Neoliberal Education and Teacher as Economical Being*, *EDUCATIONAL STUDIES*,53(1), 37–48
- Başkaya, F. (2015) *Devletçilikten 24 Ocak Kararlarına: Türkiye Ekonomisinde İki Bunalım Dönemi*, 5. Print, İstanbul: Öteki Publishing
- Bekmen, A. (2018) ‘‘Neoliberal Dönemde Türkiye’de Devlet ve Sermaye’’ *Yeni Türkiye’ye Varan Yol: Neoliberal Hegemonyanın İnşası*, Compiler: İsmet Akça, Ahmet Bekmen, Barış Alp Özden, İstanbul: İletişim Publishing
- Berlin, I. (2016), *Isaiah Berlin ile Konuşmalar*, Translator: Zeynel Abidin Kılınç, 2. print, Yapı Kredi Publishing.
- Boratay, K. (2011) *Türkiye İktisat Tarihi, 1908-2009*, 15. Print, İstanbul: İmge Publishing
- Çavdar, T. (1983) ‘‘Cumhuriyet Döneminde Türk İktisadi Düşüncesi’’ *Cumhuriyet Dönemi Türkiye Ansiklopedisi*, İstanbul: İletişim Publishing
- Demirel, T. (2018) "Adalet Partisi" *Modern Türkiye’de Siyasi Düşünce: Liberalizm*, Volume 7, İstanbul: İletişim Publishing
- Doğan, S. and Selenica, E. (2022), *Authoritarianism and Academic Freedom in Neoliberal Turkey*, *Globalisation, Societies and Education*, Vol: 20, No: 2, 163-177
- Eleventh National Education Council, 1991, 8-11 June 1982, İstanbul: Milli Eğitim Publishing
- Güllüpnar, F. (2015), "Türkiye’de İktisadi Dönüşümler ve Eğitim Politikaları", *Türkiye’de Eğitim Politikaları*, Ed: Arife Gümüş, İlem Publishing
- Hedegaard-Soerensen, L. ve Grumloese, S. P. (2020) *Exclusion: the downside of neoliberal education policy*. *International Journal of Inclusive Education*, Vol: 24, No: 6, 631-644
- İnal, K. and Akkaymak, G., (2012), *Neoliberal Transformation of Education in Turkey: Political and Ideological Analysis of Educational Reforms in the Age of the AKP*, Ed: Kemal İnal, Güliz Akkaymak, Palgrave Macmillian.
- Kazgan, G. (2006) *Tanzimat’tan 21. Yüzyıla Türkiye Ekonomisi*, İstanbul: İstanbul Bilgi University Publishing
- Kozanoğlu, H. (2001) *IMF’in Fikri, Derviş’in Zikri*, *Birikim Journal*, No: 146.
- Kumar, R. and Hill, D. (2009), "Neoliberal Capital and Education," *Global Neoliberalism and Education and Its Consequences*, Routledge
- Nussbaum, M. (2018) *Yapabilirlikler Yaratmak: İnsani Gelişmişlik Yaklaşımı*, Translator: Selda Somuncuoğlu, İletişim Publishing, s. 37.
- Lipman, P. (2011). *The new political economy of urban education: Neoliberalism, race, and the right to the city*. New York, NY: Routledge.
- Pamuk, Ş. (2022) *Türkiye’nin 200 Yıllık İktisadi Tarihi*, 14. print, İstanbul: Türkiye İş Bankası Publishing
- Parla, T. (2021) *Ziya Gökalp, Kemalizm ve Türkiye’de Korporatizm*, 2. print, Metis Publishing.
- Sipahioğlu, M. (2020), *Neoliberal Policies and Reflections on Education in Turkey*, *Political Economy and Management of Education*, 1(1), 14 – 25.
- Sönmez, M. (1980) *Türkiye Ekonomisinde Bunalım: 24 Ocak Kararları ve Sonrası*, İstanbul: Belge Publishing
- Tenth National Education Council, 1981, 23-26 June 1981, Ankara: Milli Eğitim Publishing

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
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Turkish Republic of Northern Cyprus, April 28-30, 2023**

- TURKISH GRAND NATIONAL ASSEMBLY. Official Report Journal, 19.12. 1983, 10th Meeting, Cilt 1, Legislative Law 1.
- Özden, B. A. (2018) ‘‘Refah Rejiminin ve Siyasetinin Dönüşümü: Neoliberalizm ile Popülizmin Başarılı Bir Şekilde Örtüşmesi’’ Yeni Türkiye’ye Varan Yol: Neoliberal Hegemonyanın İnşası, Compiler: İsmet Akça, Ahmet Bekmen, Barış Alp Özden, İstanbul: İletişim Publishing
- Walker, J. C. Pearce, K. Boe, and M. Lawson, (2019), "The Power of Education to Fight Inequality" Briefing Paper, September 2019, Oxford: OXFAM GB.

AKILLI ŐEHİRLERDE AFET YÖNETİMİ

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ÖZET

Ülkemizde ve dünyada nüfus sürekli olarak artmaktadır. Artan nüfus, şehirleşme hızını da aynı doğrultuda artırmaktadır. Şehirleşmenin hız kazanmasıyla ulaşım, alt yapı, doğal kaynakların sürdürülebilirliği, enerjinin verimli kullanılması gibi birçok sorun ortaya çıkmıştır. Ortaya çıkan bu sorunları ortadan kaldırmak, şehrin kaynaklarını daha verimli kullanmak ve kişilerin daha iyi hizmet alabilmelerini sağlamak için akıllı şehir kavramı ortaya çıkmıştır. Akıllı şehir, teknolojiyi kullanarak ihtiyaçlara yönelik çözüm üreten ve yaşam standartlarını arttıran şehir olarak değerlendirilir. Nüfusun daha yoğun olarak yaşadığı şehirlerde meydana gelen afetlerin etkileri daha şiddetli olmaktadır. Afetlerin olumsuz etkilerini en az düzeyde tutmak için şehirleri afetlere karşı hazır duruma getirmek gerekmektedir. Şehirleri afetlere karşı hazırlamak için afet yönetimi şehirlere entegre edilmeli ve şehirler akıllı hale getirilmelidir. Bunu gerçekleştirmek için afetlere yönelik akıllı şehir uygulamalarına önem verilmesi gerekmektedir. Afetlerin neden olduğu kayıpları önlemek için ve afetleri yönetilebilir hale getirmek için afet yönetimine önem verilmesi gerekmektedir. Afet yönetimi ile afetlere yönelik mevcut riskler azaltılarak ve gerekli olan önlemler alınarak afet sürecinin kontrol altında tutulması sağlanmaktadır. Afet yönetiminin başarılı olabilmesi için afet meydana gelmeden önce yapılması gerekenlerin belirlendiği risk yönetimi aşamasına önem verilmesi gerekmektedir. Teknolojik gelişmeler doğrultusunda afet yönetimine yönelik olarak geliştirilen akıllı şehir uygulamaları ile başta yangın, heyelan, sel, taşkın gibi afetlere karşı şehri hazır hale getirmek mümkündür. Özellikle afet bilgi sistemi, akıllı ihbar sistemi, erken uyarı sistemi ve afet türlerine göre oluşturulmuş mobil uygulamalar kişilerin bilgilendirilmesi ve yönlendirilmesine katkı sağlamanın yanında afetlerin olumsuz etkilerinin en az düzeyde tutulmasına da katkıda bulunmaktadır. Şehirleri daha yaşanılabilir kılmak için akıllı şehir uygulamaları geliştirilmeli ve toplum afetlere karşı daha dirençli hale getirilmelidir. Bu çalışmada ele alınan afet yönetimine yönelik geliştirilen akıllı şehir uygulamaları, toplumun afetlere karşı olan direncini artırmakta ve şehirlerin afetlere karşı daha dirençli hale getirilmesini sağlamaktadır. Bu nedenle afetlere yönelik akıllı şehir uygulamaları geliştirilmeli ve kullanım alanları genişletilmelidir.

Anahtar Kelimeler: Afet, Afet Yönetimi, Akıllı Şehir, Akıllı Şehir Uygulamaları, Şehir

DISASTER MANAGEMENT IN SMART CITIES

SUMMARY

Population is constantly increasing in our country and in the world. Increasing population increases the rate of urbanisation in the same direction. With the acceleration of urbanisation, many problems such as transportation, infrastructure, sustainability of natural resources, efficient use of energy have emerged. The concept of smart city has emerged in order to eliminate these problems, to use the resources of the city more efficiently and to ensure that people can receive better service. Smart city is considered as a city that produces solutions for needs and increases living standards by using technology. The effects of disasters occurring in cities where the population lives more densely are more severe. In order to minimise the negative effects of disasters, it is necessary to make cities ready for disasters. In order to prepare cities against disasters, disaster management should be integrated into cities and cities should be made smart. In order to realise this, smart city applications for disasters should be given importance. Disaster management should be given importance in order to prevent losses caused by disasters and to make disasters manageable. With disaster management, existing risks for disasters are reduced and necessary precautions are taken to keep the disaster process under control. In order for disaster management to be successful, it is necessary to give importance to the risk management stage where the things to be done before the disaster occurs are determined. With smart city applications developed for disaster management in line with technological developments, it is possible to make the city ready for disasters such as fire, landslide, flood and flood. Especially disaster information system, smart notification system, early warning system and mobile applications created according to disaster types contribute to informing and guiding people as well as minimising the negative effects of disasters. Smart city applications should be developed to make cities more livable and society should be made more resilient against disasters. Smart city applications developed for disaster management, which are discussed in this study, increase the resilience of the society against disasters and make cities more resilient against disasters. Therefore, smart city applications for disasters should be developed and their usage areas should be expanded.

Keywords: Disaster, Disaster Management, Smart City, Smart City Applications, City

GİRİŞ

Multidisipliner bir kavram olan afetin tek bir tanımı yoktur. Örneğin AFAD'a göre '*Toplumun tamamı ya da belli bir kesimi için fiziksel, ekonomik ve sosyal kayıplar doğuran, normal yaşamı ve insan faaliyetlerini kesintiye uğratan, etkilenen toplumun baş etme kapasitesinin yeterli olmadığı doğa, teknolojik veya insan kaynaklı olay*' olarak tanımlanmaktadır (AFAD, 2022). TDK'ye göre ise afet; '*çeşitli doğa olaylarının sebep olduğu yıkım*' olarak tanımlanmaktadır (TDK, 2022). Genel bir ifadeyle afet kavramı; insanlar için fiziksel, ekonomik ve sosyal kayıplar doğuran, normal yaşamı ve insan faaliyetlerini durdurarak veya kesintiye uğratarak toplumu etkileyen doğal, teknolojik veya insan kökenli olaylara denilmektedir. Afetler hem seyrek hem de yoğun nüfuslu şehir bölgelerinde meydana gelebilmektedir. Günümüzde şehirlerin imkan ve fırsatlarının daha fazla olmasından dolayı insanlar şehirlere göç etmekte ve şehirlerin nüfus yoğunluğu artmaktadır. Bu yoğunluğun artması beraberinde bir takım tehlike ve riskleri de getirmektedir. Tehlike ve risklerin artmasıyla toplumun olası afetten zarar görebilirlik düzeyi de artmaktadır. Bu durumda olası bir afette can ve mal kaybını artırmaktadır. Meydana gelebilecek kayıpları minimum düzeyde tutmak için afet yönetimine ve akıllı şehir uygulamalarına önem verilmesi gerekmektedir (TÜRKOĞLU, 2014). Afet yönetimi, afet meydana gelmeden önce afete hazırlanmak için ve afet meydana geldikten sonra afetin olumsuz etkilerini azaltmak için yapılması gereken çalışmaları kapsamaktadır. Afetin olumsuz sonuçlarını azaltmak için afet meydana gelmeden önce yapılması gereken risk yönetimine önem verilmesi gerekmektedir (ŞAHİN Ş. , 2019). Teknolojiyi kullanarak ihtiyaçlara yönelik çözümler üreten ve insanların yaşam standartlarını arttıran şehirlere akıllı şehir denilmektedir (YILDIRIM, 2022). Akıllı şehirlerin amaçlarından bir tanesi de şehri afetlere karşı hazır duruma getirerek afetlerin etkilerini minimum düzeyde tutmaktır. Bunu gerçekleştirmek için ise akıllı şehir uygulamalarına önem verilmesi gerekmektedir. Afetlere yönelik geliştirilen akıllı şehir uygulamaları; deprem, sel, taşkın, fırtına gibi afetlere karşı hazırlıklı olmayı ve erken uyarı sistemleri ile olaya hızlı bir şekilde müdahale edilmesini sağlamaktadır (Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2014). Afetlere yönelik geliştirilen yenilikçi ve akıllı çözümler sunan akıllı şehir uygulamaları, şehirlerin gelişimini ve insanların bilgi düzeyini artırmaktadır. Afetlere karşı daha bilinçli bir toplumun oluşturulmasına katkıda bulunmaktadır.

AKILLI ŐEHİRLER

Akıllı Őehir Kavramı

Akıllı Őehir (smart city), teknolojinin kullanımı ve yenilikçi çözümlerin entegrasyonu yoluyla Őehirlerin sürdürülebilirlik, verimlilik ve yaşam kalitesi gibi konularda gelişmesini hedefleyen bir kavramdır. Bu kapsamda, akıllı Őehirlerde binalar, ulaşım aęları, enerji sistemleri, çevre yönetimi gibi birçok alanda teknolojik yenilikler kullanılarak Őehirlerin yönetimi ve planlaması yapılır. Akıllı Őehirlerde veri toplama, analiz ve paylaşımı yapılarak, karar vericilerin daha doğru ve etkili kararlar alması amaçlanır. Bu sayede Őehirlerin sürdürülebilirlięi artar, çevre dostu uygulamalar yaygınlaşır, insanların yaşam kalitesi yükselir (ILGAZ, 2018).

Genel bir ifadeyle akıllı Őehir; Őehrin kaynaklarının daha etkin kullanılmasını ve kişilerin daha iyi hizmet almalarını saęlayan bir modernleşme sürecidir.

Akıllı Őehirlerin Temel Bileşenleri

Akıllı Őehirlerin temel bileşenleri akıllı Őehirlerin karakteristik özelliklerini oluşturur. Bunlar 6 tanedir.

- Akıllı ekonomi
- Akıllı insan/vatandaş
- Akıllı yönetim/devlet
- Akıllı yaşam
- Akıllı çevre
- Akıllı ulaşım/hareketlilik

Akıllı Ekonomi: Őehrin mali kaynaklarının adil bir şekilde dağıtılması, adil rekabet ortamının oluşturulması ve Őehrin gelirlerinin sürdürülebilir bir şekilde yönetilmesi, Őehrin ekonomik ve sosyal sürdürülebilirlięi için önemlidir (YILDIRIM, 2022). Yenilięi, girişimcilięi ve teknolojinin geliştirilmesini savunur, yerli ekonomi ile dünya ekonomisi arasındaki ilişkiyi geliştirmeyi hedefler (ARMAĖAN, 2018).

Akıllı İnsan: Akıllı insan kavramı, akıllı Őehirler içinde yaşadığı çevreye karşı duyarlı, Őehrin sunduęu imkanları etkili bir şekilde kullanabilen ve teknolojileri hayatını kolaylaştırmak için entegre eden insanları ifade eder (YILDIRIM, 2022).

Akıllı Yönetişim/Devlet: Akıllı yönetim, Őehrin tüm bileşenlerinin bir arada çalışmasını saęlar ve Őehirlerin daha sürdürülebilir hale gelmesine katkıda bulunur (NAM & PARDO, 2011).

Akıllı Ulaşım/Hareketlilik (Mobilité): Akıllı ulaşım sistemleri öncelikle ulaşımı ele alır ve ulaşım ağına odaklanır (ALAVİ, PENGCHENG, WILLIAM, & NİZAR, 2018). Akıllı ulaşım; çevre dostu, güvenli, sürdürülebilir ve çoğunlukla motorsuz seçeneklere öncelik vererek ulaşımı daha kaliteli ve faydalı hale getirmeyi amaçlayan bir kavramdır (McKinsey, 2018).

Akıllı Yaşam: Akıllı yaşam, internet teknolojisi aracılığıyla insanların daha kolay bir şekilde iletişim kurmasını ve işlerini yönetmesini sağlayarak yaşam kalitesini arttırmayı amaçlayan bir kavramdır (ARMAĞAN, 2018).

Akıllı Çevre: Şehrin doğasının korunmasını ve geliştirilmesini, atık maddelerin geri dönüştürülmesini, canlıların daha sağlıklı ortamda yaşamasını, kaynakların sürdürülebilir yönetiminin sağlanmasını kapsamaktadır (YILDIRIM, 2022).



Şekil 3: Akıllı Şehir Çemberi

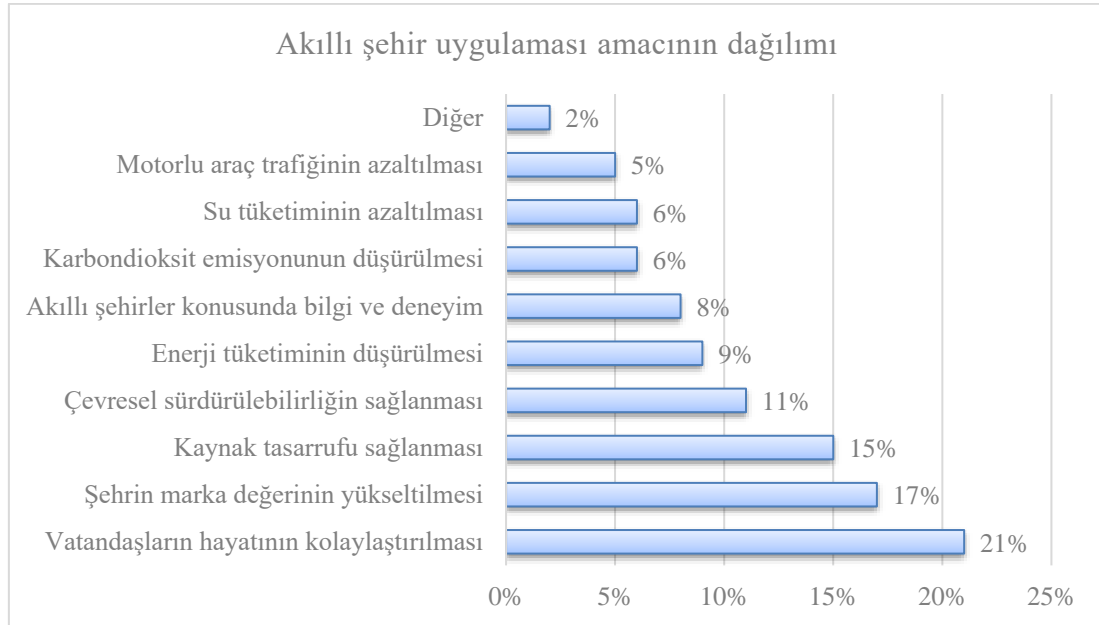
Kaynak: (T.C. Çevre ve Şehircilik Bakanlığı, 2019).

Akıllı Şehir Uygulamaları

Akıllı şehir uygulamaları;

- Kişilerin yaşam alanını geliştirmek,
- Refah seviyesini arttırmak,
- Vatandaşların yapılan hizmetlerden eşit olarak yararlanmasını sağlamak,
- Ülkenin ekonomik olarak büyümesine katkıda bulunmak,
- Yenilenebilir enerji kaynaklarını geliştirmek ve enerji tasarrufu sağlamak için kullanılır (AKSOĞAN & ÇALIŞ DUMAN, 2018).

Akıllı şehir uygulamalarının amaçlarından bazıları aşağıdaki şekilde gösterilmiştir.

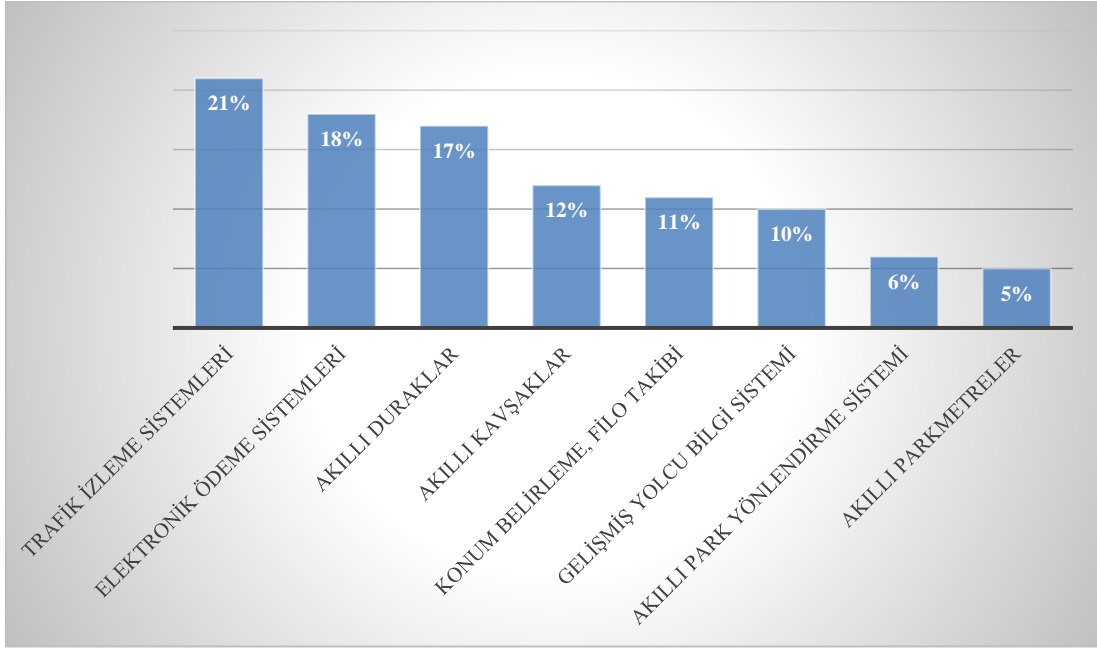


Şekil 4: Akıllı şehir uygulamalarının amaçlara göre dağılımı

Kaynak: (Türkiye Bilişim Vakfı (TBV), 2016).

Akıllı Ulaşım Sistemleri

Akıllı ulaşım sistemleri, seyahat süresini azaltarak trafik güvenliği, seyahat konforu ve enerji tasarrufu sağlamak amacıyla oluşturulan bir sistemdir. Ayrıca yolların verimli kullanımını ve çevreye verilen zararları azaltmayı hedefler (JESUS, MACHADO, carvalho, FERREIRA, & FIGUEIREDO, 2001). Aşağıdaki şekilde ulaşım alanındaki akıllı şehir uygulamalarının kullanımlarına göre dağılımı gösterilmiştir.



Şekil 5: Ulaşım Alanındaki Uygulamaların Dağılımı

Kaynak: (Türkiye Bilişim Vakfı (TBV), 2016).

Los Angeles'da Trafik kontrol ve takip sisteminin otomatik hale getirilmesiyle trafikte meydana gelen duraklamalar %35, kavşaklardan geçiş yapılırken meydana gelen gecikmelerde %20, yolculuk süresinde %13, yolculukta aracın yakıt tüketiminde %12,5 ve hava emisyonunda %10 azalma meydana gelmiştir (Şekil 4) (Deloitte Vodafone, 2016).



Şekil 6: Otomatik duruma getirilmiş trafik kontrol ve takip sisteminin faydaları

Kaynak: (Deloitte Vodafone, 2016).

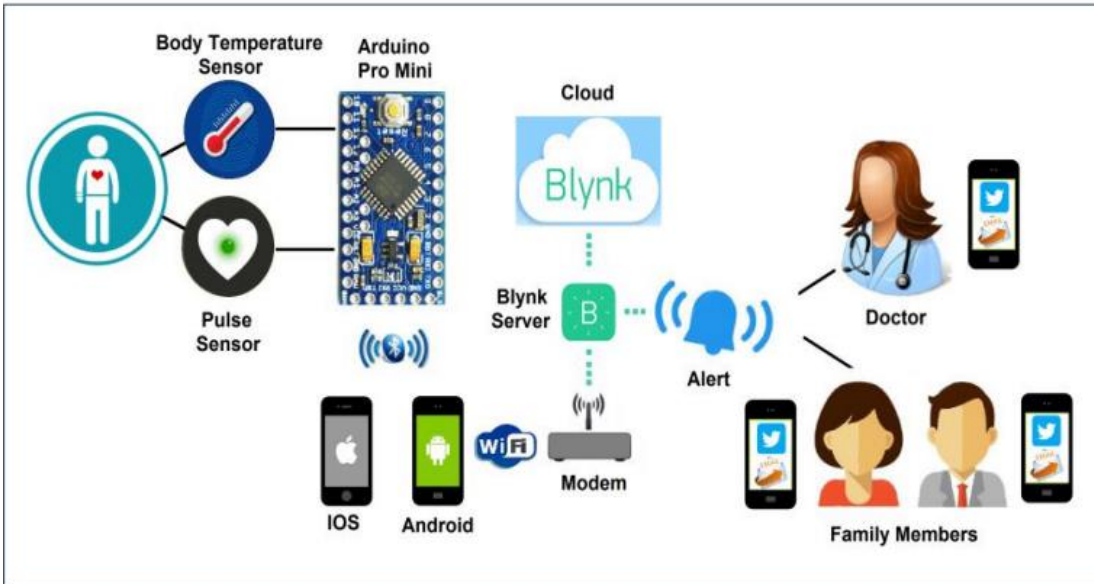
Akıllı Güvenlik Sistemleri

Vatandaşların can ve mal güvenliğini sağlamak için oluşturulmuş bir sistemdir. Mobese kamerası, acil çağrı butonu, drone gibi uygulamalar kullanılmaktadır. Ayrıca acil durumlarda polis, itfaiye, 112 acil sağlık gibi birimlere bilgiyi ulaştırarak olaya hızlı bir şekilde müdahale edilmesi de hedeflenmektedir (MARCO, MANGANO, SCORRANO, NEIROTTI, & CAGLIANO, 2014).

Akıllı Sağlık Hizmeti

Akıllı sağlık uygulamaları, artan nüfusun sağlık hizmetlerine olan ihtiyacının karşılanması amacıyla oluşturulmuş bir sistemdir. Bu uygulamalar, sağlık hizmetlerinin kalitesini artırmak, maliyetleri azaltmak, erken teşhis ve tedavi işlemlerini daha hızlı ve etkili hale getirmek için geliştirilmiştir (SOLANAS, ve diğerleri, 2014).

Health Fog, kalp hastalıklarının otomatik teşhisinde kullanılan bir akıllı sağlık uygulamasıdır. Giyilebilir sensörler sayesinde hastadan gelen veriler sürekli olarak ölçülerek kablosuz bağlantı üzerinden Android sisteme gönderilir. Belirlenmiş kritik değerler aşıldığında, hastanın konumu ve hastalıkla ilgili veriler hem doktoruna hem de aile bireylerine e-posta yoluyla gönderilir (TAŞTAN, 2018).



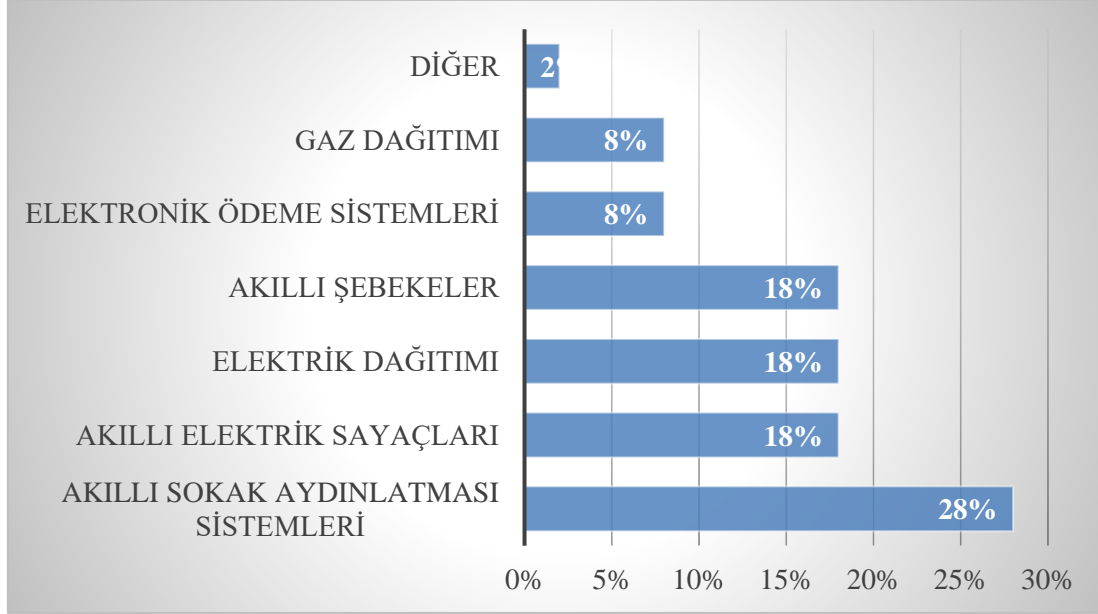
Şekil 7: Akıllı sağlık uygulaması örnek gösterimi

Kaynak: (TAŞTAN, 2018).

Akıllı Enerji Sistemleri

Akıllı enerji sistemleri, şehirlerde enerji üretim ve dağıtım altyapılarının verimli kullanımını amaçlar. Bu sistemler sayesinde;

- Enerji dağıtımını daha verimli hale gelir,
- Bakım onarım maliyetleri azalır,
- Karbon emisyonu azalır,
- Enerji tüketim ücretlerinde azalma olur (GİORDANO, GANGALE, FULLİ, & JİMENEZ, 2011). Aşağıdaki şekilde enerji alanındaki akıllı şehir uygulamalarının kullanımlarına göre dağılımı gösterilmiştir.



Şekil 8: Enerji alanındaki uygulamaların dağılımı

Kaynak: (Türkiye Bilişim Vakfı (TBV), 2016).

Akıllı Çevre Sistemleri

Çevre faktörlerine yönelik olarak oluşturulan bir sistemdir. Bu sistem, gürültü, sera gazı, hava-su kirliliği, orman alanlarının genişletilmesi gibi faktörlere yönelik çözümler sunar. Akıllı Çevre Sistemi, yeşil binalar, akıllı çöp kutuları, nem ve ısı ölçerler gibi uygulamaları içerir. Bu sayede kişilere daha yaşanılabilir bir yaşam alanı sunulur ve sürdürülebilir kalkınma sağlanır (ZHANG, ve diğerleri, 2017).

Akıllı Doğal Afet ve Acil Durum Sistemleri

Akıllı doğal afet ve acil durum sistemi, doğal afetlerin önlenmesi, tedbir alınması ve afet sonrası zararların en aza indirilmesi amacıyla geliştirilen bir sistemdir. Bu sistem, vatandaşlarla kamu kurumları arasında iletişimi sağlayarak afet öncesi, anı ve sonrasında doğru bilgi akışını sağlar. Akıllı uygulamalar aracılığıyla afet bilgi sistemi ve akıllı haritalar gibi çeşitli araçlar kullanılarak afetlerin etkileri minimize edilir (YAMAN & ÇAKIR, 2018).



Şekil 9: Akıllı harita uygulaması

Kaynak: (Deloitte Vodafone, 2016).

AFET

Afet Kavramı

Afet, beklenmedik zamanda meydana gelen, meydana geldiği bölgenin yerel imkanları ile baş edilemeyen, dış yardıma gereksinim duyulan, normal yaşamı ve insan faaliyetlerini durduran ya da kesintiye uğratan, can mal kayıplarına yol açan insan veya doğal kaynaklı olaylara denmektedir (AFAD, 2022).

Afet Türleri

Afetler, doğal ve insan kaynaklı olmak üzere 2'ye ayrılır.

Doğal Afetler

Doğal afetler, kontrol dışında gerçekleşen ve can ve mal kaybına neden olan doğa olaylarıdır. Yavaş gelişen doğal afetler ve ani gelişen doğal afetler olarak iki gruba ayrılırlar (Tablo 1). Ancak, doğal afetlerin meydana gelmeye başlamasıyla birlikte önlenememe durumuna gelirler (AFAD, 2022).

Tablo 2: Doğal Afet Çeşitleri

Ani gelişen doğal afetler	Yavaş gelişen doğal afetler
Deprem	Şiddetli soğuk
Sel ve taşkın	Kuraklık
Toprak kayması	Kıtlık
Çığ	
Fırtına/kasırga/hortum	
Yangın	
Volkan patlaması	

Kaynak: (ÇELİK, USTA, YILMAZ, & YAKUPOĞLU, 2020).

İnsan Kaynaklı Afetler

Doğal olarak gelişmeyen kısmen de olsa gelişmesinde insan etkisi olan afetlerdir. Hava kirliliği, kimyasal-biyolojik-radyolojik-nükleer kazalar, endüstriyel kazalar, ulaşım kazaları, asit yağmuru, çevre ve su kirliliği insan kaynaklı afetlere örnektir (AFAD, 2022).

AFET YÖNETİMİ

Afet yönetimi; afetlerin önlenmesi, etkilerinin azaltılması, kayıpların en aza indirgenmesi için afet öncesi, anı ve sonrasında yapılması gereken faaliyetleri içeren bir süreçtir. Bu süreçte zarar azaltma, hazırlık, müdahale, iyileştirme ve yeniden inşa aşamaları yer almakta ve tehlike ve riskler belirlenerek ortadan kaldırma çalışmaları yapılmaktadır. Afet yönetimi, afetlere yol açan olağandışı durumların üstesinden gelme çabasıdır (POSER & DRANSCH, 2010).

Afet Yönetim Sistemi

Afet yönetim sistemi, birbirinden ayrı ama birbirini tamamlayan iki yönetim sisteminden oluşur (Şekil 8, 9). Bunlar;

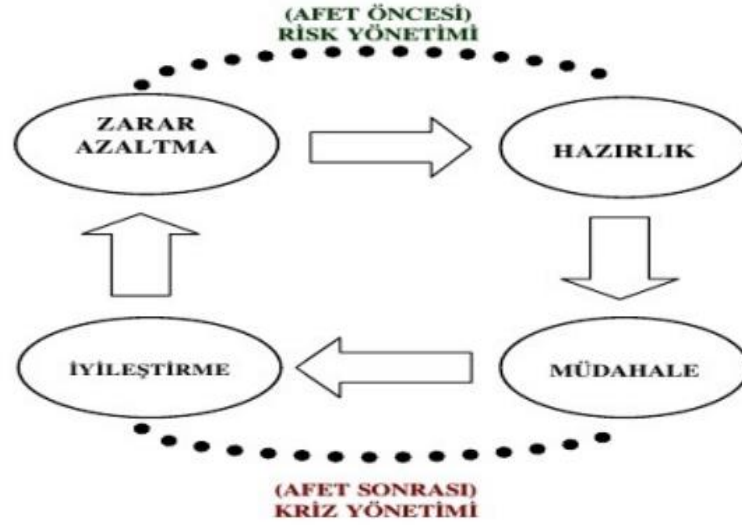
- Risk Yönetimi,
- Kriz Yönetimi.

Risk Yönetimi (Afet Öncesi Dönem)

Afet yönetimi, afetin meydana gelmesini engellemese de afet öncesi dönemde zarar azaltma ve hazırlık faaliyetleriyle afetin etkilerini en aza indirmeyi hedefler. Bu faaliyetlere risk yönetimi denir ve afetin oluşturacağı zararlar, etkileri ve riskler azaltılmaya çalışılır. Örneğin, zorunlu deprem sigortası yapılması, depreme uygun olmayan binaların güçlendirilmesi ve alt yapı çalışmaları risk yönetimine örnek olarak verilebilir. Bu çalışmalar sayesinde afet öncesi dönemde alınan tedbirlerle, afet sırasında oluşabilecek zarar ve kayıplar en aza indirgenmeye çalışılır (AKYEL, 2007).

Kriz Yönetimi (Afet Sonrası Dönem)

Afet anı ve sonrası dönemde yapılması gereken faaliyetlere kriz yönetimi denir. Kriz yönetimi, müdahale ve iyileştirme aşamalarını içerir. Afetin etkilerini azaltmak, zararları en aza indirmek ve normale döndürmek için gerekli olan faaliyetleri kapsar. Kriz yönetimi sürecinde, öncelikli olarak can ve mal kaybı önlenmeye çalışılır. Sonrasında ise, afetin neden olduğu hasarın tespit edilmesi, acil ihtiyaçların karşılanması ve iyileştirme çalışmalarının yapılması için çalışmalar yürütülür (AKYEL, 2007).



Şekil 10: Afet yönetim sistemi

Kaynak: (TÖRENCİ, 2015).



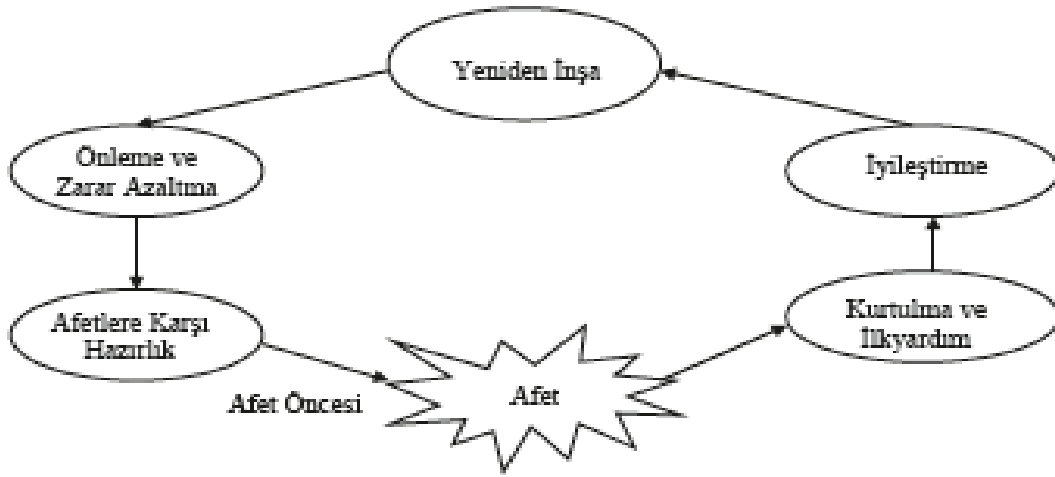
Şekil 11: Afet yönetim sistemi

Kaynak: (MEDAK, 2022).

Afet Yönetim Safhaları

Afetin çeşidi ve meydana geliş hızı fark etmeksizin, bütün afet olayları ile ilgili çalışmalar, beş ana safhaya ayrılmıştır (Şekil 10). Bu safhalar;

- Zarar azaltma,
- Hazırlık,
- Müdahale (Kurtarma ve ilk yardım),
- İyileştirme,
- Yeniden inşa.



Şekil 12: Afet yönetiminin safhaları

Kaynak: (ÖZMEN, Deprem ve Antalya, 2013).

Zarar Azaltma

Afet tehlikesi ve riskinin önlenmesi ya da büyük kayıplar oluşmaması için alınması gereken bütün önlemler ve yapılması gereken çalışmalar zarar azaltma safhasında yapılır (ŞAHİN N. , 2007). Zarar azaltma safhasında yapılan bazı çalışmalar şunlardır:

- Afet ile ilgili kanun ve yönetmeliklerin düzenlenmesi,
- Afet tehlikesi riskinin değerlendirilmesi ve tehlike risk haritalarının hazırlanması,
- Afetler için erken uyarı sistemlerinin kurulması ve geliştirilmesi,
- Afetlere karşı önleyici ve zarar azaltıcı çalışmaların yapılması ve uygulanması,
- Bilimsel araştırma ve geliştirme faaliyetlerinin planlanması ve uygulanması bu çalışmalardan bazılarıdır (KADIOĞLU, Afet Zararlarını Azaltmanın Temel İlkeleri, 2008).

Hazırlık

Afet sonrasında oluşabilecek zarar ve kayıpların giderilmesi, afet nedeniyle mahsur kalan kişilerin kurtarılması, kayıpların bulunması ve arama-kurtarma çalışmalarının geliştirilmesi

ve hazır bulundurulmasını sağlamak için yapılan çalışmalara ‘Hazırlık’ denir (AKYEL, 2007). Hazırlık çalışmalarının ana amacı; canlılar için olumsuz sonuçlara neden olabilecek tehlikelere karşı önlemler alarak, en hızlı, en uygun şekilde müdahale etmeye hazırlanmaktır. Hazırlık safhasında yapılan bazı çalışmalar şunlardır:

- Afet yönetimine ve acil yardıma yönelik planların hazırlanması ve geliştirilmesi,
- Eğitim ve tatbikatlar düzenleyerek görevli personellerin bilgi düzeylerinin yükseltilmesi,
- Vatandaşların bilinçlendirilmesine yönelik eğitim ve çalışmalar,
- Arama-kurtarma faaliyetlerine yönelik eğitimlerin verilmesi,
- Bölge teçhizat merkezlerinin kurulması ve kritik malzemelerin stoklanması bu çalışmalardan bazılarıdır (KADIOĞLU, Afet Zararlarını Azaltmanın Temel İlkeleri, 2008).

Müdahale (Kurtarma ve İlk Yardım)

Afet meydana geldikten sonra en etkin ve en hızlı şekilde hayat kurtarmak ve afetin neden olduğu zararlarını azaltmak, yaralıların ve afetzedelerin ihtiyaçlarını gidermek için yapılan çalışmaların tamamını kapsar. Müdahale aşamasında yapılacak olan bütün faaliyetlerin en kısa sürede ve en uygun yöntemle yapılması gerekmektedir (ŞAHİN N. , 2007). Müdahale safhasında yapılan bazı çalışmalar şunlardır:

- İletişim ve ulaşım,
- İhtiyaçların tespit edilmesi,
- Arama, kurtarma ve ilk yardım çalışmaları,
- Geçici barınmanın sağlanması,
- Yiyecek, içecek, giyecek ve yakacak temini,
- Güvenlik, çevre sağlığı çalışmaları,
- Yangın, patlama, salgın hastalıklar ve diğerleri gibi ikincil afetlerin önlenmesi bu çalışmalardan bazılarıdır (KADIOĞLU, Afet Zararlarını Azaltmanın Temel İlkeleri, 2008). Herhangi bir afet meydana geldiğinde yapılması gereken en önemli nokta insan yaşamını korumaktır. İnsan yaşamını korumak için afetten sonraki ilk 72 saat çok kritiktir. İlk 72 saat ‘Altın Saat’ olarak adlandırılmakta ve bu da arama-kurtarma çalışmalarının mümkün olduğunca hızlı ve verimli yapılması gerektiği anlamına gelmektedir (INSARAG, 2017).

İyileştirme

İyileştirme; afet meydana geldikten sonra başlar ve toplumun afet olmadan önceki yaşamına dönmeye kadar devam eder. İyileştirme çalışmaları afetten etkilenen kişilerin ve toplumun

afetten önceki faaliyetlerini devam ettirmesini sağlamak için çalışmalar yapmaktadır (ERSOY YILMAZ , 2020). İyileştirme safhasında yapılan bazı çalışmalar şunlardır:

- Yerel ekonomik canlılığı yeniden kazandırma çalışmaları,
- Altyapıyı geliştirme,
- Sanayi ve ticareti destekleme,
- Toplumun eğitim ve bilgi düzeyini yükseltme çalışmaları,
- Toplumun olası bir afet karşısında daha dirençli olmasını sağlamak için sosyal ve psikolojik destek vermek bu safhadaki çalışmalardandır (AKYEL, 2007).

Yeniden İnşa

Afet, meydana geldiği toplumun sosyo-ekonomik yapısını ve afetzedelerin psiko-sosyal yaşantısını bozmaktadır. Yeniden inşa safhası; bozulmuş olan sosyo-ekonomik yapı ve psikososyal yapının en az afet öncesindeki düzeye yükseltilmesini sağlamak ve yıkılan ya da hasar gören tüm yapıları yeniden inşa etmek için çalışmalar yürütür. Yeniden inşa çalışmalarının süresi afetin büyüklüğüne ve etkisine göre değişmektedir. Afetin meydana geldiği bölgede zarar gören insan, kurum, yerleşim alanı gibi bütün unsurlar ekonomik, sosyal, eğitim, sağlık, fiziki yönden yeniden inşası gerekmektedir. Bu safhada yapılan bazı çalışmalar şunlardır:

- Afet sonucunda hasar almış ya da yıkılmış yapıların yeniden inşa edilmesi,
- Afetzedenin bozulmuş olan psikolojisinin tedavi edilmesi,
- Afet neticesinde bozulmuş olan ekonomik hayatı yeniden canlandırmak için ekonomik destek paketlerinin uygulanması,
- Afet nedeniyle bozulan sosyal yaşam alanlarının yeniden inşa edilmesi bu safhada yapılan çalışmalardan bazılarıdır (ERSOY YILMAZ , 2020).

AKILLI ŞEHİRLER VE AFET YÖNETİMİ

Şehirler, insanların için yaşam alanıdır. Doğal veya insan kaynaklı afetler toplumsal yaşamı etkilemekte ve bu etkiler en çok şehirler üzerinde olmaktadır. Bu nedenle şehirlerdeki tüm sorunlara çözüm aranması gerekmektedir. Şehirlerin afetlerden en az düzeyde etkilenmesi ve can ve mal kayıplarının oluşmaması için afet yönetimi şehirlere entegre edilmeli ve akıllı şehirlere önem verilmelidir. Bu çalışma afetlere karşı akıllı şehir uygulamalarının afet yönetimi için önemini göstermektedir.

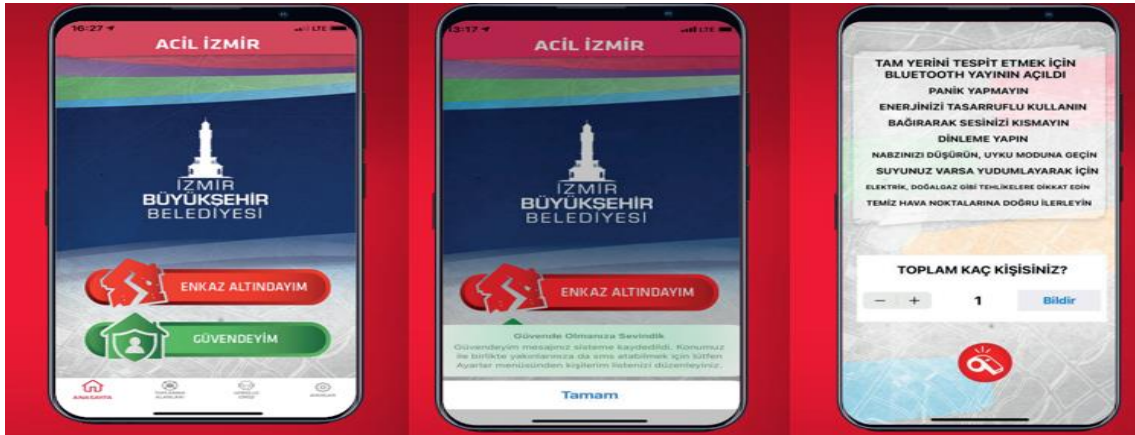
Afet Yönetim Sürecinde Öne Çıkan Akıllı Şehir Uygulamaları

Afet yönetim sürecinde dünyada ve Türkiye’de öne çıkan ve iyi uygulama örneği olarak gösterilen akıllı şehir uygulamalarından bazıları aşağıda açıklanmıştır.

Acil İzmir Uygulaması

İzmir, deprem tehlikesi açısından riskli bölgede yer aldığı için depremin neden olacağı zararları önlemek ya da en düşük düzeye indirmek için akıllı şehir uygulamalarının kullanımının yaygınlaştırılması gerekmektedir. Depremin etkilerini en aza indirebilmek için ‘Acil İzmir’ uygulaması hizmet vermektedir.

Acil İzmir uygulaması olası deprem sonrasında enkaz altında kalan vatandaşlara ulaşmak ve arama kurtarma çalışmalarını daha verimli hale getirmek amacıyla oluşturulmuştur. Uygulama, deprem sonrasında vatandaşların enkaz altında olduklarını ya da güvende olduklarını bildirdikleri bir mobil uygulama olarak çalışmaktadır. Ayrıca deprem sonrasındaki çalışmalarda gönüllü olarak yer alacak vatandaşlar arasındaki iletişimin sağlıklı bir şekilde gerçekleşmesini sağlamak ve toplanma alanlarının yerleri de bu uygulama içerisinde gösterilmektedir. Uygulamanın içeriği şu şekildedir (İzmir Büyükşehir Belediyesi, 2021).



Şekil 13: Acil İzmir uygulaması

Kaynak: (İzmir Büyükşehir Belediyesi, 2021).

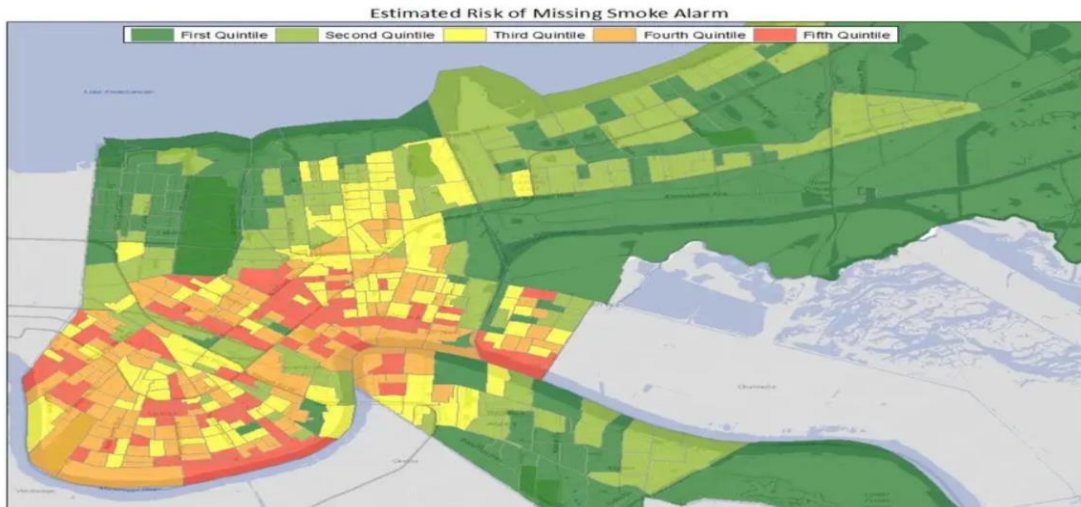


Şekil 14: Acil İzmir uygulaması

Kaynak: (İzmir Büyükşehir Belediyesi, 2021).

Smoke Detectors

Amerika'nın Louisiana Eyaleti'ne bağlı New Orleans şehrinde kullanılan 'Smoke Detectors' uygulaması ile olası bir yangın önceden tespit edilip önlenmektedir. New Orleans itfaiyesi yangına daha erken müdahale edebilmek ve yangının olumsuz sonuçlarını en aza indirebilmek için evlere ücretsiz bir şekilde duman dedektörü kurulumunu sağlamıştır. Şehrin yangın risk haritası birinci dereceden beşinci dereceye kadar renklendirme yöntemiyle oluşturulmuştur (Şekil 13). Yangın riskine göre belirlenen alanlarda alınan önlemler ve kurulan duman dedektörü sayesinde yangına erken müdahale imkanı sağlanmaktadır. New Orleans'ta kullanılan bu uygulama ile olası bir yangının neden olacağı can ve mal kayıpları en aza indirilmektedir (SHROPSHIRE, 2019).



Şekil 15. New Orleans Smoke Detectors

Kaynak: (SHROPSHIRE, 2019).

İzmir-Yapay Zeka İle Yangın Tespit ve Analiz Sistemi/Akıllı İhbar Sistemi (AİS)

Şehirleşme ve iklim değişikliği, doğal yaşamı tehdit eden orman yangınlarının oluşma riskini her geçen gün artırmaktadır. Türkiye’de orman yangın riski yüksek olan İzmir’de ‘Akıllı İhbar Sistemi (AİS)’ ile İzmir ormanlarının %62’lik kısmı 18 kuleden toplam 72 kamera ile 360 derece 7/24 kesintisiz olarak izlenmektedir. AİS, kameralar yardımıyla dumanı algılayıp, yangının şeklini ve seyrini belirleyip dumanın görüntüsünün yerini, koordinatlarını itfaiye ekipleri ile muhtarlara aktarmaktadır. Sistem canlı izleme özelliği sayesinde ekipler tarafından alınan ihbar canlı olarak izlenebilir ve kayıt altına alınabilir (Şekil 14, 15). Akıllı İhbar Sisteminin amacı yangını başlangıç anında söndürmektir. AİS ile 3 ayda 34 orman yangınına başlangıç aşamasında müdahale edilip yangının büyüüp genişlemeden söndürülmesi başarılı bir şekilde gerçekleştirilmiştir (İzmir Büyükşehir Belediyesi, 2022).



Şekil 16. Akıllı İhbar Sistemi (AİS)

Kaynak: (İzmir Büyükşehir Belediyesi, 2022).

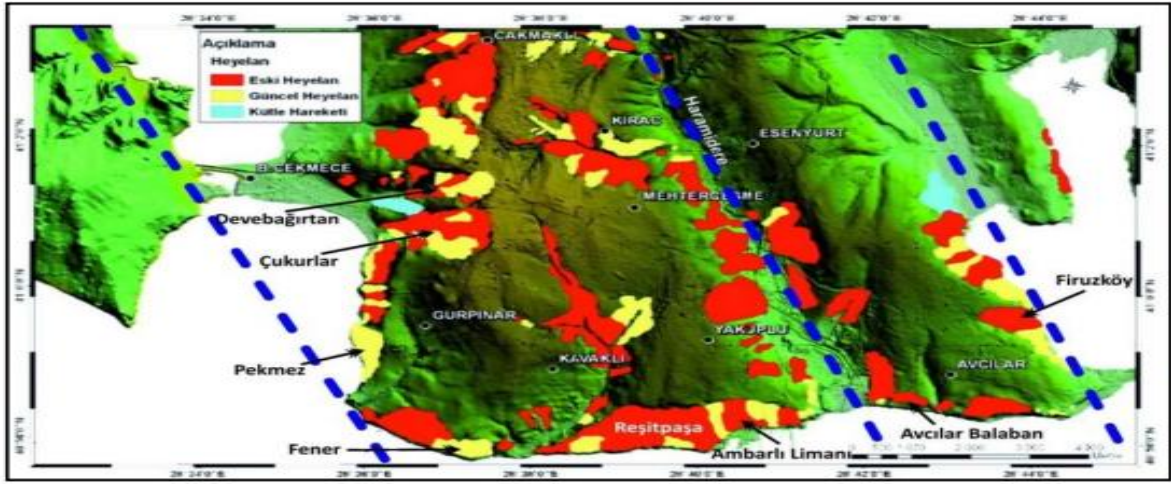


Şekil 17. Akıllı İhbar Sistemi (AİS)

Kaynak: (İzmir Büyükşehir Belediyesi, 2022).

Beylikdüzü Afet Bilgi Sistemi (ABİS)

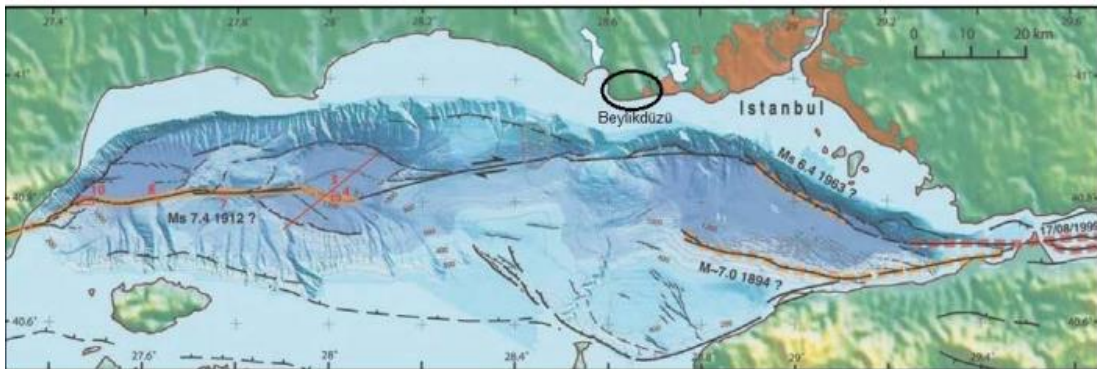
İstanbul'un Beylikdüzü İlçesi can ve mal kaybına yol açan deprem, heyelan gibi afetlere maruz kalmaktadır. İlçenin litolojik yapısı kum, kil, çakıl, marn gibi gevşek yapıları zeminden oluştuğu için heyelan olaylarının yaşanmasına ortam hazırlamaktadır. Heyelan olayı genel olarak kıyı kesimlerde eğim değerlerinin arttığı yamaçlar ile akarsu vadilerinde eğim değerlerinin arttığı yamaçlarda yoğunlaşmıştır. İlçede heyelan olayı en fazla Gürpınar Mahallesi'nin Büyükçekmece koyuna bakan yamaçlarında meydana gelmektedir. Ayrıca Marmara Denizine komşu güney yamaçlarda da heyelan olayı görülmektedir (YAMAN KOCADAĞLI, 2017).



Şekil 18. Eski ve güncel heyelan alanlarının dağılımı

Kaynak: (YAMAN KOCADAĞLI, 2017).

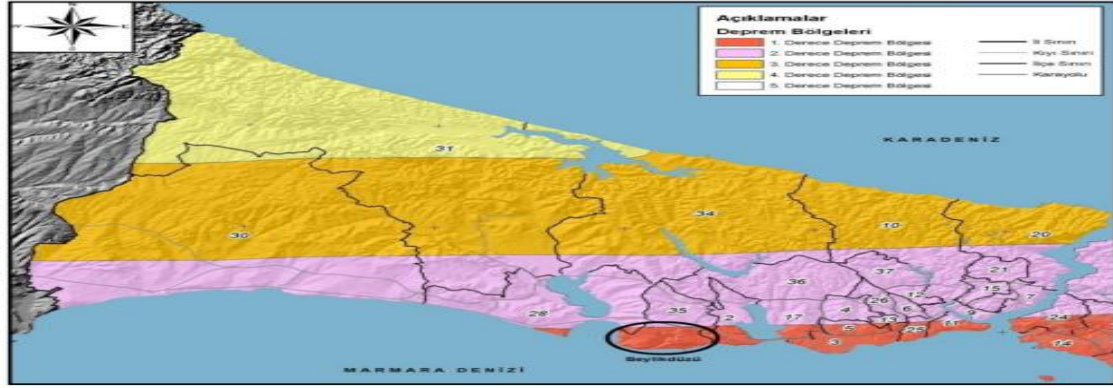
Beylikdüzü için tehlike arz eden bir diğer afet depremlerdir. Kuzey Anadolu Fay Hattı'nın varlığı bölgenin deprem riskini arttırmaktadır (Şekil 17). Tarihsel süreç içerisinde bu fay hattı üzerinde büyük miktarlarda can ve mal kayıplarına neden olan birçok deprem meydana gelmiştir.



Şekil 19. Kuzey Anadolu Fay Hattı'nın Marmara Denizi içerisindeki uzanım hattı ve Beylikdüzü'ne göre konumu

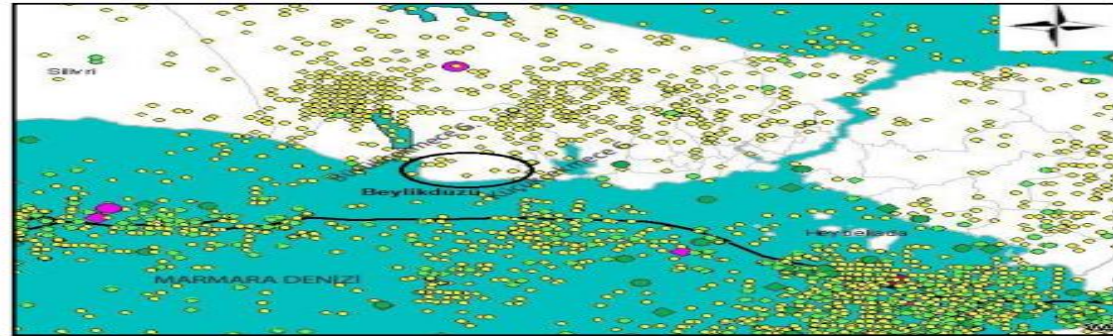
Kaynak: (YAMAN KOCADAĞLI, 2017).

Ülkemizin en aktif ve deprem üretme potansiyeli en yüksek fay hatlarından birisi Kuzey Anadolu Fay Hattıdır. Aktif bir deprem sahasında yer alan Beylikdüzü 1.dereceden deprem bölgesinde yer almaktadır (Şekil 18). İstanbul ve çevresinde 1999 Marmara depremleri başta olmak üzere çeşitli büyüklüklerde birçok deprem meydana gelmiştir (Şekil 19).



Şekil 20. İstanbul deprem bölgeleri dağılım haritası

Kaynak: (YAMAN KOCADAĞLI, 2017).



Şekil 21. 1900 ile 2010 yılları arasında Marmara Denizinin kuzeyi ve İstanbul ilinde büyüklüğü 2 'nin üzerinde meydana gelmiş olan depremlerin dağılımı

Kaynak: (YAMAN KOCADAĞLI, 2017).

Afetler açısından riskli bir konumda olan Beylikdüzü İlçesinde olası bütün afetlere karşı hazırlıklı olma yönünde çalışmalar yapılmaktadır. Ayrıca doğa olaylarının bir afete dönüşmesini engellemek için ve vatandaşların güvenli bir yaşam sürdürmesini sağlamak amacıyla etkin bir 'Afet Yönetim Sistemi' oluşturma yönünde çalışmalar yapılmaktadır. Bu doğrultuda 'Beylikdüzü Hazır' uygulaması kullanılmaktadır. Bu uygulamada;

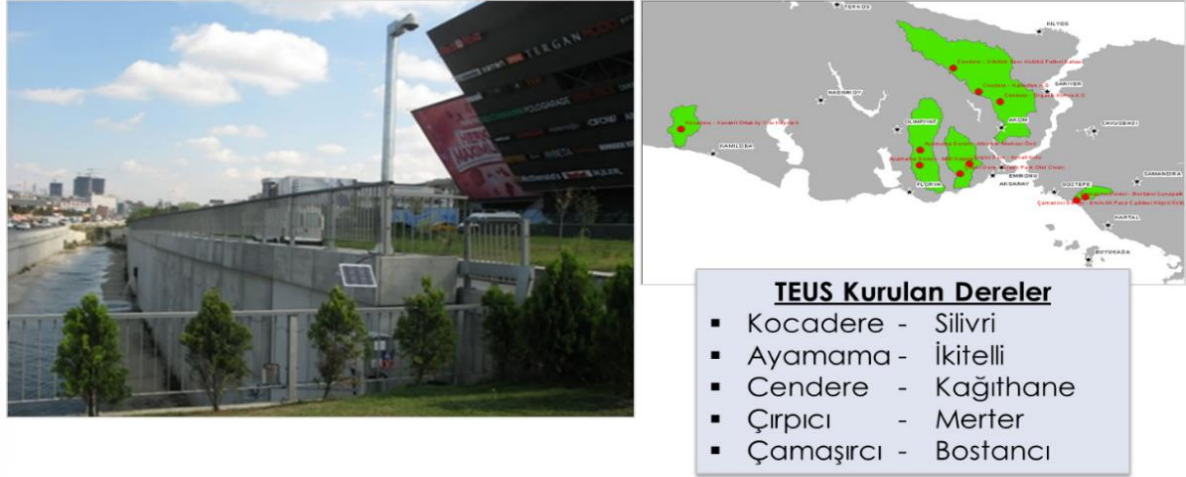
- Acil durum planı,
- Toplanma alanları,
- Deprem çantasında nelerin bulunması gerektiği,
- Afet öncesi, anı ve sonrasında dikkat edilmesi gerekenler,

- Afet öncesinde yapılması gereken risk azaltma faaliyetleri,
- Alınması gereken önlemler,
- Vatandaşlara yönelik eğitim çalışmaları,
- İlçenin güncel verilerine yönelik bilgiler yer almaktadır (Beylikdüzü Belediyesi, 2017).

Ayrıca ‘Afet Bilgi Sistemi (ABİS)’ uygulaması Beylikdüzü’nün afetlere karşı var olan tüm kapasitesinin belirlenmesini ve yönetilmesini sağlamaktadır. ABİS ile ilçede yaşayan vatandaşların ikamet ettikleri ya da çalıştıkları yerlere özel toplanma alanları oluşturulmuştur. Ayrıca olası bir afet durumunda ihtiyaç duyulan tüm unsurların (hastane, eczane, acil ulaşım yolları, su temin noktaları vb.) adres bilgileri bu sistemde yer almaktadır. Beylikdüzü İlçesi sahip olduğu akıllı şehir uygulamaları ile afet yönetimini etkin bir şekilde uygulamaktadır (Beylikdüzü Belediyesi, 2017).

Taşkın Erken Uyarı Sistemi (TEUS) ve Sel Erken Uyarı Sistemi

Türkiye orta kuşakta yer almasından dolayı atmosferik kökenli afetlere maruz kalmaktadır. Türkiye’de yaşanan taşkınların genel nedeni, plansız ve kontrolsüz yapılaşma ve şehirleşme faaliyetleridir (ÖZMEN, Sel-Taşkın Türkiye ve Antalya, 2015). Dünyada önemli afetler arasında gösterilen taşkın afeti, Türkiye’de en fazla can ve mal kaybına yol açan ikinci afet türüdür. (Birinci sırada deprem vardır.) Bu nedenle taşkınların önlenmesi ve etkilerinin azaltılması için taşkın tahmin yöntemleri kullanılmaktadır. Taşkının önceden tahmin edilmesi ve etkilerinin azaltılması hususunda taşkın bölgesinde yaşayan kişilere erken uyarı sistemiyle uyarı yapılabilen, can ve mal kayıpları en aza indirilebilmektedir (KADIOĞLU, Kent Selleri Yönetim ve Kontrol Rehberi, 2019). Türkiye’nin en büyük şehri olan İstanbul’da AKOM ve İSKİ tarafından ortak bir çalışma yürütülerek taşkın afeti sonucunda oluşabilecek can ve mal kayıplarını en az düzeyde tutmak için ‘Taşkın Erken Uyarı Sistemi (TEUS)’ kurulmuştur (Şekil 20). TEUS, su seviyesinde meydana gelen artışı ve bu artışa bağlı olarak artan su akımının yerleşim alanlarında oluşturduğu taşkın riskini tespit etmek için kullanılır. Bu sistem dereler üzerine kurulan akım gözlem istasyonu ve bazı sensör ve ekipman yardımıyla su seviyesi takip edilmekte ve kamera vasıtasıyla dereler izlenmektedir. Su seviyesinin anlık ve canlı bir şekilde izlenip takip edilebildiği bu uygulama sayesinde İstanbul’un taşkın karşısındaki dirençliliği arttırılmış ve afet yönetimi noktasında şehrin güvenliği sağlanmıştır.

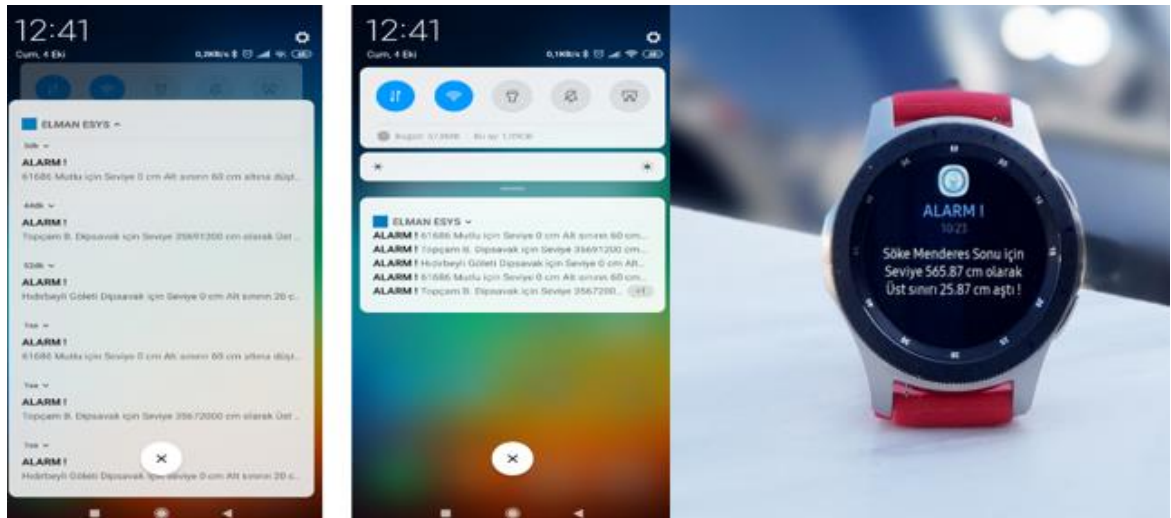


Şekil 22. Taşkın Erken Uyarı Sistemi (TEUS)

Kaynak: (İstanbul Büyükşehir Belediyesi AKOM, 2022).

Sel erken uyarı sistemi, akarsularda bulunan suların ani olarak yükselmeleri durumunda ilgili kamu kurum ve kuruluşlarına erken uyarı verip önlemlerin önceden hızlı bir şekilde alınmasını ve can ve mal kaybının önlenmesini sağlamaktadır. Tehlikeli bir durum oluştuğunda sistemi kullanan kurum kuruluşlara;

- Akıllı telefon ya da tablet üzerinden bildirim göndererek (Şekil 21),
- Akıllı saatlerden alarm uyarısı ileterek (Şekil 21),
- SMS ile bildirim yaparak,
- Hoparlör ile sesli uyarı vererek tehlikeli duruma karşı erken uyarı sağlanır. Böylece sel durumu gerçekleşmeden önce hazırlık yapmak için, meydana gelebilecek can ve mal kaybını en az düzeyde tutmak için gerekli olan önlemleri alma fırsatı oluşur (ELMAN, 2023).

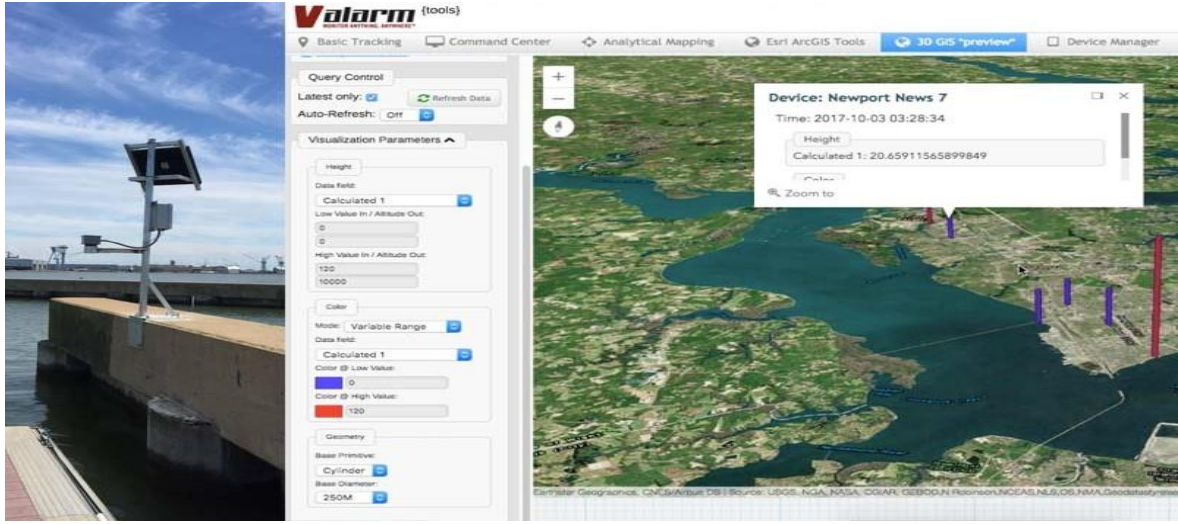


Şekil 23: Sel erken uyarı sistemi

Kaynak: (ELMAN, 2023).

Valarm

Amerika'nın okyanus kıyısında yer alan Virginia Eyaleti'nde sel afetiyle mücadele etmek için 'Valarm' sistemi uygulanmaktadır (Şekil 22). Bu uygulama ile fırtınalardan, yağmurdan ya da gelgitlerden kaynaklanan sel olayını engellemek hedeflenmektedir. Bunun için okyanus kenarlarına ve şehrin belirli bölgelerine konumlandırılan sel ve su izleme sistemleri ve derinlik sensörleri kullanarak su seviyesi ve derinlik seviyesi ölçülmektedir (Şekil 23). Olası bir tehdit durumunda eyalet sakinleri erken uyarı sistemleriyle harekete geçirilecektir. Böylece sel nedeniyle oluşabilecek can ve mal kaybı en düşük seviyede tutulmuş olacaktır (Valarm, 2022).



Şekil 24. Valarm

Kaynak: (Valarm, 2022).



Şekil 25. Valarm

Kaynak: (Valarm, 2022).

Smart Water Vejle

Danimarka bulunduğu konum nedeniyle sel afetine maruz kalmaktadır. Danimarka'nın kıyı şehirlerinden birisi olan Vejle şehri, nehirlerin ve vadilerin birleştiği yerde bulunduğundan dolayı sel riskiyle karşı karşıyadır. Tarihsel süreç içerisinde Vejle şehrinde yoğun yağışlar ve sık sık sel olayları meydana gelmiş ve bu sel olaylarından şehir sakinleri zarar görmüştür. Zaman içerisinde yağışların artması, deniz suyu seviyesinin yükselmesi, iklim değişikliğinin etkisi ve fırtınaların sık sık olması nedeniyle sellerin sıklığı ve şiddeti artmıştır. Vejle şehrinin bu yapısı nedeniyle sel afeti şehir için sürekli bir tehdit oluşturmaktadır. Şehri sellerden korumak için nehirlere taşkın koruma kapakları yapılmıştır (Şekil 24) (DHI Worldwide, 2018). Sel olayının olumsuz sonuçlarını minimuma indirmek için taşkın kontrol yapılarını etkin bir şekilde yönetmek gerekmektedir. Bunu gerçekleştirmek için 'Smart Water Vejle' uygulaması geliştirilmiştir. Bu uygulama ile taşkına bağlı ölçüm ve hesaplamalar yapılarak uyarı sistemleri ve planlamalar geliştirilir. Smart Water Vejle uygulamasıyla;

- Radar tahminlerini kullanma: 10 dakika arayla radardan gelen yağış verileri ilk olarak yağmur ölçere göre kalibre edilir. Sonra 2 saatlik yağış tahmini yapılır.
- Nehir akışını ve su seviyelerini tahmin etme: Radar ölçümlerine göre yüzey sularının, nehir sularının ve yer altı sularının akışı tahmin edilir.
- Yağış tahminleri, sensör verileri, su seviyesi ve akış tahminlerini kullanarak taşkın kontrol sistemlerinin kontrolü gerçekleştirilir.
- Yer altı, nehir ve yağmur suyunun drenajı için destek sistemleri geliştirilir, kentsel yağmur suyu drenajını belirlemek için modelleme yöntemiyle tahmin yapılır.
- Veri görselleştirme: Ölçülen, tahmin edilen verilerin daha iyi anlaşılabilmesi için görselleştirme yapılır.
- Elde edilen bütün veriler ve tahminler tek bir platforma aktarılır (DHI Worldwide, 2018).

Bu uygulama ile sel tehlikesi altında yer alan Vejle şehrinin sel olayına karşı direnci arttırılmış, selin meydana getirebileceği muhtemel zararları en az düzeye indirmek için çalışmalar yapılmıştır. SMART Water Vejle uygulaması olumlu sonuçlar vermiştir. Sonuç olarak;

- ✓ Vejle şehri; akarsu, yağmur, kıyı taşkın riskini yönetebilir seviyeye gelmiştir.

- ✓ Erken uyarı sistemiyle daha güvenli ve daha hızlı sel acil durum yönetimi sağlanır (Resilient Vejle, 2016).



Şekil 26. Taşkın koruma kapakları

Kaynak: (DHI Worldwide, 2018).

Tokyo-Japonya Sel Suları Yeraltı Depolama Sistemi

Japonya'nın başkenti Tokyo'da şehri fırtına, sel ve taşkından korumak için yeraltına sel sularını depolama sistemi yapılmıştır. Tokyo'nun bazı eyaletleri Nakagawa Havzasında yer almaktadır. Bu havza; Edogawa Nehri (Şekil 25) seviyesinin altında, alçak bir arazi şeklinde ve içinden Edogawa Nehri de dahil olmak üzere birkaç nehrin geçtiği bölgedir. Bölge, nehir sularının kaynağını oluşturan dağlardaki karların erimesi döneminde ve şiddetli yağışlarla beraber oluşan tayfun ve fırtına sonucunda sel ile karşı karşıya kalmaktadır. Şehir, meydana gelen sel ve taşkınlar sonucunda zarar görmektedir. Tarım mahsulleri, tarım arazilerinin sular altında kalmasından dolayı yok olmaktadır. Bölgede defalarca ciddi sel olayları meydana gelmiş ve sel afeti sonucunda birçok kişi mağdur olmuştur. Nüfusun yoğun olduğu bölgeyi sel afetinin olumsuz etkilerinden korumak için yeraltı depolama sistemleri geliştirilmiştir. 1992 yılında başlanan bu proje 2006 yılında tamamlanmıştır. Geliştirilen proje sonucunda, şehirde sel ve taşkınların yol açtığı can ve mal kayıpları azalmıştır. Bu proje, üzerinde bina bulunmayan tarım arazisi altına inşa edilmiştir.



Şekil 27. Edogawa Nehri

Kaynak: (Japan Experience , 2014).

**International Conference on Global Practice of Multidisciplinary Scientific Studies-
IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

Yeraltı depolama sistemi (Şekil 26, 27);

- 6,3 km. uzunluğundaki merkezi tünel aracılığı ile nehirlerdeki fazla su toplanır ve muhafaza silolarına aktarılır.
- Yüksekliği 70 metre, genişliği 30 metre olan muhafaza siloları fazla suyu biriktirir.
- Toplanan su daha sonra 10 metre genişliğindeki yeraltı su tünelinden dengeleme tankı tesisine aktarılır.
- Yağış bittikten sonra ve durum normale döndüğünde depolanan su güvenli bir şekilde Tokyo Körfezi'ne bırakılmak için Edogawa Nehrine Pompalanır.
- Sel suları Edogawa Nehri aracılığı ile Tokyo Körfezi'ne boşaltılır (Japan Experience , 2014).



Şekil 28. Yeraltı taşkın koruma deposu

Kaynak: (Japan Experience , 2014).



Şekil 29. Yeraltı su deposu

Kaynak: (Japan Experience , 2014).

Stockholm (İsveç)-Hammarby Sjöstad

Sera gazları, atmosferdeki ısıyı tutarak sıcaklığı artırmakta ve küresel ısınmaya ve iklim değişikliğine neden olmaktadır. Stockholm (İsveç) yetkilileri atmosfere zararlı olan sera gazlarının salınımını azaltmak için fosil yakıt kullanımı azaltıp yenilenebilir enerji kaynaklarının kullanımını yaygın hale getirmiştir. Bu sayede sera gazının salınımı Stockholm’de ülke ortalamasının yarısına düşürülmüştür (YILDIZ, 2013). Stockholm’ün Hammarby Sjöstad semti akıllı şehir kapsamında yeniden inşa edilmiştir. 1997 yılında başlanan bu proje kapsamında;

- Yeraltına otomatik atık toplama sistemi yapılması,
- Isıtma ve soğutmanın merkezi sistem üzerinden sağlanması,
- Sıcak su ve elektriğin güneş enerjisinden elde edilmesi,
- Eysel kanalizasyon suyu ve atıklardan biyogaz elde edilmesi,
- Yüzey sularının toplanması ve filtrelenmesi yer almaktadır (YILDIZ, 2013).

Hammarby Sjöstad semtinde yer altına atık maddelerin dönüşümünü sağlamak için bir alt yapı sistemi kurulmuştur (Şekil 28) (YILDIZ, 2013). Bölgedeki evlerin önüne çöp kutusu yerine geçen metal kutular yerleştirilmiştir (Şekil 29). Bu kutuların kapakları farklı renklerde, bu renkler atık maddelerin cinslerine göre ayrılmasını sağlamak ve atık maddelerin uygun çöp kutusuna atılmasını sağlamaktadır. Bu çöp kutuları günde 2 defa vakum sistemiyle çöpleri yeraltındaki boru sistemine aktarmaktadır (Şekil 28). Organik atık maddeler gübre üretim merkezine gönderilmekte, diğer atık maddeler yakılarak enerji elde edilmekte ve merkezi ısıtma sisteminde kullanılmaktadır. Atık sıvı maddelerden ise arıtma tesislerinde biyogaz elde edilmektedir. Elde edilen biyogaz mutfaklardaki ocaklarda ve belediye otobüslerinde kullanılmaktadır (YILDIZ, 2013).



Şekil 30. Yeraltı atık toplama sistemi

Kaynak: (YILDIZ, 2013).



Şekil 31. Metal çöp kutuları

Kaynak: (YILDIZ, 2013).

Bölgede soğuk geçen kış aylarında ısınmayı sağlamak için ‘temiz atık yakım teknolojisi’ ile bölgesel merkezi ısıtma sistemi oluşturulmuştur. Bu sistem ile bölgedeki enerji tesislerinde elde edilen buhar ve sıcak su, yeraltındaki borular aracılığı ile binalara iletilmektedir. Bu sistem aracılığıyla bölge nüfusunun %50’sinin ısınma ihtiyacı karşılanmaktadır. (YILDIZ, 2013). Stockholm şehrinde ısınma için gerekli olan enerjinin %80’i yenilenebilir enerji kaynaklarından karşılanmaktadır. Bu sistem sayesinde atmosfere salınan sera gazı emisyonunun azaldığı belirlenmiştir. Yaz aylarında bölgenin soğutma ihtiyacı da aynı sistem üzerinden soğuk göl ve deniz suyu kullanılarak gerçekleştirilmektedir. Bu soğutma sistemi sayesinde karbondioksit emisyonu yılda yaklaşık olarak 50 bin ton azalmaktadır (DİLER, 2012). Ayrıca bölgede sıcak su ve elektrik üretimi konusunda güneş enerjisi teknolojilerinden yararlanılmaktadır. İsveç’te ısınma ve elektrik üretimi için kullanılan petrol miktarı %90 oranında azalmıştır. Buna bağlı olarak da karbondioksit emisyonu azalmıştır (YILDIZ, 2013).

SONUÇ VE ÖNERİLER

Dünya nüfusunun hızla artış göstermesi ve insanların daha iyi imkanlar altında yaşamak istemesinden dolayı şehirlerde yaşayan insan sayısı gün geçtikçe artmaktadır. Şehirleşmenin hızlı bir şekilde olması şehirlerde; çevre sorunları, denetimsiz yerleşim, gecekondulaşma, alt yapı sorunları gibi birçok sorunları ciddi boyuta ulaştırmıştır. Böyle bir durumda şehirlerde meydana gelebilecek olası afetlerin maddi ve manevi etkileri çok büyük olacaktır. Bu nedenle şehirleri daha yaşanabilir kılmak için ve yaşam standartlarını arttırmak için akıllı şehir uygulamaları geliştirilmektedir. Afetlerin olumsuz etkilerini azaltmaya yönelik ve afetleri daha yönetilebilir kılmaya yönelik geliştirilen akıllı şehir uygulamalarından bazıları ele alınarak anlatılmıştır.

Doğal kökenli ya da insan kökenli meydana gelen afetler her geçen gün daha çok can ve mal kaybına neden olmaktadır. Özellikle çarpık kentleşme, nüfusun hızla artması, zayıf binalar, alt yapı eksiklikleri, toplumun afet bilinci düzeyinin düşük olması gibi etkenler afetin toplum üzerindeki etkilerinin artmasına neden olmaktadır. Afetleri önlemek ya da afetlerin zararlarını azaltmak için toplumu afetlere karşı dirençli hale getirmek gerekmektedir. Toplumun afetlere karşı direncini arttırmak için;

- Afetlere yönelik eğitim verilmeli,
- Afet yönetimi konusunda risk yönetimi alanına daha çok önem verilmeli,

- Afet meydana gelmeden önce önlem alınmalı, hazırlık yapılmalı,
- Afetlerle mücadele modelleri, uygulamaları oluşturulmalı,
- Afet risk haritaları oluşturularak afetlere özel çalışmalar yapılmalı,
- Afet tehlikesi ve riski konusunda toplum bilinçlendirilmelidir.

Afetler, toplumun olağan yaşamını etkileyen önemli etkenlerden bir tanesi olmakla beraber özellikle şehir yaşamını olumsuz etkilemektedir. İklim değişikliği, toprak kayması, sel, deprem gibi birçok afetlere karşı yenilikçi çözüm üretmek gerekmektedir. Bu noktada çözüm üretme aracı olarak karşımıza akıllı şehir uygulamaları çıkmaktadır. Şehirlerdeki; alt yapı yetersizliği, birimler arasındaki koordinasyon eksikliği, toplumun bilinç düzeyindeki eksiklikler afetlerle mücadele konusunda karşılaşılan zorluklardandır. Akıllı şehir uygulamaları karşılaşılan bu ve buna benzer sorunların giderilmesi konusunda yenilikçi çözümler üretmektedir. Şehirlerin sorun ve ihtiyaçlarına çözüm üreten akıllı şehir uygulamaları, afet yönetimi sürecinde de çözüm üretmektedir. İzmir, New Orleans, İstanbul, Virginia, Vejle, Stockholm, Tokyo gibi şehirlerde uygulanan akıllı şehir uygulamalarının;

- Afet yönetiminde kullanılan birçok akıllı uygulama geliştirdiği,
- Afetlerin neden olduğu can ve mal kaybının azalmasında etkisi olduğu,
- Şehirlerin afetler karşısında daha dirençli hale gelmesinde etkisi olduğu görülmektedir.

Akıllı şehir uygulamaları, ihtiyaç ve sorunlara yönelik vatandaş odaklı sürdürülebilir çözümler üretmesinden dolayı afet yönetimi sürecinde etkin rol oynamakta ve afet ve acil durumlarda mücadelede önemli bir yer tutmaktadır.

Afetlere karşı dirençli şehirler geliştirmek için akıllı şehir uygulamalarına önem verilmelidir. Afet yönetiminde öne çıkan akıllı şehir uygulamaları vatandaşları bilgilendirerek toplumun afetlere karşı olan direncini artırmakta ve akıllı uygulamalarla şehirleri afetlere karşı daha dirençli hale getirmektedir.

ÖNERİLER

- Akıllı şehirler konusunda öncelikle yapılması gereken ‘Merkezi Kent Bilgi Sistemi’ uygulamalarının yaygınlaştırılması gerekmektedir.
- Akıllı şehir projelerinin yaygınlaşması için akıllı şehir çalıştayları ile belediyeler arasında bilgi aktarımı geliştirilmelidir.
- Kentsel dönüşüm çalışmalarında akıllı şehir yaklaşımı temel alınmalıdır.

- Akıllı şehir uygulamaları şehrin ihtiyaçlarına ve zorluklarına cevap verecek şekilde dizayn edilmelidir.
- Akıllı şehirlerde sürdürülebilir ve modern bir ağ altyapı sistemleri oluşturulmalıdır.
- Akıllı şehirleşme sürecinde insanlarla olan iş birliği ve iletişim artırılmalıdır.
- Afetler önlenemez ancak zararları toplumun direncini arttırarak azaltılabilir. Afet zararlarının azaltılabilmesi için akıllı ve bütünleşik afet yönetim sistemi uygulanmalıdır. Afet planları akıllı ve sürdürülebilir hale getirilmelidir.
- Toplumun afetlere karşı dirençli yapıya getirilmesi için afet bilinci eğitimi verilmelidir.
- Afetlere yönelik akıllı şehir uygulamaları geliştirilmeli ve kullanım alanları artırılmalıdır.
- Toplumun afetlere karşı bilinci arttırmak için afet bilgi sistemi gibi uygulamalar yaygınlaştırılmalıdır.
- Yangın afetine karşı akıllı ihbar sistemi ve duman dedektörleri gibi uygulamaların kullanımı yaygınlaştırılmalıdır.
- Sel ve taşkın olaylarının afete dönüşmesini engellemek için erken uyarı sistemlerinin kullanımı yaygınlaştırılmalıdır.
- Şehirleri afetlere karşı hazırlamak için afet planları geliştirilmelidir.
- Şehirlerde afetlerin neden olduğu olumsuz etkileri azaltmak için afetlere özel akıllı şehir uygulamaları geliştirilmeli ve bu uygulamalarının kullanımlarının yaygınlaştırılması gerekmektedir.

7.KAYNAKÇA

- (SHETOS), S. O. (1942). Nazim Ibrahim Frakulla from Berati. *Kultura Islame, No. 5-6-7*, 159.
- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*.
<https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953> adresinden alındı
- (1939). *Kultura Islame, No. 6-7*, 228-229.
- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), s. 1-20.
- AFAD. (2022). *Açıklamalı Afet Yönetimi Terimleri Sözlüğü*. Açıklamalı Afet Yönetimi Terimleri Sözlüğü Web Sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu> adresinden alındı
- AFAD. (2022). *AFAD*. AFAD Web sitesi: <https://www.afad.gov.tr/aciklamali-afet-yonetimi-terimleri-sozlugu> adresinden alındı
- AFAD. (2022). *AFAD Afet Türleri* Web sitesi: <https://www.afad.gov.tr/afet-turleri> adresinden alındı
- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi, 16*(1), s. 17-35.
doi:<https://doi.org/10.17130/ijmeh.700812>
- AKSOĞAN , M., & ÇALIŞ DUMAN, M. (2018, Aralık 7-9). Akıllı Şehir Uygulamaları; Malatya Örneği. *1. Uluslararası Battalgazi Multi Disipliner Çalışmalar Kongresi Tam Metin Kitabı Cilt 1, 1*, s. 183-202.
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 6*(2).
- AKYEL, R. (2007). *Afet Yönetim Sistemi: Türk Afet Yönetiminde Karşılaşılan Sorunların Tespit ve Çözümüne İlişkin Bir Araştırma*. Adana: Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Doktora Tezi.
- ALAVİ, A., PENGCHENG, J., WILLİAM, G., & NİZAR, L. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. *Measurement, 129*, s. 589-606.
- Albuquerque, R. (2003). The composition of international capital flows: risk sharing through foreign direct investment. *Journal of International Economics, 61*(2), 353-383.
- Ali, H. (1944). Hasan Zyko Kamberi 200 years ago. *Kultura Islame, No. 7-8*, 201.
- ARMAĞAN, V. (2018). Dijital Dönüşüm Sürecinde Akıllı Şehirler ve E-Devlet Platformu. *İletişim Kuram ve Araştırma Dergisi*(46), s. 387-414.
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Baetens, F. (2013). *Investment law within international law: integrationist perspectives*. Cambridge University Press.
- Bala, M. (1942). Do we have a modern Albanian drama. *Kultura Islame, No. 5-6-7*, 214.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. <https://www.bbc.com/news/world-europe-17776876> adresinden alındı
- Beqiri, G. (2017). Marketinguindërmarrjeve në Kosovë përmes aplikimit të mediave sociale. Tiranë .
- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development, 62*, s. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>
- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from <https://berkeleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>

- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Beurden, S. V. (2022, 4 30). *A New Congo Crisis?* https://origins.osu.edu/article/new-congo-crisis?language_content_entity=en adresinden alındı
- Beylikdüzü Belediyesi. (2017). *ABİS (Afet Bilgi Sistemi)*. ABİS (Afet Bilgi Sistemi) Web sitesi: <http://www.beylikduzuhazir.com/Abis> adresinden alındı
- Beylikdüzü Belediyesi. (2017). *Beylikdüzü Hazır*. Beylikdüzü Hazır Web Sitesi: <http://www.beylikduzuhazir.com/BeylikduzuHazir> adresinden alındı
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri. *International Peace Information Service*, 2-50.
- Britannica. (2021, 12 24). *Romania*. <https://www.britannica.com/place/Romania> adresinden alındı
- Britannica. (2022, 01 03). *Security*. Retrieved from <https://www.britannica.com/place/Romania/Political-process>
- Carey, B. (2021, April 1). *What's the Social Media Impact on Tourism?* CheckFront: <https://www.checkfront.com/blog/social-media-impact-on-tourism/> adresinden alındı
- Çelik, H. (2022). Türkiye'de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), s. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- ÇELİK, İ. H., USTA, G., YILMAZ, G., & YAKUPOĞLU, M. (2020). Türkiye'de Yaşanan Teknolojik Afetler (2000-2020) Üzerine Bir Değerlendirme. *AÇÜ Uluslararası Sosyal Bilimler Dergisi*, 6(2), s. 49-57.
- CENTER for ECONOMIC and SOCIAL RIGHTS. (2022, 04 14). Retrieved from Key Concepts: Human Rights and the Economy: <https://cesr.org/key-concepts/>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*. <https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/> adresinden alındı
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania's social strata in the past 30 years*. <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/> adresinden alındı
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*. https://www.constituteproject.org/constitution/Romania_2003?lang=en adresinden alındı
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*. <https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604>. adresinden alındı
- Critic and criticism. (1941). *Kultura Islame, No.20-21*, 179.
- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- Dave Evans with Jake McKee. (2010). *Social Media Marketing: The Next Generation of Business Engagement*. Canada: Wiley Publishing, Inc., Indianapolis, Indiana.
- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf
- De Schutter, O., Swinnen, J., & Wouters, J. (2012). *Foreign direct investment and human development: the law and economics of international investment agreements*. Routledge.
- Deloitte Vodafone. (2016, 12). *Akıllı Şehir Yol Haritası*. DeloitteTürkiye.
- DHI Worldwide. (2018). Improved Flood Control and Water Quality With A Smart Water Solution See How The City Of Vejle In Denmark Protects Its Streets From Flooding. *The Expert In Water Environments*.
- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- DİLER, G. (2012, 04 30). Avrupa Birliği'nin İlk Yeşil Başkenti Stockholm. *Ekoyapı*.
- Dolzer, R., & Stevens, M. (1995). *Bilateral investment treaties*. Martinus Nijhoff Publishers.

- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153> adresinden alındı
- ELMAN. (2023). *Elman Sel Erken Uyarı Sistemi*. Elman Sel Erken Uyarı Sistemi Web Sistesı: <https://elmantech.com/ehs/#:~:text=Ta%C5%9Fk%C4%B1n%20erken%20uyar%C4%B1%20sistem%20nehir,olarak%20uyar%C4%B1lar%20olu%C5%9Fturmas%C4%B1%20esas%C4%B1n%20dayan%C4%B1r> adresinden alındı
- ERSOY YILMAZ , A. (2020). *Afet Yönetimi*. Acil Durum ve Afet Yönetimi Uzaktan Eğitim Önlisans Programı.
- EU. (2022, 1 2). *History of the European Union 1960-69*. https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en adresinden alındı
- EU. (2022, 1 02). *History of the European Union 2000-19*. https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en adresinden alındı
- EU. (2022, 01 03). *Romania*. https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en adresinden alındı
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022> adresinden alındı
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. https://europa.eu/ecsc/index_en.htm adresinden alındı
- Europa.eu. (2021, 12 30). *Romania*. <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx> adresinden alındı
- European Commission . (2022, 1 2). *From 6 to 27 members*. https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en adresinden alındı
- European Commission. (2022, 01 02). *Accession criteria*. https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en adresinden alındı
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union: Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf adresinden alındı
- European Commission D G C. (2022, 01 02). *Bulgaria*. https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en adresinden alındı
- European Union. (2022, 1 2). *Country profiles*. https://european-union.europa.eu/principles-countries-history/country-profiles_en adresinden alındı
- European Union. (2022, 01 01). *History of the European Union 1945-59*. https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en adresinden alındı
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en adresinden alındı
- European Union law. (2021, 01 04). *Accession Treaties*. <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html> adresinden alındı
- Foldrejt. (2019). *Çfarë nënkuptojmë me sjelljen konsumatore?* Foldrejt: <https://foldrejt.com/cfare-nenkuptojme-me-sjelljen-konsumatore/> adresinden alındı
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Gallagher, K., & Zarsky, L. (2007). *The enclave economy: foreign investment and sustainable development in Mexico's Silicon Valley*. Mit Press.
- GIORDANO, V., GANGALE, F., FULLÌ, G., & JIMENEZ, M. S. (2011). *Smart Grid projects in Europe: Lessons Learned And Current Developments*. Joint Research Centre Institute for Energy European Commission.
- Global Edge. (2021, 12 30). *Romania: Government*. <https://globaledge.msu.edu/countries/romania/government> adresinden alındı
- Global Witness. (2009). NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- Goodale, M. (2018, 04). *The UNESCO Courier Seventy-year-old views that remain contemporary*. UNESCO: <https://en.unesco.org/courier/2018-4/seventy-year-old-views-remain-contemporary> adresinden alındı

- Heifetz A. R, Linsky M. (2014). *Leadership on the line*. Boston: Harvard Business School Publishing.
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* .
<https://www.heritage.org/index/country/romania> adresinden alındı
- Hosts. (2023). *What's the Social Media Impact on Tourism?* Hosts: <https://hotspot.earth/blog/whats-the-social-media-impact-on-tourism#:~:text=One%20of%20the%20greatest%20ways,and%20accommodations%20they%20can%20use.> adresinden alındı
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>
- ILGAZ, E. (2018). *Akıllı Şehirler ve Akıllı Şehirlerin Kurulmasında Rüzgar Enerjisinin Yönetimi ve Organizasyonu*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yönetim Organizasyon Bilim Dalı Yüksek Lisans Tezi.
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romania-foreign-policy-after-nato-and-eu-accession>
- INSARAG. (2017). *International Search and Rescue Advisory Group (INSARAG)*. International Search and Rescue Advisory Group (INSARAG) Web sitesi: <https://www.unocha.org/story/five-essentials-first-72-hours-disaster-response> adresinden alındı
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*.
<https://www.trade.gov/country-commercial-guides/romania-market-overview> adresinden alındı
- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- İstanbul Büyükşehir Belediyesi AKOM. (2022). *İstanbul Büyükşehir Belediyesi AKOM*. İstanbul Büyükşehir Belediyesi AKOM Web Sitesi: <https://akom.ibb.istanbul/hazirlik-planlama-calismalari/> adresinden alındı
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. <https://www.trade.gov/country-commercial-guides/romania-market-challenges> adresinden alındı
- İzmir Büyükşehir Belediyesi. (2021, 03 12). *Acil İzmir*. İzmir: Bilgi İşlem Dairesi Başkanlığı Harita ve CBS Dairesi Başkanlığı.
- İzmir Büyükşehir Belediyesi. (2022 , 10 3). *İzmir Akıllı İhbar Sistemi ile daha güvende*. İzmir Akıllı İhbar Sistemi ile daha güvende Web Sitesi: <https://www.izmir.bel.tr/tr/Haberler/izmir-akilli-ihbar-sistemi-ile-daha-guvende/47318/156> adresinden alındı
- Japan Experience . (2014, 11 10). *Japan Experience*. Kasukabe Underground Flood Protection Tank Web Sitesi: <https://www.japan-experience.com/all-about-japan/saitama/attractions-excursions/kasukabe-underground-flood-protection-tank> adresinden alındı
- Jashi, C. (2013). Significance of Social Media Marketing in Tourism. *ResearchGate*, 36-40.
- JESUS, I., MACHADO, J. A., carvalho, J. L., FERREIRA, J. R., & FIGUEIREDO, L. (2001). Towards the Development of Intelligent Transportation Systems. *Intelligent Transportation Systems Conference Proceedings - Oakland (CA) USA*(81), s. 1-6.
- KADIOĞLU, M. (2008). *Afet Zararlarını Azaltmanın Temel İlkeleri*. (M. KADIOĞLU, & E. ÖZDAMAR, Dü) Ankara: JICA (Japonya Uluslararası İşbirliği Ajansı) Türkiye Ofisi, Yayın No:2.
- KADIOĞLU, M. (2019). *Kent Selleri Yönetim ve Kontrol Rehberi*. Kültür Yayınları.
- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Developmen*, 6(4), s. 91-102.
- Kotter, J. (2014). *Accelerate: Building strategic agility for a faster moving world*. Boston: Harvard Business Review Press.
- Kouzes, J, Posner. B. (2022). *The leadership challenge* (Cilt Seventh edition). USA.
- Krajewski, M. (2018). Human rights in international investment law: recent trends in arbitration and treaty-making practice. *Available at SSRN 3133529*, 1-10.
- Kultura Islame. (1939). 228-229.
- Langevin, L., Lamarche , N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- Leaders Mag. (2022, 01 04). *Romania's Recovery*.
http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html adresinden alındı

- Li, C. (2014). *The engaged leader; A strategy for your digital transformation*. Philadelphia: Wharton School Press.
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*.
<https://www.macrotrends.net/countries/ROU/romania/population> adresinden alındı
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- MARCO, A. D., MANGANO, G., SCORRANO, F., NEIROTTI, P., & CAGLIANO, A. C. (2014). Current Trends In Smart City Initiatives: Some Stylised Facts. *Cities*, 38, s. 25-36.
- Mayfield, A. (2008). *What is Social Media?* iCrossing.
- McKinsey. (2018). *Smart Cities: Digital Solutions For A More Livable Future*. McKinsey & Company.
- Md Yusuf Hossein Khan and Tanvir Abir. (2022). *The Role of Social Media Marketing in the Tourism and Hospitality Industry*. IGI Global.
- MEDAK. (2022). *MEDAK*. MEDAK Web sitesi: <https://www.medak.org.tr/faydali-bilgiler/faydali-bilgiler/> adresinden alındı
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>
- MONUSCO. (2022, 4 20). *UNITED NATIONS ORGANIZATION STABILIZATION MISSION IN THE DR CONGO*. <https://monusco.unmissions.org/en/drc-attacks-adfarmed-group-may-amount-crimes-against-humanity-and-war-crimes> adresinden alındı
- Mosley, L. (2010). *Labor rights and multinational production*. Cambridge University Press.
- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*.
<https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants> adresinden alındı
- Mustafa, M. (1945). Gjuha amtare, Native language. *Kultura Islame, No. 3-4* , 72.
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- NAM, T., & PARDO, T. (2011, Haziran 12). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, s. 282-291.
doi:<https://doi.org/10.1145/2037556.2037602>
- Nations, D. (2021, January 26). *What Is Social Media?* Lifewire: <https://www.lifewire.com/what-is-social-media-explaining-the-big-trend-3486616> adresinden alındı
- NATO. (2022, 01 04). *NATO-Russia relations: the facts*.
https://www.nato.int/cps/en/natohq/topics_111767.htm adresinden alındı
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME* . <https://netaffair.org/documents/1957-rome-treaty.pdf> adresinden alındı
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- ÖZMEN, M. (2013). *Deprem ve Antalya*. Antalya: Kutlu&Avcı Ofset.
- ÖZMEN, M. (2015). *Sel-Taşkın Türkiye ve Antalya*. Antalya: Kutlu&Avcı Ofset Ltd. Şti.

- Pcweb. (2022, October 22). *Tourism industry meaning*. Pcweb.info: <https://pcweb.info/tourism-industry-meaning/?lang=en> adresinden alındı
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Petras, J., & Veltmeyer, H. (2007). *Multinationals on trial: Foreign investment matters*. Ashgate Publishing, Ltd.
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- PLUS. (1940). About Albania literary production. *Kultura Islame*, No. 10, 396.
- PLUS. (1940). The poet of "Bagëti e Bujqësi". *Kultura Islame*, No. 13-14, 28.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102. https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema adresinden alındı
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.
- POSER, K., & DRANSCH, D. (2010). Volunteered Geographic Information For Disaster Management With Application To Rapid Flood Damage Estimation. *Geomatica*, 64(1), s. 89-98.
- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Resilient Vejle. (2016). *Vejle's Resilience Strategy*. Resilient Vejle.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. <https://www.romania-insider.com/1918-great-union-historical-events-romania> adresinden alındı
- Rufanges, J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.
- ŞAHİN, N. (2007). Afet Yönetimi ve Acil Yardım Planları. *TMMOB İzmir Kent Sempozyumu*, s. 131-142.
- ŞAHİN, Ş. (2019). The Disaster Management in Turkey and Goals of 2023. *Turkish Journal of Earthquake Research*, 1(2), s. 180-196.
- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*. <https://www.schengenvisa.info/countries-in-europe/eu-countries/> adresinden alındı
- Scott, C. (2001). Introduction to "Torture as Tort: From Sudan to Canada to Somalia". *Torture As Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, Craig Scott, Ed, 3-44.
- Scott, C. (2011). Introduction to "Torture as Tort: From Sudan to Canada to Somalia". *TORTURE AS TORT: COMPARATIVE PERSPECTIVES ON THE DEVELOPMENT OF TRANSNATIONAL HUMAN RIGHTS LITIGATION*, Craig Scott, 3-44.
- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- SHROPSHIRE, A. (2019). Stories from the World of Municipal Analytics. *Towards Data Science*.
- Simma, B. (2011). Foreign investment arbitration: a place for human rights? *International & Comparative Law Quarterly*, 60(3), 573-596.
- SOLANAS, A., VLACHOS, I., RAMOS, V., FALCONE, F., POSTOLACHE, O., PERREA, D., . . . MARTINEZ-BALLESTE, A. (2014). Smart Health: A Context-Aware Health Paradigm within Smart Cities. *IEEE Communications Magazine*, s. 74-81.
- Spar, D. (1999). Foreign investment and human rights. *Challenge*, 42(1), 50-80.
- Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* <https://www.statista.com/statistics/1109873/challenges-romania/> adresinden alındı
- Statistics, G. S. (Jan 2023). *The world's most used social platforms* .

- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*–, 2-9.
- T.C. Çevre ve Şehircilik Bakanlığı. (2019). *Akıllı Şehirler Beyaz Bülteni*.
https://webdosya.csb.gov.tr/db/cbs/menu/akillisehirler-kitap_20190311022214_20190313032959.pdf adresinden alındı
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), s. 2816-2820.
- TAŞTAN, M. (2018). IoT Based Wearable Smart Health Monitoring System. *Celal Bayar University Journal of Science*, 14(3), s. 343-350.
- TDK. (2022). *Türk Dil Kurumu Sözlükleri*. Türk Dil Kurumu Sözlükleri Web Sitesi: <https://sozluk.gov.tr/> adresinden alındı
- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>
- The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF*.
<https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html> adresinden alındı
- The World Bank. (2021, 12 25). *The World Bank in Romania*.
<https://www.worldbank.org/en/country/romania/overview#1> adresinden alındı
- Tjoe, K. (2022, February 28). *The vital role of social media in tourism marketing*. Rezdy blog:
<https://rezdy.com/blog/the-vital-role-of-social-media-in-tourism-marketing/#:~:text=Social%20media%20can%20be%20a,up%20in%20the%20area%2C%20and> adresinden alındı
- Toral, M., & Schultz, T. (2010). The state, a perpetual respondent in investment arbitration? Some unorthodox considerations. *The backlash against investment arbitration: Perceptions and reality*, 577-602.
- TÖRENCİ, H. E. (2015). *Afet Yönetimi ve Bursa'da Sağlık Sektöründe Afet Yönetimi*. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Anabilim Dalı Yüksek Lisans Tezi.
- Trading Economic. (2022, 01 03). *Romania GDP*. <https://tradingeconomics.com/romania/gdp> adresinden alındı
- Truyols, M. (tarih yok). *POSITIVE AND NEGATIVE EFFECTS OF SOCIAL MEDIA ON THE TOURISM INDUSTRY*. Hotelmize: <https://www.hotelmize.com/blog/positive-and-negative-effects-of-social-media-on-the-tourism-industry/> adresinden alındı
- Tudor, I. (2008). *The Fair and Equitable Treatment Standard, in the International*. Oxford University Press on Demand.
- Türkiye Bilişim Vakfı (TBV). (2016). *Türkiye Akıllı Şehirler Değerlendirme Raporu*. Türkiye Bilişim Vakfı (TBV).
- Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı. (2014). *Onuncu Kalkınma Planı Afet Yönetiminde Etkinlik Özel İhtisas Komisyonu Raporu*. Ankara: T.C. Kalkınma Bakanlığı.
- TÜRKOĞLU, H. (2014). *İSMEP Rehber Kitaplar Afete Dirençli Şehir Planlama ve Yapılaşma*. İstanbul: İstanbul Valiliği, İstanbul İl Afet ve Acil Durum Müdürlüğü (İstanbul AFAD), İstanbul Proje Koordinasyon Birimi (İPKB).
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Washington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*,. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from
<https://www.unhcr.org/558c0e039.pdf>
- United Nations. (2023, 04 18). United Nations Human rights office of the high commissioner :
<https://www.ohchr.org/en/human-rights/economic-social-cultural-rights> adresinden alındı
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- Valarm. (2022). *Valarm*. Valarm Web Sitesi: <https://www.valarm.net/blog/monitoring-water-levels-flood-detection-early-warning-systems-virginia-smart-cities/> adresinden alındı

- Voineagu , V. (2022, 01 02). ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING 1.I-28.II.2007 PERIOD. *IDEAS*, 48-72. Retrieved from <https://plagiarism.repec.org/socol-socol/socol-socol2.pdf>
- World Bank. (2021, 12 29). *Gross domestic product 2020*. <https://databank.worldbank.org/data/download/GDP.pdf> adresinden alındı
- World Bank. (2023, 04 10). World Development Indicators: <https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#> adresinden alındı
- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from <https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>
- YAMAN KOCADAĞLI, A. (2017). *Beylikdüzü'nün Coğrafi Özellikleri*.
- YAMAN, M., & ÇAKIR, E. (2018). Dijitalleşen Dünyada Akıllı Afet ve Acil Durum Uygulamaları. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 7(2), s. 1124-1138.
- YILDIRIM, A. M. (2022). *Akıllı Şehirlerde Trafik Yönetimi İçin Bir Dinamik Rotalama Yöntemi ve Cupcarbon Gerçekleşmesi*. Kocaeli: Kocaeli Üniversitesi Fen Bilimler Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı Yüksek Lisans Tezi.
- YILDIZ, D. (2013, 03 22). Ekolojik Kentsel Dönüşümde Örnek Kent : Stockholm. *Stockholm Winner 2010 European Green Capital*, s. 1-9.
- ZHANG, K., YANG, K., REN, J., SHEN, X. S., NI, J., & LIANG, X. (2017). Security and Privacy in Smart City Applications: Challenges and Solutions. *IEEE Communications Magazine*, s. 122-129.

**ANALYZING TEACHERS' VIEWS REGARDING SCHOOL ADMINISTRATORS'
SOCIAL JUSTICE LEADERSHIP IMPLEMENTATIONS**

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ABSTRACT

Social justice leadership has recently become a significant phenomenon within the organizations in terms of the fact that it attaches importance to each member's gaining the equal rights and opportunities to improve the organization and the self no matter what their identical characteristics are. According to what the literature illustrates, prominent school leaders might utilize social justice leadership and implement the concept into their managerial decisions and organizational procedures and thus might enable a desirable education environment. Nevertheless, there is no adequate research – based knowledge about teachers' comprehension of the social justice leadership implementations of the school administrators in a deep, inquisitive qualitative analysis in the context of vocational and technical Anatolian high schools in Türkiye. In that respect, this paper reports an in-depth analysis of the social justice leadership in the case of a vocational and technical Anatolian high school. Using data gathered from the teachers views' regarding the school administrators' social justice leadership implementations, the study aims to analyze the following topic: how the teachers comprehend the school administrators' implementations in the context of the social justice leadership. Based on the data of the study, it has been concluded that social justice leadership is a critical matter as for the participants of the study and thus it is recommended that social justice leadership be emphasized by the school administrators within the organizational behaviours so as to enable a positive school climate.

Keywords: Social justice leadership, school administrators, teachers, vocational and technical Anatolian high schools

Introduction

With the ever-changing interpretation of the organizations and the procedures led by the management within them, it is evidently seen that there has become an evolutionary tendency towards the contemporary leadership styles rather than the classical understanding of leading the organizations. In that respect, the literature illustrates that social justice leadership has recently obtained a remarkable place on the organizational management procedures. Social justice leadership can be expressed as an inclusive leadership style that enables the equality for access to the organizational services by supporting the minority differentiating from the majority in terms of the language, racial, religious, gender – based aspects and so on (Theoharis, 2007). In that respect, a social justice leader can be considered as the one who considers the differences as the source of the power in a whole sense within the management procedures no matter what the members of the organization carry as properties.

As for the identification of the social justice leadership, Warner (2020) emphasizes the fact that the implementation of focusing on the social justice with the preliminary target is what social justice leadership actually means and requires and adds that it aims to remove segregation depending on ethnical or socioeconomical positions by carrying out the just and equal applications for the education process. According to Fraser (2012), by the way, social justice leadership might be identified as a style of leadership which focuses on the efficiency of the leader in terms of the implementations so as to enable a better and more successful organization experienced by all the stakeholders even if they are in extreme despair.

Social justice leaders naturally assume and become aware of the current situation in terms of the inequalities in their organization and implement the reflective decisions or actions regarding this situation (Doğan & Yıldırım, 2022). When viewed from this aspect, social justice leadership is the most appropriate leadership to be exhibited so as to overcome the problems resulting from the inequalities and find out the strategical remedies to them (Furman, 2012). Regarding the requirement of the social justice leadership, Turhan (2010) emphasizes the fact that social justice is necessary to be guaranteed within the education and the various fields of everyday life as in the legal documents and laws consider it as the basic element of their essence as well as its significance within organizing and managing processes of the organizations.

As for the educational institutions that have the role and the mission of improving and serving the society via the output of individuals, social justice leadership implementations have key importance considering the fact that the stakeholders' behaviours and attitudes are directly affected by the school leaders' policies and strategies in terms of their understanding of justice (Demirel, 2009). In coherence to this, it is an irrefutable fact upon the accumulated knowledge

via the literature that school leader's acting in sensitivity regarding social justice by enhancing justice-based implementations will have a positive impact upon teachers' commitment to the school, success and motivation as well as the school climate that influences all the stakeholders of the school (Küçükçene & Aydoğan, 2018). Establishing social justice within the educational institutions is correlated to the implementations of the management of the schools, including a wide range of differences within the students and teachers regarding the racial, ethnic and gender-founded factors; in that context, school leaders have a great responsibility in order to enable a school environment that attaches importance to the social justice within the institution regardless of the qualities of the stakeholders by implementing just and equal school build-up (Turhan, 2010).

Skousen & Domenque (2020) focuses on the challenges of the social justice leadership in that schools can consist of the students who are deliberately or indeliberately in extreme ends due to the socioeconomic deficiencies they have, as a result of which leaders of the school had better get the awareness of those extreme student groups and improve their leading skills so as to enable the social justice based organization functioning. Within the scope of educational aspects, social justice leadership includes certain wide categories such as ethical virtues, equality, respectful and careful attitudes or behaviours in the permanently significant place and getting the fundamental consciousness over the influence of racial, gender – based and disability – related conditions on the educational institutions and student enhancement (Cameron – McCabe & McCarthy, 2005).

Bozkurt (2023) advocates that school climate is affected by the social justice leadership skills of the school administrators and this seems as a controversial issue due to the fact that enabling just implementations at institutions like schools focusing on the education is not an easy thing to accomplish as for the building of the schools with the members having distinct properties and that schools carry the characteristic of a social entity.

When focusing on the literature regarding the negligence or deficiency of the social justice leadership implementations in the educational institutions, it is evidently seen that this might lead to organizational conflict, professional burnout, isolation or anomie, dissent and cynicism that would be experienced by the stakeholders of the organization. Nevertheless, depending on analyzing the literature and the implementations at schools, social justice leadership contributes to the organization in that it enables stakeholders of the institution such as parents, students, teachers and auxiliary staff to get through some negative impacts they feel related to the managerial processes and experience trust, commitment, motivation, collaboration, equality and inclusiveness within their organization more evidently, which helps them become an integrated component of the institution. According to Bilgi (2020), in order that school administrators can lead successfully and effectively, they have to create a non-problematic and tolerant interaction

with the members of the organization. In that respect, the interaction between a school manager who exhibits the social justice leadership implementations and the other stakeholders such as teachers, students and parents should rely on the feeling of trust (Furman, 2012). In line with this, it can be emphasized that school administrators who have social leadership skills target to build up a positive school climate (Gören, 2019).

The following is the diagram illustrating the theoretical framework of the study with regard to the themes or sub –categories:



Figure 1: Theoretical Framework of Social Justice Leadership

Research and Findings

The study, which is essentially a case research, has been carried out via the semi – structured interview technique which is one of the preliminary qualitative research methods. Herein, it is aimed to get a comprehensive and deep accumulation of knowledge related to the implementations of the school administrators by demanding both the views of the teachers’ and those of the school administrators.

Due to the fact that eight department chiefs in the school, which is basically a vocational and technical Anatolian high school, directly participate in the implementations (training process), and in that respect, they have a great deal of information on this process thanks to their active interactions with the students and their parents and the other teachers in different fields, they have been included in the study within the scope of the purposeful sampling pattern and on the basis of the criterion of at least two – year professional seniority, the views of the department chiefs have been asked via the semi – structural interview form.

In that respect, the questions of the form have been formed in accordance with the research problem and themes of the study. The answers obtained from the study group have been classified into the categories related to the theoretical framework of the study and the recommendations have been made in the conclusion by making an overall assessment.

Within the study, it has been aimed to put forward how school administrators' social justice leadership implementations are comprehended by the teachers. In that respect, the problem statement of the study is how the teachers comprehend the school administrators' implementations in the context of the social justice leadership. The subproblems of the study are given as below:

- How are the school administrators' implementations towards parents in the context of social justice leadership? (How do the parents' socioeconomic positions / differences / identities (etnical – political – gender based, etc.) / cultures reflect on the school administrators' implementations towards them?)
- How are the school administrators' implementations towards students in the context of social justice leadership? (How do the students' socioeconomic positions / differences / identities (etnical – political – gender based, etc.) / cultures reflect on the school administrators' implementations towards them?)
- How are the school administrators' implementations towards teachers in the context of social justice leadership? (How do the teachers' socioeconomic positions / differences / identities (etnical – political – gender based, etc.) / cultures reflect on the school administrators' implementations towards them?)
- How are the school administrators' implementations towards auxiliary staff in the context of social justice leadership? (How do the auxiliary staff's socioeconomic positions / differences / identities (etnical – political – gender based, etc.) / cultures reflect on the school administrators' implementations towards them?)
- How are the reflections of the social justice leadership implemented by the school administrators towards parents, students, teachers and auxiliary staff on trust, commitment, motivation, collaboration, equality and inclusiveness at school?

The following is the table illustrating the demographic variables of the participants:

Table 1. Demographic variables of the participants

Participants	Gender	Age	Institution	Professional Seniority	Educational Status	Career Title	Field	Occupation
P1	Male	31 – 40	6 years and over	11 – 20 years	B.A.	Specialist Teacher	Food and Beverage Services	Field Chief
P2	Male	31 – 40	6 years and over	11 – 20 years	B.A.	Specialist Teacher	Food and Beverage Services	Department Chief
P3	Male	31 – 40	6 years and over	11 – 20 years	B.A.	Teacher	Food and Beverage Services	Department Chief
P4	Male	31 – 40	0 – 2 years	11 – 20 years	M.A.	Specialist Teacher	Food and Beverage Services	Department Chief
P5	Female	41 – 50	3 – 5 years	21 years and over	B.A.	Specialist Teacher	Accommodation and Transportation Services	Field Chief
P6	Female	31 – 40	6 years and over	6 – 10 years	B.A.	Teacher	Accommodation and Transportation Services	Department Chief
P7	Male	31 – 40	0 – 2 years	6 – 10 years	B.A.	Teacher	Accommodation and Transportation Services	Department Chief
P8	Female	30 years and below	0 – 2 years	0 – 5 years	B.A.	Teacher	Accommodation and Transportation Services	Department Chief

As seen in the table above, while the half of the teachers are the field and department chiefs working at Food and Beverage Services Department, the other half consists of those working at Accommodation and Transportation Services. It is also seen that four of the participants are specialist teachers -a title brought by the Ministry for those who have ten years of experience, passes the proficiency exam or a graduate degree- while four of them are not, due to the low experience period. In addition, just one of the participants has a graduate degree and only two of the participants are field chiefs responsible from all the procedures.

Table 2. Demographic variables of the participants of the study

Sub-Problems	Some Replies of the Participants Regarding the Questions for the Sub – Problems
School administrators' implementations towards parents in the context of social justice leadership	<p>P1 says "In our school, it is seen that administrative staff does not exhibit an inclusive and integrative approach towards parents in terms of political power, social status, economical power and official status."</p> <p>P2 says "I think that parents' socioeconomic situation is effective within the decisions of the school administrators in our school and parents who are economically powerful or close to the politicians can make what they want realized more easily than the others."</p>
School administrators' implementations towards students in the context of social justice leadership	<p>P3 says "The school administration approaches the students equally without making any discrimination regarding socioeconomic terms, language, religion or gender; however, for the activities that are organized in and outside the school, the students who have tight ties with the school administration are selected. Those who are introvert, cannot express themselves explicitly but who are academically successful and do not have any discipline problems might not utilize the school activities or school projects."</p> <p>P4 says "The school administration, as for the students, gives moral and material support they need to them who have socioeconomic problems and cares about the students having family problems. They act more tolerantly in terms of appearance and clothes. They enable the students to equally utilize the school facilities regardless of the ethnical origins of the students."</p>
School administrators' implementations towards teachers in the context of social justice leadership	<p>P5 says "The school administration does not explicitly exhibit discriminative acts towards teachers; however, they share information and ideas related to the school management and planning more often with the teachers they feel close to them politically and as gender."</p> <p>P6 says "The implementations of the school administrators do not vary towards teachers' ethnic, politic or gender-based properties and everyone is approached equally."</p>
School administrators' implementations towards auxiliary personnel in the	<p>P7 says "In our school, as the auxiliary personnel are generally selected from the acquaintance in the cities the school administrators reside in, the personnel are those who do not reject anything, do not have any problems, do not have a stable political thought and whom the school management can even be transferred at some points."</p>

context of social justice leadership	P8 says “In our school, regardless of any factors, implementations are equally realized.”
Reflections of social justice leadership implemented by school administrators towards parents, students, teachers and auxiliary staff	<p>P1 says “School administrators’ social justice leadership towards parents are not completely realized in terms of the reflections on the trust, commitment, motivation, cooperation, equality and inclusiveness at the school. It is seen that activities integrating parents and the school are not adequately organized, no activities other than the economical based meetings made in the cooperation by school – family union exist; there is no trust towards all of the teachers, adequate attitude and behaviours to enable the motivation for a better working performance are not exhibited while speeches towards students enabling morale and motivation are occasionally made during ceremonies and meetings. Short – time talks with the auxiliary personnel and close care and motivating sayings for them can be said towards improving the feeling of the commitment and enabling the motivation.</p> <p>P2 says “In line with the views I have previously indicated, I don’ have positive ideas regarding trust, commitment and motivation at our school. I think that the majority of the problems experienced at our school stems from the staff’s unconfidence in the institution and the administrators.</p>

The table illustrating the selection of the participants' replies regarding the sub-problems – oriented questions is as follows:

Conclusion

In accordance with the data obtained from the views of the eight teachers, in our case – the department chiefs, it can be emphasized that the reflections of the social justice leadership implemented by the school administrators in the school can be commented as having some problems or deficiencies in terms of the inclusiveness, motivation, trust, commitment, equality and collaboration. As for finding out the current situation related to the social justice leadership implementations towards parents, students, teachers and auxiliary staff, the participants mostly underline the fact that the equal and just practice of the managerial actions is not efficient and effective while a minority of the participants advocates the vice versa. From this point of view, the data illustrate the fact that the school administrators have some way to get through regarding their social justice leadership implementations, due to the fact that the existing reflection of the case is not mostly welcomed by the participants of our research.

Considering the demographic variables of the participants, the data illustrates that gender, term time in the institution, career title, occupation and educational status have no significance in terms of differentiating the views of the participants regarding the social justice leadership

implementations of the school administrators. However, age and professional seniority are significant in that the participant who is 30 years old and below and who has 0 – 5 years of experience thinks differently from the other ones as advocating that all the dimensions of the social justice leadership implementations of the school administrators are well – organized and there is no problem at school.

As for the recommendations; based upon the preliminary studies, practices and the literature, social justice leadership in educational institutions is so significant that it must be attached importance by the school administrators:

- a positive school climate
- a collaborative teacher work
- an inclusive environment
- organizational trust
- organizational commitment
- professional motivation by the stakeholders

To make a final point, in the case of our research; if the school administrators apply social justice leadership in a more comprehensive and inclusive manner regardless of any difference, they might easily improve their organization and realize the organizational aims.

References

- Adams, M. (2011). *Social justice education*. In Daniel J. Christie (Ed.), *The encyclopedia of peace psychology*, 1033 – 1036. Wiley-Blackwell.
- Bilgi, R. (2020). Ortaokul yöneticilerinin liderlik stilleri ile örgüt iklimi arasındaki ilişkinin öğretmen algılarına göre incelenmesi [Examination of the relationship between leadership styles and organizational climate of secondary school administrators according to teacher perception] [Unpublished master's thesis]. Hacettepe University.
- Bozkurt, B. (2023). Social justice leadership as a predictor of school climate. *Pedagogical Research*, 8(2). <https://doi.org/10.29333/pr/13078>
- Cambron-McCabe, N., & McCarthy, M. M. (2005). Educating school leaders for social justice. *Educational policy*, 19(1), 201-222. doi: 10.1177/0895904804271609
- Demirel, Y. (2009). Örgütsel adaletin yönetici - çalışan ilişkileri üzerine etkisi: Farklı sektör çalışanlarına yönelik bir araştırma. *Sosyal Ekonomik Araştırmalar Dergisi*, 9(17), 137-154.
- Doğan, H., & Yıldırım, N. (2022). The relationship between social justice leadership and school climate. *International Journal of Leadership Studies: Theory and Practice*, 5(3), 174-195. doi: 10.52848/ijls.1146935
- Fraser, K. (2012). Exploring the leadership practices of social justice leaders at urban charter schools [Doctoral dissertation, University of San Francisco].
- Furman, G. (2012). Social justice leadership as praxis: Developing capacities through preparation programs. *Educational Administration Quarterly*, 48(2), 191-229. <https://doi.org/10.1177/0013161X11427394>
- Gören, S. Ç. (2019). Sosyal adalet liderliği, okul yaşam kalitesi ve okula aidiyet duygusu ilişkisi [Relationship between social justice leadership, quality of school life and sense of school belonging] [Unpublished doctoral thesis]. Hacettepe University.
- Küçükçene, M., & Aydoğan, İ. (2018). Eğitim yönetiminde adaletin önemi ve gerekliliği üzerine bir inceleme. *Kırıkkale Üniversitesi Sosyal Bilimler Dergisi*, 8(2), 641-664
- Ryan, J. (2010). Promoting social justice in schools: Principals' political strategies. *International Journal of Leadership in Education*, 13(4), 357-376.
- Theoharis, G. (2007). Social justice educational leaders and resistance: Toward a theory of social justice leadership. *Educational Administration Quarterly*, 221-258.
- Turhan, M. (2010). Social justice leadership: implications for roles and responsibilities of school administrators. *Procedia Social and Behavioral Sciences*, 9, 1357 – 1361.
- Skousen, J. D., & Domangue, E. (2020). Leadership for Social Justice in High-Poverty Schools: Exploration of Equity and Fundraising in an Urban-Suburban School. *Journal of Cases in Educational Leadership*, 23(1), 93–110. <https://doi.org/10.1177/1555458919883320>
- Warner, T. L. G. (2020) "Leading for Social Justice: a call to action to improve society" *Journal of Organizational & Educational Leadership*, 5 (1) , Article 2. <https://digitalcommons.gardner-webb.edu/joel/vol5/iss1/2>

EFFECT OF MATERIAL CALCINATION ON GEOPOLYMER SYNTHESIS

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ABSTRACT

In this study, geopolymeric behavior of two pozzolans as a result of calcination was investigated. 900°C was used as the calcination temperature. After the calcination process, compressive strength, XRD and SEM/EDX analysis were performed. From the analysis it was observed that both raw materials calcined at 900°C had amorphous structure. As a result of the compressive strength analysis, clinoptilolite-bearing pozzolan reached a compressive strength of 40MPa at room temperature. However, pozzolan, which does not contain clinoptilolite, did not achieve sufficient compressive strength. From this, it was concluded that the calcination process is not sufficient to activate every material. In other words, in order to the calcination process to be successful, the mineralogical content of the raw material must be appropriate. The decrease in the clinoptilolite peak as a result of XRD analysis indicated that clinoptilolite consumed and participated in the geopolymeric reaction. Additionally, the hump pattern indicating the glassy phase demonstrates the formation of geopolymeric gel. Si/Al ratio, which gives similar values in SEM/EDX analysis, indicates well developed CSH phase. The decrease in peak intensity and the presence of geopolymeric gel observed in clinoptilolite-bearing pozzolan-based geopolymer were not observed for clinoptilolite-free pozzolan-based geopolymers.

Keywords: Geopolymer, clinoptilolite, Pileki Taşı, curing time, cure temperature

1. Introduction

Concrete used in the construction industry is a preferred material due to its advantages such as easy production, low cost, high durability and accessibility. However, it is known that CO₂ gas released into the atmosphere during the burning of clinker at high temperatures during concrete production increases global warming and negatively affects the ecological balance. For this reason, new binding materials are being tried to be developed. Among these materials, geopolymers have attracted worldwide attention as an alternative binder material, as they cause very low CO₂ emissions (80-90%) compared to Portland cement (van Deventer et al., 2021). Geopolymers, also called alkaline activated material (AAM), were first used as a construction material by Glukhovsky, Kiev, Ukraine in 1960. Later, Davidovits activated the metakaolin with alkaline solutions and called polysialate consisted of tetrahedral anions.

Although geopolymers are an important alternative to portland cement, they have some disadvantages. For example, the supply of industrial by-products such as blast furnace slag and fly ash, which have high binding properties in geopolymer production, is not sufficient for the long term (Ruiz-Santaquitera et al., 2016). In the literature, it has been stated that this problem can be overcome by using natural material-based geopolymers in addition to waste material-based geopolymers. For this reason, pozzolans are shown as a good alternative. However, natural pozzolans have some disadvantages such as low early strength development despite their high reserve capacity (Özen and Uzal, 2021). Some methods are being developed to overcome the disadvantage of natural material-based geopolymers. These methods include activating the natural material by the calcination process. With the calcination method, the crystal structures of the minerals are deteriorated and converted into a glassy structure that can be easily dissolved in a low alkaline environment. For example, Bondar et al., (2011) produced geopolymer from calcined pozzolan and showed that the strength of these geopolymers was increased. In addition, Nikolov et al., (2020) tried to calcine the clinoptilolite-containing tuff to activate it for geopolymer synthesis.

To sum up, significant developments have been achieved in terms of improving the mechanical and physical properties of geopolymers produced with calcined natural materials. However, there are still questions that need to be answered in the literature. Research is needed to understand and develop the mechanisms of the binder systems produced after the calcination process in detail. For this reason, the phase content of the two starting materials was examined and the role of the calcination process in the synthesis of geopolymers was examined.

2. Materials and Method

The two pozzolan (volcanic tuff) used as the starting raw material in the study. Sodium silicate (Na_2SiO_3) and sodium hydroxide (NaOH) activators were used to activate the starting raw material. Sodium silicate, also known as glass water, was supplied in liquid form (27.7% SiO_2 , 9.8% Na_2O , 62.5% H_2O). Sodium hydroxide was supplied in the form of pellets and was prepared for use as sodium hydroxide solution (12M).

The raw materials were ground with a bond type ball mill to pass through a 45 micron sieve. Grain size distribution was determined by sieve analysis. Chemical analysis of the starting materials was done by X-ray fluorescence (XRF) analysis. Pellets were prepared from 5 gr powdered pozzolan samples and XRF images were taken and the results were determined as oxide. In order to understand the behavior of two pozzolans as a result of calcination, the phases in the raw materials were determined by quantitatively (Pittsburg Mineral and Environmental Technology Inc., PMET Inc.). Laboratory measurements were made using the PANalytical X'Pert Pro device X'Pert High Score Plus 3.0. The obtained readings were recorded in vertical Bragg-Brentano geometry varying from 3 to 80°C with an angle of 2θ and values of 40 kV and 30 mA (Philips PW1730).

2.1. Calcination

Two starting raw materials were subjected to calcination process to increase the raw material reactivity before geopolymer synthesis. The calcination process was carried out in an oven at 900°C with an increase of 10°C per hour (Figure 1).



Figure 1. The calcination process of the starting raw material at 900°C .

2.2. Geopolymer Synthesis

For the production of geopolymer, the pozzolan measured was poured into the Hobart mixer. Then NaOH alkali activator was added to the mixture and mixed for 3 minutes. After, Na₂SiO₃ alkali activator was added to the mixture. After the geopolymer synthesis process, the mixture was placed in cube molds of 5X5X5 cm (Figure 2). As the curing process, two cures were applied at room conditions and at 50°C.



Figure 2. Synthesis of geopolymers.

3. Results

3.1. Mineralogical Characterization

The mineral contents and values of the pozzolans named as B-1 and B-2 are given in Table 1. As can be seen from the table, sample B-1 contains clinoptilolite mineral, but sample B-2 does not contain clinoptilolite mineral. B-2 raw material consists of 12% K-feldspar and 25% plagioclase minerals. When the mineralogical analysis results are examined, we can say that the B-1 pozzolan will be much more active than the B-2 pozzolan.

Table 1. Quantitative XRD (QXRD) analysis results of starting raw materials.

Mineral	B-1 (%)	B-2 (%)
Clinoptilolite	65	
Quartz	15	37
K-Feldspar	20	12
Plagioclase		25
Mica		15
Kaoline		5
Calcite		6
Sum	100	100

3.2. Physical and Chemical Characterization

The results of chemical analysis of the pozzolans used in the production of geopolymer are given in Table 2. When the table is examined, it can be seen that the SiO₂ and Al₂O₃ amounts of the B-2 sample are higher than the B-1 raw material. In addition, the amount of CaO of B-2 pozzolan is slightly higher than that of B-1 pozzolan.

Table 2. Chemical compositions and physical properties of starting materials.

	B-1	B-2
Chemical Composition (%)		
SiO ₂	53	67.3
Al ₂ O ₃	17	12
Fe ₂ O ₃	4	0.8
CaO	10	12
MgO	1	0.9
Na ₂ O	0.1	0.2
K ₂ O	1	0.6
MnO	0.3	0.2
L.O.I.	13.6	6
Total	100	100
Physical Properties		
Specific Gravity	2.13	2.14
Fineness (<45µm,%)	84	83

3.3. SEM Analysis of Raw Material

SEM image of B-1 is given in Figure 1. As can be seen in figure, clinoptilolite crystals that grow secondarily in the glassy pumice fragment are found as euhedral crystals in assemblages.

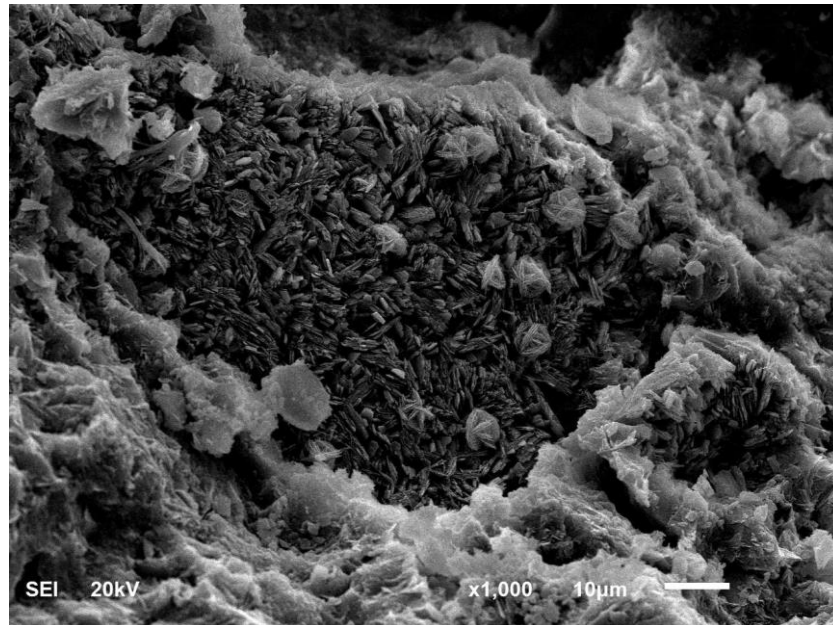


Figure 3. Scanning electron micrograph (SEM) of B-1 sample.

When we examine the SEM image of the B-2 pozzolan, we see that there are anhedral and massive structures in general. Quartz mineral is only seen as euhedral crystals.

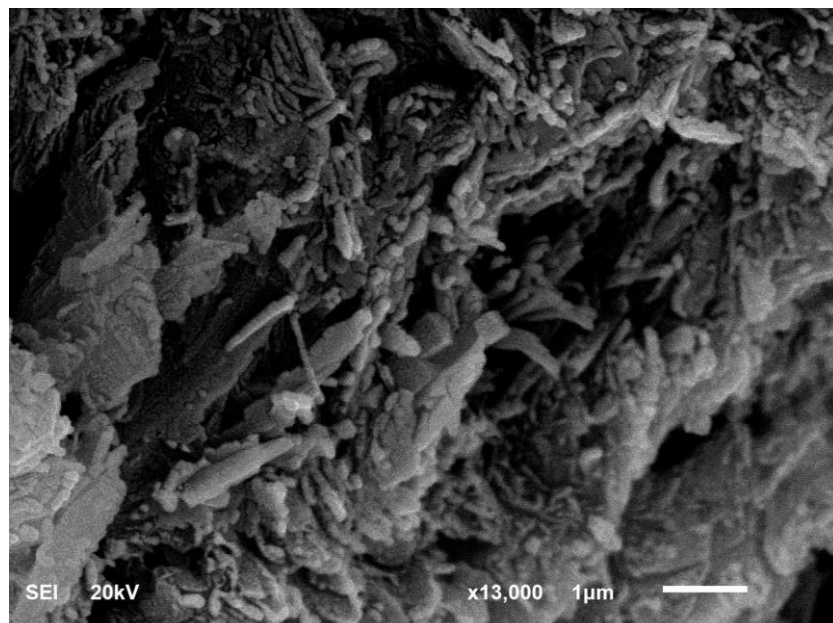


Figure 4. Scanning electron micrograph (SEM) of B-2 sample.

3.4. Compressive Strength Analysis

In Figure 3, the highest compressive strength values of B-1-900°C and B-2-900°C geopolymers at 7, 28 and 56 days are compared. As can be seen from the figure, the 7-day compressive strength of both geopolymers is the same. However, the compressive strength of B-1-900°C geopolymer increased rapidly after 7 days, but such an increase was not detected in B-2-900°C geopolymer. The reason for the difference is thought to be due to the fact that both pozzolana have different mineralogical contents despite being taken from the same tuff bed. B-1 contains 65% clinoptilolite in the starting pozzolan. It is known that clinoptilolite is an active phase for geopolymeric reaction (Güngör and Özen 2021). With this study, it is seen that its reactivity is much more increased as a result of calcination.

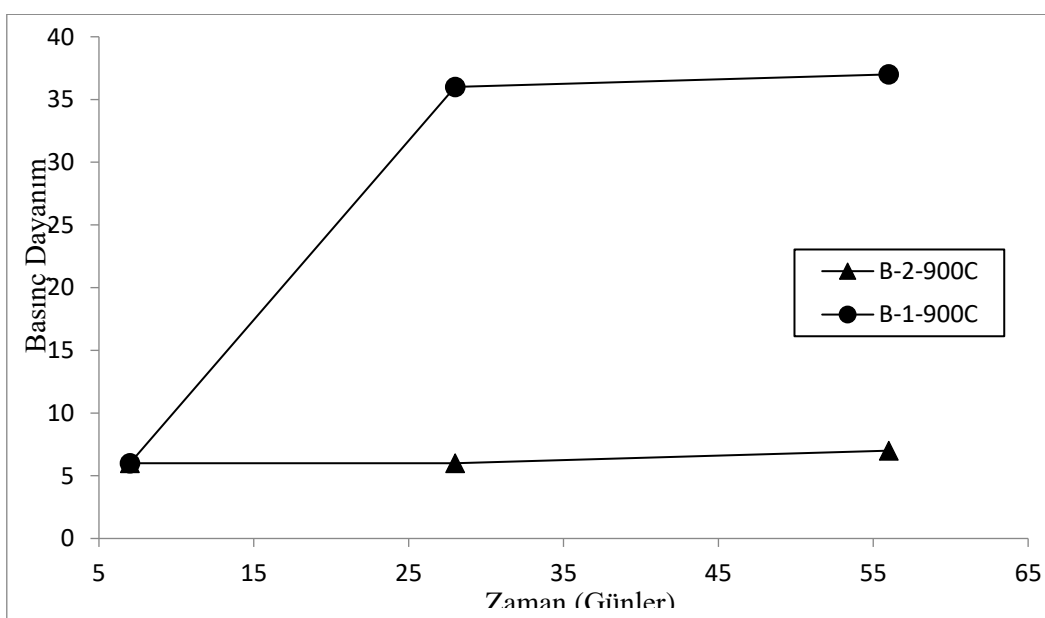


Figure 5. Compressive strength developments of B-1-900°C and B-2-900°C geopolymers.

3.5. SEM/EDX Analysis of Geopolymer Products

After the micro-morphological examinations of the geopolymers, semi-quantitative chemical analyzes were made. According to the analysis results, we see that the Si/Al ratios of the B-1-900°C geopolymer are in the similar range. Si/Al ratio of B-2-900°C geopolymer, on the other hand, exhibits a wide spread range. Based on this data, we conclude that the geopolymeric gel, which gives strength to the material, well developed in the B-1-900C geopolymer. This result is also supported by compressive strength analysis. Because the compressive strength of B-1-900°C geopolymer is high.

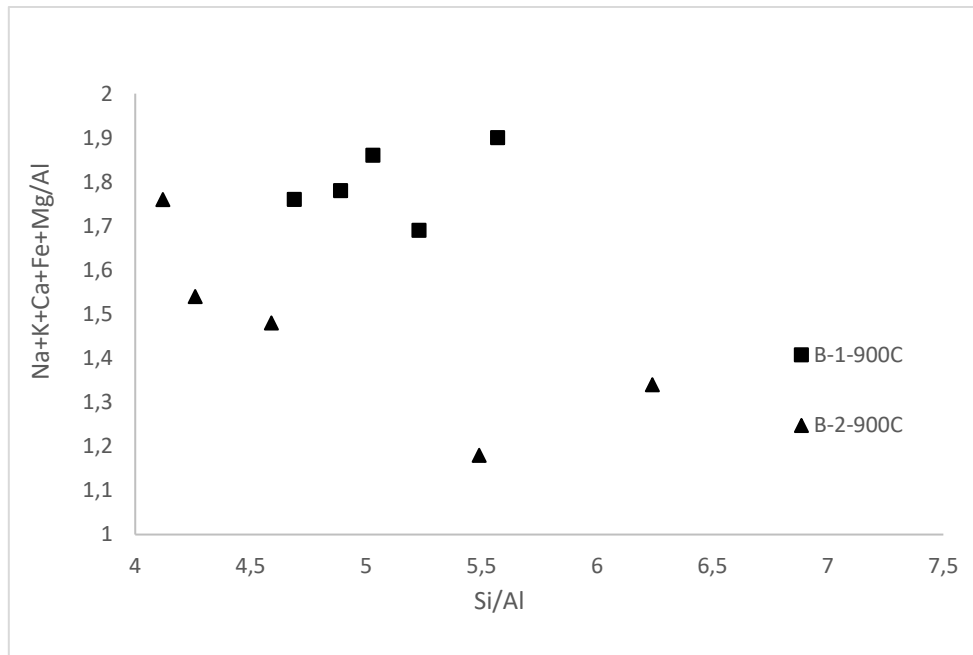


Figure 6. Semi-quantitative SEM/EDX analysis results of B-1-900°C and B-2-900°C geopolymers.

Conclusions

- In this study, the starting material was calcined at 900°C and the crystalline structure of clinoptilolite was transformed into amorphous structure. The pozzolan-based geopolymer containing calcined clinoptilolite was cured at room conditions and a compressive strength of 22 MPa for 28 days was obtained. In other words, the calcination process has been successful and it has been shown that natural material-based geopolymers can be cured at room conditions without thermal curing.
- However, feldspar group minerals did not become active despite calcination process and could not reach the expected compressive strength values both at room conditions and 50°C.
- Based on these data, it is concluded that although the calcination process is a suitable method for activating the starting material, its success depends on the mineralogical phase content of the raw material.
- It was also concluded that the mineralogical characterization of the starting raw material is an important step for the predicting the geopolymer behavior.
- As a result of SEM/EDX analysis of geopolymers, we conclude that the gel (CSH) that gives strength to the material is well developed in B-1-900°C geopolymer.

References

- Bondar, D., Lynsdale, C. J., Milestone, N. B., Hassani, N., & Ramezaniyanpour, A. A. (2011). Effect of heat treatment on reactivity-strength of alkali-activated natural pozzolan. *Construction and Building Materials* 25, 4065-4071
- Nikolov, A., Nugteren, H., & Rostovsky, I. (2020). Optimization of geopolymers based on natural zeolite clinoptilolite by calcination and use of aluminate activators. *Construction and Building Materials* 243, 118257
- Özen, S. & Uzal, B. 2021. Effect of characteristics of natural zeolites on their geopolymerization. *Case Studies in Construction Materials* 15, e00715.
- Ruiz-Santaquitera, C., Fernandez-Jimenez, A., & Palomo, A. (2016). Alternative prime materials for developing new cements: Alkaline activation of alkali aluminosilicate glasses. *Ceramics International* 42(8), 9333-9340
- van Deventer, J. S. J., White, C. E., & Myers, R. J. (2021). A roadmap for production of cement and concrete with low-CO₂ emissions. *Waste and Biomass Valorization* 12, 4745-4775

**KÜRESELLEŞMENİN TÜKETİM HARCAMALARI ÜZERİNDEKİ ETKİSİ:
TÜRKİYE İÇİN AMPİRİK BİR ANALİZ**

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Özet

Küreselleşme kavramı giderek hayatın her alanında kendini hissettiren bir kavram olmaktadır. Özellikle internetin gelişimi, teknolojik ilerlemeler, iletişim araçlarının yaygınlaşması, ulusal ve uluslararası ulaştırma hizmetlerinin artması vb. gelişmeler ulusların birbirinden çeşitli alanlarda etkilenmesine neden olarak küreselleşmeyi hızlandırmaya katkı sağlamaktadır. Ulusların birbirinden etkileşimi başta sosyal, ekonomik, politika, siyaset vb. bir çok alanda gerçekleştiği insanların üretim, tüketim, tasarruf gibi birey davranış ve tutumları üzerinde de etkileri ortaya çıkması kaçınılmazdır. Bu noktadan hareketle bu çalışmanın amacı küreselleşmenin tüketim harcamaları üzerindeki etkisini ortaya koymaktır. Çalışmanın ampirik analizleri 1987-2020 dönemini kapsamakta olup Türkiye için gerçekleştirilmiştir. Çalışmanın ampirik analizlerinde kurulan ekonometrik modele nihai tüketim harcamaları bağımlı değişken, genel küreselleşme, ekonomik küreselleşme, sosyal küreselleşme indeksleri ve ekonomik büyüme de bağımsız değişken olarak dahil edilmiştir. Zaman serisi ADF ve Phillips-Perron birim kök test sonuçları neticesinde değişkenlerin I(0) ve I(1) olduğu tespit edilmiştir. Değişkenlerin birim kök durağanlık mertebelerinin farklı olmasından dolayı ARDL sınır testi yaklaşımı ile ampirik analizlere devam edilmiştir. ARDL sonuçlarına bakıldığında öncelikle modelde %1 istatistiksel önem düzeyinde eşbütünleşme ilişkisi elde edilmiştir. Uzun dönem katsayı sonuçları genel küreselleşme indeksinin, sosyal küreselleşmenin ve ekonomik büyümenin tüketim harcamalarını pozitif yönde etkilediği, ekonomik küreselleşmenin negatif etkilediği sonucu elde edilmiştir. Kısa dönemde ise genel küreselleşme ve ekonomik büyümenin tüketim harcamaları üzerinde etkisi olduğu görülmüştür.

Anahtar Kelimeler: Küreselleşme, Tüketim harcamaları, ARDL, Türkiye.

**THE EFFECT OF GLOBALIZATION ON CONSUMPTION EXPENDITURE: AN
EMPIRICAL ANALYSIS FOR TÜRKİYE**

Abstract

The concept of globalization is increasingly becoming a concept that makes itself felt in all areas of life. It can be stated that developments such as the development of the internet, technological advances, the widespread use of communication tools, and the increase in national and international transportation services contribute to accelerating globalization by causing nations to be affected in various fields. The interaction of nations with each other takes place in many areas, especially in social, economic and political areas, and it is possible for people to have effects on individual behaviors and attitudes such as production, consumption and savings. From this point of view, the aim of this study is to reveal the effect of globalization on consumption expenditures. The empirical analyzes of the study cover the period 1987-2020 and were carried out for Türkiye. In the econometric model established in the empirical analysis of the study, final consumption expenditures are included as dependent variables, general globalization, economic globalization, social globalization indices and economic growth are included as independent variables. As a result of time series ADF and Phillips-Perron unit root test results, it has been determined that the variables are $I(0)$ and $I(1)$. Since the unit root stationarity levels of the variables are different, empirical analyzes were continued with the ARDL bound approximation test. Considering the ARDL results, first of all, a cointegration relationship was obtained at the 1% statistical significance level in the model. Long-term coefficient results have been obtained as the result that the general globalization index, social globalization and economic growth affect consumption expenditures positively, while economic globalization affects negatively. In the short term, it has been observed that general globalization and economic growth have an effect on consumption expenditures.

Key Words: Globalization, Consumption expenditures, ARDL, Türkiye

Giriş

Son iki yüzyılda başlayıp süregelen dönemde toplumlar ekonomik, kültürel, sosyal vb. birçok alanda değişimler yaşamıştır. Bu değişim sürecinde teknolojik ilerlemeler, uluslararası ulaşım ve transfer sistem ve araçlarındaki artış ve gelişimlerle toplumlar kültürel, sosyal, politik ve ekonomik olmak üzere birçok alanda bir bütünleşme ve yakınsama yaşamıştır. Dünyada meydana gelen bu gelişmelere bağlı olarak ortaya çıkan bütünleşme ve yakınsama küreselleşme olarak ifade edilmektedir (Adıgüzel, 2013;1).

Küreselleşme sürecinin nedenleri sırlanırken yukarıda belirtilenler haricinde başka unsurlardan da söz edilebilir. Yani küreselleşme süreci bir veya birkaç unsur sonucu olarak ifade edilemez. Diğer yandan küreselleşmenin sosyal, siyasal, kültürel ve ekonomik olmak üzere çeşitli sonuçları da olmaktadır. Aslında nedenler ve sonuçlar genel olarak göz önün alındığında neden-sonuç, sonuç-neden şeklinde bir etkileşim olduğu görülmektedir. Fakat bu etkileşim döngüsünde özellikle gelişmekte olan ülkelerde ekonomik etkilerinin daha belirgin olduğu gözlemlenmektedir. Bu da 1980'li yıllardan itibaren uluslararası sermaye hareketlerinin artması, dışa açılma ve liberalleşme hareketleri ekonomik küreselleşmeyi öne çıkarmıştır. Ekonomi küreselleşme beraberinde piyasa ekonomisinin gelişmesi, serbest ticaretin yaygınlaşması, ekonomik birliklerin hızlanması, çok uluslu firma faaliyetlerinin artması ve dış ticaret hacmindeki artışları da beraberinde getirmiştir (Aktel, 2001;197).

Küreselleşmenin bölge ve ülke ekonomileri üzerindeki etkilerinin yanında bireysel iktisadi davranışlar üzerinde de etkilerinin olması kaçınılmazdır. Şöyle ki küreselleşme ile beraber bireylerin tutum, zevk ve tercihlerinin değişmesi ile bunlara bağlı olarak da tüketim ve tasarruf eğilimleri değişecektir. Nitekim bir ekonomi için yatırım harcamaları nasıl önemli ise tüketim harcamaları da ekonominin dinamikliği açısından önemlidir. Bu noktadan hareketle bu çalışmanın amacı küreselleşmenin tüketim harcamaları üzerindeki etkisi ortaya koymaktır. Çalışma 1987-2020 dönemini kapsayacak şekilde elde edilen Türkiye ekonomisine ait veriler ARDL sınır testi yaklaşımı ile incelenmiştir. Bu çalışmanın küreselleşme ve tüketim harcamaları ilişkisini özellikle Türkiye için ele alan nadir çalışmalardan olması bakımından literatüre katkı sağlaması beklenmektedir.

Çalışma dört bölümden oluşmaktadır. Birinci bölümünde giriş, ikinci bölümde literatür taraması, üçüncü bölümde veri seti, model ve yöntem, dördüncü bölümde ampirik bulgular ve son bölümde sonuçlar olmak üzere dizayn edilmiştir.

Literatür

Literatür taramasında küreselleşmenin tüketim harcamaları üzerindeki etkisini doğrudan ele alan çalışmaya rastlanmamıştır. Ancak tüketim harcamalarının dolaylı da olsa yoksulluk, gelir

dağılımı ile ilgili olduğundan elde edilen çeşitli çalışmalar ve bu çalışmalara ait bulgulara aşağıda yer verilmiştir. Bunlardan ilki Bergh ve Nilson (2014) tarafından gerçekleştirilen çalışmadır. Çalışmada 14 ülke için küreselleşmenin yoksulluk üzerindeki etkisini rassal etkiler modeli incelemiştir. Küreselleşmenin yoksulluğu olumsuz yönde etkilediği sonucuna ulaşılmıştır.

Kiangi (2015) Tanzania ekonomisi için küreselleşmenin kamu harcamaları üzerindeki etkisini incelemiştir. Küreselleşmenin kamu harcamaları üzerinde negatif bir etkisi olduğu sonucuna ulaşılmıştır.

Akbakay ve Barak (2020) yükselen piyasa ekonomileri için küreselleşme ve gelir dağılımı ilişkisini ele almıştır. 1994-2014 dönemini kapsayan çalışmada PMG yöntemi ile tahmin edilmiştir. Elde edilen sonuçlara göre küreselleşmenin gelir eşitsizliğini olumsuz yönde etkilediği görülmüştür.

Benzer şekilde Tabetando (2014) Endonezya için küreselleşmenin gelir dağılımı üzerindeki etkisini 2000-2010 dönemi için araştırmış ve küreselleşmenin gelir dağılımı adaletsizliğini arttırdığını ortaya koymuştur.

Literatüre küreselleşme ve tüketim harcamalarını direk ele alan çalışmaya rastlanmamıştır. Bu durum yapılan bu çalışmanın ilgili literatüre önemli bir katkı sağlayacağı düşünülmektedir.

Veri Seti ve Model

Bu çalışmanın amacı küreselleşmenin tüketim harcamaları üzerindeki etkisini Türkiye ekonomisi için ortaya koymaktır. Çalışma veri setinin mevcut olduğu kadarıyla alınmış olup ampirik analizler 1987-2020 dönemini kapsamaktadır. Nihai tüketim harcamaları (Consumption-C) bağımlı değişken, genel küreselleşme endeksi (Globalization-GL), ekonomik küreselleşme (Economic globalization-EG), sosyal küreselleşme (Social globalization-SG) ve ekonomik büyüme (Economic growth-GDP) bağımsız modele dahil edilmiştir. Tüketim harcamalarının logaritması alınarak modele dahil edilmiştir. Veri seri Dünya bankası ve İsviçre Ekonomi Enstitüsünden elde edilmiştir.

Ampirik analizlerde öncelikle serilere ADF ve Phillips-Peron birim kök testi uygulanmıştır. Daha sonraki aşamada birim kök sonuçlarının I(0) ve I(1) düzeyinde farklı mertebelerden durağan olmaları nedeniyle ARDL sınır yaklaşım testinden faydalanılmıştır. Ayrıca ARDL sınır testi yaklaşımının eşbütünleşme, kısa ve uzun dönem tahmin sonuçlarını vermesinden dolayı tercih edilmiştir.

ARDL kısa dönem tahmin sonuçları Denklem 1'de ve uzun dönem tahmin sonuçları ise Denklem 2'de verilmiştir.

$$\Delta \log C_t = \alpha_0 + \sum_{i=1}^p \alpha_{1i} C_{t-i} + \sum_{i=1}^p \alpha_{2i} GL_{t-i} + \sum_{i=1}^p \alpha_{3i} EG_{t-i} + \sum_{i=1}^p \alpha_{4i} SG_{t-i} + \sum_{i=1}^p \alpha_{5i} GDP_{t-i} + \varphi ECT_{T-1} + \varepsilon_t \quad (1)$$

$\Delta \log C_t = \varphi_t + \varphi_1 \log C_{t-1} + \varphi_2 GL_{t-1} + \varphi_3 EG_{t-1} + \varphi_4 SG_{t-1} + \varphi_5 GDP_{t-1} + \sum_{i=1}^p \alpha_{1i} \log C_{t-i} + \sum_{i=1}^p \alpha_{2i} GL_{t-i} + \sum_{i=1}^p \alpha_{3i} EG_{t-i} + \sum_{i=1}^p \alpha_{4i} SG_{t-i} + \sum_{i=1}^p \alpha_{5i} GDP_{t-i} + \varepsilon_t$	(2)
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Bulgular

Birim Kök Test Sonuçları

Modeli oluşturan değişkenlere ait birim kök test sonuçları Tablo 1’de gösterilmiştir. Elde edilen sonuçlara göre tüketim harcamalarını ifade eden logC ile sosyal küreselleşmeyi gösteren SG değişkenleri sabit ve sabitli & trendli modellerin her ikisinde de seviyede birim köklü, birinci farkta durağan hale geldiği tespit edilmiştir. Küreselleşme endeki sabitli modelde %10 istatistiksel önem düzeyinde seviyede durağan, sabitli ve trendli modelde ise birinci farkta durağan hale gelmektedir. Ekonomik küreselleşme endeksini temsil eden EG değişkeni her iki modelde de seviyede durağandır. GDP değişkenini de seviyede durağan olduğu görülmektedir.

Tablo 1. Birim Kök Test Sonuçları

Seriler	Model	Seviye		Birinci Fark	
		ADF	PP	ADF	PP
logC	C	-18.112 [0.368]	-18.306 [0.359]	-54.928 ^a [0.000]	-55.036 ^a [0.000]
	C+T	-11.138 [0.911]	-11.495 [0.904]	-59.667 ^a [0.000]	-59.667 ^a [0.000]
GL	C	-26.358 ^c [0.096]	-28.877 ^c [0.057]	-55.796 ^a [0.000]	-55.766 ^a [0.000]
	C+T	-18.268 [0.668]	-18.580 [0.653]	-59.723 ^a [0.000]	-61.488 ^a [0.000]
EG	C	-31.773 ^b [0.030]	-33.383 ^b [0.021]	-53.159 ^{aa} [0.000]	-74.655 ^a [0.000]
	C+T	-34.445 ^c [0.062]	-33.930 ^c [0.069]	-55.572 [0.000]	86.597 ^a [0.000]
SG	C	-0.942 [0.761]	-0.837 [0.794]	-38.925 ^a [0.005]	-38.677 ^a [0.005]
	C+T	16.013 [0.970]	-13.933 [0.844]	-38.871 ^a [0.000]	-38.871 ^a [0.024]
GDP	C	-61.162 ^a [0.000]	-61.160 ^a [0.000]	-41.334 ^a [0.000]	-199.642 ^a [0.000]
	C+T	-20.669 ^b [0.038]	-65.327 ^a [0.000]	-40.413 ^b [0.019]	-188.142 ^a [0.000]

Not: C: Sabitli model. C+T: Sabitli ve trendli model. ^a, ^b ve ^c sırasıyla $p < 0,01$; $p < 0,05$ ve $p < 0,1$ temsil etmektedir.

ARDL Sınır Yaklaşımı Test Sonuçları

Modeli oluşturan değişkenlerin birim kök sonuçlarında $I(0)$ ve $I(1)$ olmak üzere farklı mertebelerden durağan oldukları görülmüştür. bu sonuç doğrultusunda ARDL sınır testi yaklaşımı ile analizlere devam edilmiştir. Çünkü bu test değişkenler $I(2)$ olmamak koşulu ile farklı durağanlık mertebelerine sahip değişkenler arasında eşbütünleşme ilişkisini sınavabilmektedir.

ARDL sınır testi yaklaşımı eşbütünleşme sonuçları Tablo 2’de gösterilmiştir. Elde edilen sonuçlara göre modelde %1 istatistiksel önem düzeyinde eşbütünleşme ilişkisi elde edilmiştir.

Tablo 2. ARDL Sınır Testi Yaklaşımı Eşbütünleşme Sonuçları

Test İstatistikleri	Değer	K
F-istatistiği	10.7968 ^a	4
Kritik Sınır Değerleri		
Anlamlılık Düzeyleri	I(0) Sınırı	I(1) Sınırı
% 1	4.768	6.67
% 5	3.354	4.774
% 10	2.752	3.994

Not: ^a, $p < 0,1$ temsil etmektedir.

Modelin uzun dönem katsayı sonuçları Tablo 3'te verilmiştir. Elde edilen bulgulara göre GL değişkeni olarak ifa edilen küreselleşme endeksinin tüketim harcamaları üzerinde %10 istatistiksel anlamlılık düzeyinde pozitif etkilediği görülmektedir. Ekonomik küreselleşmenin de %10 istatistiksel önem düzeyinde tüketim harcamalarını anlamlı etkiye sahip olduğu ancak negatif bir etkinin varlığı tespit edilmiştir. Ekonomik büyümenin de istatistiksel olarak %5 istatistiksel önem düzeyinde tüketim harcamalarını pozitif etkilediği sonucuna ulaşılmıştır.

Tablo 3. ARDL Uzun Dönem Katsayı Sonuçları (2.0.0.4.3)

Değişkenler	Katsay	t-istatistiği	Olasılık (P-value)
GL	0.0385 ^c	2.021	0.060
EG	-0.0263 ^c	-2.017	0.061
SG	0.0110	1.330	0.202
GDP	0.0169 ^b	2.641	0.017
R-kare	0.87	F-istatistik	15.899
Düzeltilmiş R-Kare	0.82	Prob.(F-istatistik)	0.000

Not: ^b ve ^c, sırasıyla $p < 0,5$ ve $p < 0,1$ temsil etmektedir.

Model ait ARDL kısa dönem hata düzeltme katsayı sonuçları Tablo 4'te gözlemlenmektedir. ARDL modeli (2.0.0.4.3) ile tahmin edilmiştir. Öncelikle hata düzeltme teriminin (CointEg(-1)) %1 istatistiksel önem düzeyinde anlamlı olduğu ve katsayısının -0.995 yani (-1 ile 0) aralığında olduğu görülmektedir. bu katsayı modelde meydana gelen kısa dönem sapmaların 1 yılı aşkın bir sürede dengeye geldiğini göstermektedir. diğer yandan bağımsızın değişkenler arasından sosyal küreselleşmeyi, temsil eden SG değişkeninin ile GDP'nin tüketim harcamalarını sırasıyla %5 ve %1 istatistiksel önem düzeyinde tüketim harcamaları üzerinde pozitif etkiye sahip olduğu görülmektedir.

ARDL modeli (2.0.0.4.3) olup GL ve EG değişkenlerinin uygun gecikme uzunluklarının 0 olduğu görülmektedir. uygun gecikme uzunluğunun burada 0 olması kısa dönemde bu

değişkenlerde herhangi bir sapma olmadığı anlamına gelmektedir (Çelik, 2022; 155). Söz konusu değişkenlerin uygun gecikme uzunlukları 0 olduğundan yani kısa dönemde dengeden sapma olmadığı için tabloda görülmemektedir.

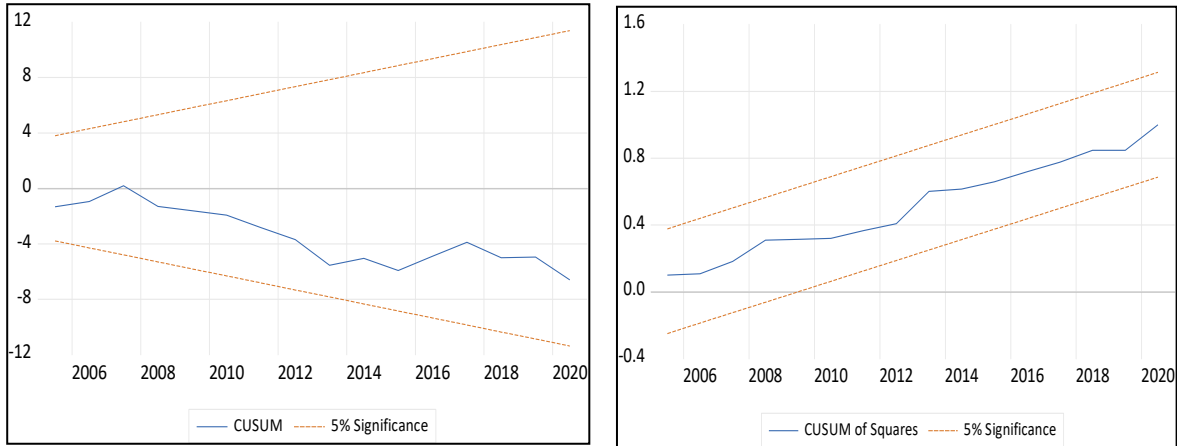
Tablo 4. ARDL Kısa Dönem Hata Düzeltme Sonuçları (2.0.0.4.3)

Değişkenler	Katsayı	t-istatistiği	Olasılık (P-value)
Cons	9.638 ^a	1.172	0.000
D(SG)	0.001 ^b	2.379	0.030
D(GDP)	0.0055 ^a	4.379	0.000
CointEq(-1)	-0.995 ^a	0.061	0.000

Not: ^a ve ^b sırasıyla $p < 0,01$ ve $p < 0,05$ temsil etmektedir.

Uzun ve kısa dönem katsayı tahminlerinin istikrarlı olup olmama durumları CUSUM ve CUSUM² testleri ile gerçekleştirilmiştir. CUSUM ve CUSUM² dağılımları Grafik 1’de gösterilmiştir. İstikrar koşulunun grafikten incelendiği zaman dağılım dağılımların %5 istatistiksel önem düzeyini temsil eden kırmızı çizgiler arasında olması beklenir. Çalışmamıza ait CUSUM ve CUSUM² grafikleri incelendiğinde dağılımın beklenen istatistiksel anlamlılık sınırları içinde dağıldığı görülmektedir.

Grafik 1. CUSUM ve CUSUM² Dağılımları



Sonuç ve Öneriler

Bu çalışmada küreselleşme tüketim harcamaları ilişkisi ele alınmıştır. Çalışmanın ampirik analizleri Türkiye için gerçekleştirilmiştir. 1987-2020 dönemini kapsayan yıllık frekanslı veri seti ADF ve Phillips-Peron birim kök testleri ve ARDL sınır testi yaklaşımı ile analiz edilmiştir. Ampirik analizler neticesinde değişkenlerin I(0) ve I(1) olmak üzere farklı mertebelerden durağanlığa sahip olduğu sonucu elde edilmiştir. ARDL sonuçlarından eşbütünleşme ilişkisinin varlığı tespit edilmiştir. Uzun dönemde genel küreselleşme endeksinin tüketim harcamalarını

arttırdığı, ekonomik küreselleşmenin tüketim harcamalarını istatistiksel olarak anlamlı şekilde azalttığı gözlemlenmiştir. Sosyal küreselleşmenin tüketim harcamalarını pozitif etkilediği ancak istatistiksel olarak anlamlı olmadığı görülmüştür. diğer yandan ekonomik büyümenin de anlamlı olarak tüketim harcamalarını arttırdığı tespit edilmiştir.

Küreselleşme hayatın birçok alanında etkileri olduğu gibi tüketim, tüketim alışkanlıkları ve buna bağlı olarak da tüketim harcamalarını etkilemektedir. Tüketim harcamalarının artması aynı zamanda refah artışı olarak değerlendirildiğinden burada iktisadi bir perspektiften ele alındığında artan tüketimin azaltılması ve artırılmasından ziyade nasıl karşılandığına bakılmalıdır. Yani tüketimin ne derece de yurtiçi veya ithalattan karşılandığı önemlidir. Çünkü tüketim ithalata dayalı bir yapıya sahip ise artan tüketim harcamaları dış ticaret açığı, döviz kurları, carı açık gibi iktisadi göstergeler üzerinde etkileri doğacaktır. Tüketimin önemli kısmını yurtiçi üretimden karşılayabilen ülkeler artan tüketimin çeşitli ekonomik göstergeler üzerinde doğabilecek olumsuzlukları da bertaraf etmiş olacaktır. Bu bağlamda birkaç politik öneride bulunulabilir. Öncelikle yurtiçi tüketimin içeriği ve yapısı doğru belirlenerek yurtiçi üretimin iç tüketime cevap verebilmesi sağlanabilir. Tüketime yönelik mal ve hizmetlerin yurtiçi talebi aşan kısmı ihraç edilerek dış ticaret hadleri üzerinde olumlu etkilerin ortaya çıkması da sağlanabilir.

Tüketim harcamalarının genel olarak ele alınması bu çalışmanın sınırlılıkları olarak ifade edilebilir. Gelecekte yapılacak çalışmalarda tüketim alt kalemler bazında ele alınarak küreselleşmenin etkileri ele alınabilir. Küreselleşme ve tüketim ilişkisi başka ülke veya ülke grupları için ele alınabilir.

Kaynakça

- Adıgüzel, M. (2013). Ekonomik küreselleşmenin Türkiye ekonomisine etkileri. *Akademik Bakış Dergisi*(35), s. 1-20.
- Akbakay, Z., & Barak, D. (2020). Yükselen piyasalarda ekonomik küreselleşme ve gelir eşitsizliği ilişkisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 16(1), s. 17-35. doi:<https://doi.org/10.17130/ijmeh.700812>
- Aktel, M. (2001). Küreselleşme süreci ve etki alanları. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(2).
- Bergh, A., & Nilson, T. (2014). Is Globalization Reducing Absolute Poverty? *World Development*, 62, s. 42-61. doi:<https://doi.org/10.1016/j.worlddev.2014.04.007>
- Çelik, H. (2022). Türkiye’de ihracat çeşitliliği ve ekonomik büyüme ilişkisi: ARDL yaklaşımı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*(35), s. 147-162. doi:<https://doi.org/10.18092/ulikidince.1048669>
- Dickey, D. A., & Fuller, W. A. (1981). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association*, 79, 355-367.
- Kiangi, R. (2015). Globalization and the size of public expenditure: Analysis of gGrowth effect of globalization on Tanzanian economy. *Journal of Economics and Sustainable Developmen*, 6(4), s. 91-102.
- Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. doi:10.1002/jae.616
- Phillips, P. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.
- Tabetando, R. (2014). Globalization and expenditure inequality in Indonesia: A panel data approach. *International Journal of Development Research*, 4(12), s. 2816-2820.
- World Bank*. (2023, 04 10). World Development Indicators: <https://databank.worldbank.org/indicator/NE.EXP.GNFS.ZS/1ff4a498/Popular-Indicators#>

COVID-19 HASTALARINDA TORAKS BİLGİSAYARLI TOMOGRAFİ (BT)
BULGULARI İLE VÜCUT KİTLE İNDEKSİ (VKİ) ARASINDAKİ İLİŞKİ

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ÖZET

AMAÇ: Bu çalışmada koronavirüs hastalığı 2019 (COVID-19) tanısı alan 440 hastanın ilk başvuru sırasındaki toraks bilgisayarlı tomografi (BT) bulguları ile vücut kitle indeksi (VKİ) değerleri arasındaki ilişkiyi belirlemeyi amaçladık. **GEREÇ VE YÖNTEM:** Bu retrospektif çalışmaya mayıs 2020 ile temmuz 2021 tarihleri arasında hastanemizde COVID-19 tanısı alan ve toraks BT incelemesi olan 440 hasta dahil edildi. Altta yatan komorbiditelere ilişkin veriler, tip 2 diabetes mellitus, hipertansiyon, kardiyovasküler hastalık, kronik akciğer hastalığı ve kanser dahil olmak üzere hastaların geçmiş tıbbi öykülerinden elde edildi. Hastaların şikayetleri, RT-PCR test sonuçları ve ek hastalıkları tıbbi kayıt sisteminden, BT görüntüleri ise PACS sisteminden retrospektif olarak tarandı. Toraks BT’de parankim lezyonları buzlu cam sahası, konsolidasyon ve buzlu cam sahası ile konsolidasyon birlikteliği tipik bulgular olarak kabul edildi. Pnömoni şiddeti toraks BT’de toplam akciğer hacminin tutulum derecesine göre hafif (parankimal tutulum < %25), orta (parankimal tutulum = %25-50) ve ağır (parankimal tutulum > %50) pnömoni şeklinde kategorize edildi. VKİ (kg/m^2) ağırlığın (kg), boyun (m) karesine bölünmesiyle hesaplandı. **BULGULAR:** COVID-19 tanısı alan 440 hastanın 213’ü kadın 227’si erkekti. Tüm hastaların yaş ortalaması 40.8 ± 12.5 iken bu oran erkeklerde 41.2 ± 11.3 , kadınlarda ise 40.3 ± 13.7 olarak bulundu. Torak BT bulgularına göre hastalar 3 grup şeklinde kategorize edildi. Grup 1’e pnömoni bulgusu bulunmayan hastalar (189 hasta), grup 2’ye hafif-orta pnömoni bulgusu olan hastalar (166 hasta) ve grup 3’e ağır pnömoni bulgusu olan hastalar (85 hasta) dahil edildi. Vücut kitle indeks değerleri grup 1’de $24,3 \pm 4,2 \text{ kg/m}^2$, grup 2’de $25,1 \pm 3,7 \text{ kg/m}^2$ ve grup 3’de $31,6 \pm 5,5 \text{ kg/m}^2$ olarak belirlendi. Ağır pnömoni bulgusu olan grup 3 hastalarda VKİ anlamlı olarak daha yüksekti (grup 1-2 $p=0,180$, grup 1-3 $p<0,05$, grup 2-3 $p<0,05$). En az bir ve daha fazla komorbiditesi olan hastalar çalışmaya dahil edilmediğinde benzer şekilde ağır pnömoni bulgusu

olan hastalarda VKİ anlamlı olarak daha yüksek bulundu (grup 1-2 $p=0,537$, grup 1-3 $p<0,05$, grup 2-3 $p<0,05$)

SONUÇ: Çalışmamız, COVID-19'lu obez hastaların ağır pnömoni açısından daha yüksek risk altında olduğunu göstermektedir. Bulgularımız, VKİ'nin COVID-19 pnömonisinin radyolojik şiddetindeki önemli rolünü vurgulamaktadır ve bu nedenle obez COVID-19 hastalarında olası komplikasyonlarının önlenmesi için hastaneye erken yatış dahil olmak üzere daha agresif bir yaklaşımdan fayda görebileceğini düşündürmektedir.

Anahtar Kelimeler: COVID-19, Vücut Kitle İndeksi (VKİ) , Pnömoni, Toraks Bilgisayarlı Tomografi (BT)

GİRİŞ

COVID-19 (koronavirüs hastalığı-2019) ateş, nefes darlığı, halsizlik ve kas ağrıları gibi semptom ve bulgularla ortaya çıkan çoğunlukla asemptomatik seyreden fakat viral pnömoni, sepsis hatta ölümlle sonuçlanabilen bulaşıcı bir hastalıktır (1). Yapılan çalışmalarda, diabetes mellitus, hipertansiyon, koroner arter hastalığı ve yüksek vücut kitle indeksi (VKİ) gibi risk faktörleri bireylerin enfekte olma olasılığını ve komplikasyon gelişme ihtimalini artırmaktadır (1-3).

Obezite, proinflamatuvar sitokinlerin artışa neden olan bağışıklık yanıt etkinliğini bozan ve çeşitli kronik hastalıklara yol açan önemli bir sağlık sorunudur (4). Bu hastalarda enfeksiyon, malignite ve kardiyovasküler hastalıkların normal popülasyona göre arttığı öne sürülmüştür (5). 2009 yılında H1N1 influenza A pandemisinde obezitenin hastaneye yatış, akut solunum sıkıntısı sendromu (ARDS) ve mortalite için bir risk faktörü olduğu bildirilmiştir (6-8). COVID-19'un patogeneğinde önemli bir rol oynayan bağışıklık sistemi, obezite kaynaklı yağlı doku inflamasyonunda da önemli bir yere sahiptir. Yağ dokusunun inflamasyonu, potansiyel olarak dislipidemiye, insülin direncine, tip 2 diabetes mellitusa, hipertansiyona ve kardiyovasküler hastalığa yol açan metabolik işlev bozukluğuna neden olur (9). Obezitenin bağışıklık yanıt etkinliğini bozduğunu bu nedenle COVID-19 hastalarında morbidite ve mortalite için bir risk faktörü olabileceği bildirilmiştir (10).

Obezite, solunum sisteminin fonksiyonel yeteneğini azalttığı gibi solunum fizyolojisini de değiştirdiği bilinmektedir (11). Obez hastalarda özellikle artan hava yolu direnci, bozulmuş gaz değişimi, azalan zorlu vital kapasite (FVC) ve zorlu ekspirasyon volümü (FEV) ile karakterize edilen solunum fonksiyon bozukluğu vardır. Bu nedenle obezite pnömoni için bir risk faktörü olarak kabul edilmektedir (12). COVID-19 hastalarında özellikle yüksek duyarlılık nedeniyle bilgisayarlı tomografisi (BT), asemptomatik hastalarda bile erken dönemde bazı parankim bulgularını ile hastalığın teşhisine yardımcı olabilmektedir (13). Ayrıca BT, hastalığın şiddetinin ve tedaviye yanıtın değerlendirilmesinde de önemli bir role sahiptir (14).

Bu çalışmada, COVID-19 hastalarında toraks bilgisayarlı tomografi (BT) bulguları ile vücut kitle indeksi (VKİ) arasındaki ilişkiyi belirlemeyi amaçladık.

GEREÇ VE YÖNTEM

Bu retrospektif çalışmaya Mayıs 2020 ile Temmuz 2021 tarihleri arasında hastanemizde COVID-19 tanısı alan ve toraks BT incelemesi olan 440 hasta dahil edildi. Altta yatan komorbiditelere ilişkin veriler, tip 2 diabetes mellitus, hipertansiyon, kardiyovasküler hastalık, kronik akciğer hastalığı ve kanser dahil olmak üzere hastaların geçmiş tıbbi öykülerinden elde

edildi. Hastaların şikayetleri, RT-PCR test sonuçları ve ek hastalıkları tıbbi kayıt siteminden, BT görüntüleri ise PACS sisteminden retrospektif olarak tarandı.

Klinik muayene, laboratuvar testleri ve RT-PCR test sonucuna göre COVID-19 tanısı alan bütün hastaların toraks BT görüntüleri incelendi. Tüm toraks BT çekimleri supin pozisyonda ve uygun toraks protokolünde 16 kesit BT cihazı (Siemens Scope 16) ile 3 mm kesit kalınlığında kontrast madde verilmeden aksiyel kesitler şeklinde elde edildi. Toraks BT’de parankim lezyonları buzlu cam sahası, konsolidasyon ve buzlu cam sahası ile konsolidasyon birlikteliği tipik bulgular olarak kabul edildi. Tipik bulguların eşlik etmediği plevral effüzyon, septal kalınlaşma, hava bronkogramı ve mediastinal LAP gibi atipik bulguları olan hastalar çalışmaya dahil edilmedi. Pnömoni şiddeti toraks BT’de toplam akciğer hacminin tutulum derecesine göre hafif (parankimal tutulum < %25), orta (parankimal tutulum = %25-50) ve ağır (parankimal tutulum > %50) pnömoni şeklinde kategorize edildi (15,16). VKİ (kg/m^2) ağırlığın (kg), boyun (m) karesine bölünmesiyle hesaplandı. Ağırlık verileri hastaneye yatışın ilk günündeki ölçümlere göre, boy verileri ise hastaların beyan ettiği ölçülere göre hesaplanmıştır. VKİ, zayıf ($\text{BMI} < 18.5\text{kg/m}^2$), normal ağırlık ($\text{VKİ } 18,5\text{--}24,9 \text{ kg/m}^2$), fazla kilolu ($\text{VKİ } 25\text{--}29,9 \text{ kg/m}^2$) ve obez ($\text{BMI} \geq 30 \text{ kg/m}^2$) şeklinde kategorize edilmiştir (17).

İSTATİSTİKSEL ANALİZ

Veri analizleri Statistical Package for Social Sciences 18.0 for Windows (SPSS Inc., Chicago, IL) kullanılarak yapıldı. Çalışma verilerinin değerlendirilmesinde tanımlayıcı istatistiksel yöntemlerin (ortalama, standart sapma) yanında nicel verilerin analizinde Student-t testi, ikiden fazla grubun kıyaslanmasında tek yönlü anova ardından gruplar arası farklılıklar için TUKEY testi kullanıldı. Tüm parametrelerin birbiriyle ilişkisi Pearson korelasyon katsayısı ile irdelenmiştir. Sonuçlar %95’lik güven aralığında, anlamlılık $p < 0,05$ düzeyinde değerlendirildi.

BULGULAR

COVID-19 tanısı alan 440 hastanın 213’ü kadın 227’si erkekti. Tüm hastaların yaş ortalaması 40.8 ± 12.5 iken bu oran erkeklerde 41.2 ± 11.3 , kadınlarda ise 40.3 ± 13.7 olarak bulundu. VKİ’ne göre 21 hasta zayıf ($16,9 \pm 1,2 \text{ kg/m}^2$), 139 hasta normal kiloda ($22,1 \pm 1,6 \text{ kg/m}^2$), 179 hasta fazla kilolu ($26,8 \pm 1,4 \text{ kg/m}^2$) ve 101 hastanın obez ($33,3 \pm 3,7 \text{ kg/m}^2$) olduğu saptandı. Tüm hastaların VKİ ortalaması $26,3 \pm 5,1 \text{ kg/m}^2$ idi. En az bir komorbidite sahip 151 hastanın % 6’i zayıf (9 hasta), %22’si normal kilolu, %42’si fazla kilolu ve %30’u obez grupta idi (Tablo 1).

Tablo 1 :COVID-19 hastalarında vücut kitle indeksi alt gruplarına göre kategorize edilmiş temel özellikleri

VKİ ALT GRUPLARI						
	Zayıf (n=21)	Normal Kilolu (n=139)	Fazla Kilolu (n=179)	Obez (n=101)	Toplam (n=440)	p
VKİ (kg/m²)± SD	16,9±1,2	22,1±1,6	26,8±1,4	33,3±3,7	26,3±5,1	<0,001
Cinsiyet;						
Erkek ,n	8	60	108	51	227	
Kadın,n	13	79	71	50	213	
Yaş ± SD	35,4±10,7	36,7±12,9	42,3±11,1	44,9±13,1	40,8±12,5	=0,101
Erkek ± SD	37,6±11,2	37,9±12,3	42,5±10,3	42,8±11,3	41,2±11,3	=0,377
Kadın ± SD	34±10,6	35,8±13,3	41,8±12,1	47,1±14,3	40,3±13,7	=0,225
Hematolojik değerler;						
WBC mcL± SD	6590±4260	6711±2806	6694±2876	6696±2888	6698±2925	=0,999
Nötrofil mcL± SD	4176±2712	4007±2040	4151±3659	4058±2062	4083±2836	=0,537
Lenfosit mcL± SD	1699±861	1811±819	1839±792	1825±676	1820±777	=0,334
Monosit mcL± SD	606±234	622±255	596±255	560±222	596±247	=0,508
Akciğer Tutulumu;						
Grup1, n	12	90	71	16	189	
Grup2,n	8	41	90	27	166	
Grup3,n	1	8	18	58	85	
Komorbidite; Bulunmayan, n	12	105	115	57	289	
1 veya daha fazla,n	9	34	64	44	151	

Not: SD; Standart Deviasyon, p; Pearson korelasyon katsayısı (Student-t testi)

Grup1: normal akciğer parankim bulguları, Grup 2: Hafif-orta pnömoni bulguları Grup 3: ağır pnömoni bulgularına sahip hastalar

Tablo 2: Grup 1,2 ve 3 vucut kitle indeks (VKİ) değerleri

	Grup 1	Grup 2	Grup 3	p
Vücut Kitle İndeksi ^x (kg/m ²)±SD Grup 1 ve Grup 2 Grup 1 ve Grup 3 Grup 2 ve Grup 3	24,3±4,2 (n=189)	25,1±3,7 (n=166)	31,6±5,5 (n=85)	<0,05 ^a 0,180 ^b <0,05 ^b <0,05 ^b
Vücut Kitle İndeksi ^y (kg/m ²)±SD Grup 1 ve Grup 2 Grup 1 ve Grup 3 Grup 2 ve Grup 3	24,1±3,9 (n=148)	25,0±3,97 (n=87)	30,8±5,7 (n=50)	<0,05 ^a 0,537 ^b <0,05 ^b <0,05 ^b

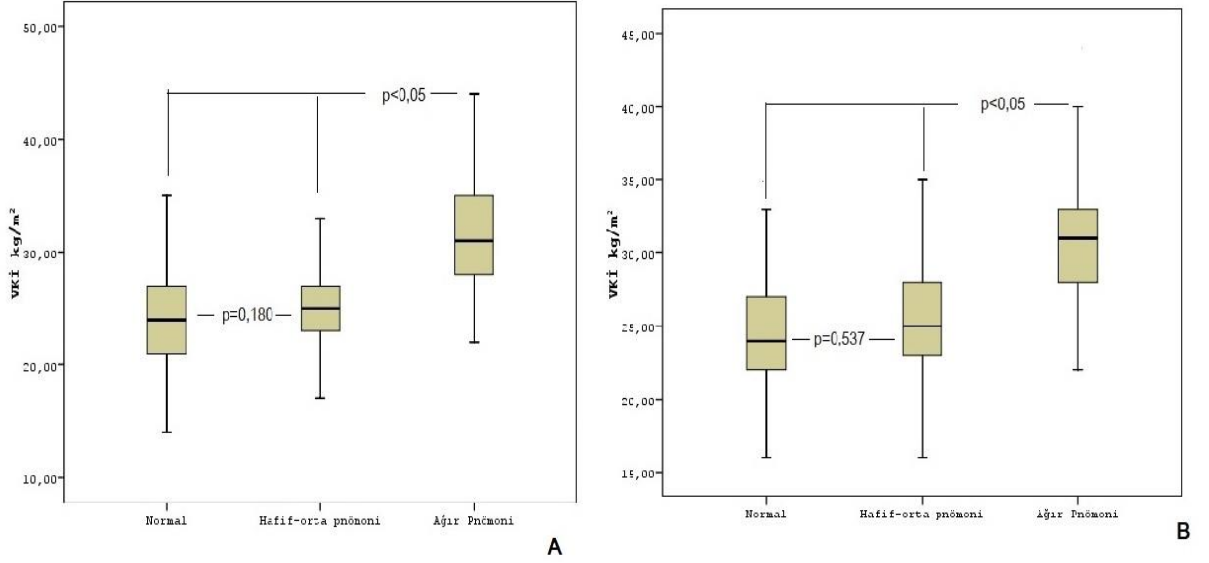
Grup1 normal akciğer parankim bulguları, Grup 2 hafif-orta pnömoni bulguları Grup 3 ağır pnömoni bulgularına sahip hastalar.

Vücut Kitle İndeksi^x tüm hastalar, Vücut Kitle İndeksi^y herhangi bir komorbiditesi olmayan hastalar.

^ap < 0.05, istatistiksel olarak anlamlı kabul edildi (tek yönlü ANOVA).

^bp < 0.05, istatistiksel olarak anlamlı kabul edildi (post-hoc Tukey testi).

Toraks BT bulgularına göre hastalar 3 grup şeklinde kategorize edildi. Grup 1'e pnömoni bulgusu bulunmayan hastalar (189 hasta), grup 2'ye hafif-orta pnömoni bulgusu olan hastalar (166 hasta) ve grup 3'e ağır pnömoni bulgusu olan hastalar (85 hasta) dahil edildi. Vucut kitle indeks değerleri grup 1'de 24,3±4,2 kg/m², grup 2'de 25,1±3,7 kg/m² ve grup 3'de 31,6±5,5 kg/m² olarak belirlendi. Gruplar arası akciğer tutulum bulgularına göre anlamlı farklılık gösterip göstermediğini test etmek için anova testi uygulandı ve test sonucunda gruplar arasında anlamlı farklılık saptadık. Farklılığın yönünü belirlemek için Tukey testi yapıldı ve test sonucuna göre, ağır pnömoni bulgusu olan grup 3 hastalarda VKİ anlamlı olarak daha yüksekti (grup 1-2 p=0,180, grup 1-3 p<0,05, grup 2-3 p<0,05). En az bir ve daha fazla komorbiditesi olan hastalar çalışmaya dahil edilmediğinde benzer şekilde ağır pnömoni bulgusu olan hastalarda VKİ anlamlı olarak daha yüksek bulundu (grup 1-2 p=0,537, grup 1-3 p<0,05, grup 2-3 p<0,05)(Tablo 2 ve şekil 1).



Şekil 1: Her grup için görünen vucut kitle indeksi (VKİ) değerleri (grup 1: normal, grup 2: hafif-orta pnömoni grup:3 ağır pnömoni)

Kutu grafikleri, tüm hastaların (A) ve komorbititesi olmayan (B) hastaların vucut kitle indeksi (VKİ) değerlerini gösterir. Her kutu içindeki yatay çizgiler ortalama değerleri, her kutunun alt ve üst çizgileri sırasıyla minimum ve maksimum değerleri temsil eder.

TARTIŞMA

Obezite, başta kronik hastalıklar olmak üzere önemli bir halk sağlığı sorunu olarak kabul edilmektedir. Obezitenin COVID-19'da hastalık şiddetinde katkıda bulunan bir etken olduğu bilinmektedir. Bu katkıyı açıklayacak kesin bir mekanizma olmamakla beraber obez hastalarda akciğer fonksiyonunun bozulması, düşük kronik inflamasyon, azalan makrofaj aktivitesi, daha yüksek leptin ve daha düşük adiponektin konsantrasyonları hastalık şiddeti için potansiyel risk faktörleridir (19-22). Ayrıca adipoz doku, makrofajlardan interlökin (IL-1, IL-6, IL-8, IL-10), tümör nekroz faktörü (TNF- α) ve C-reaktif protein (CRP) gibi proinflamatuvar sitokinlerin salınımına neden olabilir. Obez hastalarda gözlenen bu proinflamatuvar sitokinlerin artışı, COVID-19 hastalarında ki inflamasyonu daha da kötüleştirip kötü prognoza yol açabilir (18-20).

Simonnet ve arkadaşları, yoğun bakım hastaları üzerinde yaptıkları araştırmada COVID-19 dışı solunum hastalığı olan hastalara kıyasla COVID-19 enfeksiyonu olan hastalarda obezite ve şiddetli obezite sıklığının daha fazla olduğunu belirtmişlerdir (21). Cai ve arkadaşlarının, 383 COVID-19 hastasıyla yaptığı bir çalışmada normal kilolu hastalara kıyasla aşırı kilolu ve obez hastalarda daha yüksek oranda ciddi pnömoni gelişme riski olduğunu bildirmişlerdir (22). Ayrıca Földi ve arkadaşlarının yaptıkları bir meta-analizde, obezitenin COVID-19 hastalarında hastalık şiddetini artırdığını ve obezitenin önemli bir risk faktörü olduğunu kabul etmişlerdir(3). Bizim çalışmamızda akciğer tutulumu olan hastalar içerisinde en yüksek pnömoni sıklığını fazla kilolu (VKİ > 25 kg/m²) ve obez (VKİ > 30 kg/m²) hastalar oluşturuyordu (sırasıyla; %43 ve %33,8

). Ayrıca, önceki çalışmalara benzer şekilde COVID-19'lu obez hastalar, normal ve fazla kilolu COVID-19 hastalarına kıyasla daha yüksek ciddi pnömoni riski taşıyordu (21-24). Yapılan bazı çalışmalarda yüksek VKİ'nin enfeksiyonlara yatkınlık oluşturduğu ve obezitenin şiddetli COVID-19 için bağımsız bir risk faktörü olduğu belirtilmiştir (25,26). Bizim çalışmamızda da en az bir veya daha fazla komorbiditesi olan hastalar çalışmaya dahil edilmediğinde ağır pnömonisi olan hastalar daha yüksek VKİ'ne sahipti.

SONUÇ

Çalışmamız, COVID-19'lu obez hastaların ağır pnömoni açısından daha yüksek risk altında olduğunu göstermektedir. Bulgularımız, VKİ'nin COVID-19 pnömonisinin radyolojik şiddetindeki önemli rolünü vurgulamaktadır ve bu nedenle obez COVID-19 hastalarında komplikasyonların önlenmesi için hastaneye erken yatış dahil olmak üzere daha agresif bir yaklaşımdan fayda görebileceğini düşündürmektedir.

KAYNAKLAR

1. Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. *New England journal of medicine* 2020; 382: 727-733
2. Fang X, Li S, Yu H, et al. Epidemiological, comorbidity factors with severity and prognosis of COVID-19: A systematic review and meta-analysis. *Aging (Albany NY)* 2020; 12:12493–12503
3. Földi M, Farkas N, Kiss S, et al. Obesity is a risk factor for developing critical condition in COVID-19 patients: A systematic review and meta-analysis. *Obesity Reviews* 2020; 21:e13095
4. Tilg H, Moschen AR. Adipocytokines: mediators linking adipose tissue, inflammation and immunity. *Nat Rev Immunol.* 2006; 6:772–83
5. Malik VS, Ravindra K, Attri S. V, Bhadada SK, Singh M. Higher body mass index is an important risk factor in COVID-19 patients: a systematic review and meta-analysis. *Environmental Science and Pollution Research* 2020; 27(33), 42115-42123
6. Sun Y, Wang Q, Yang G, Lin C, Zhang Y, Yang P Weight and prognosis for influenza A(H1N1)pdm09 infection during the pandemic period between 2009 and 2011: a systematic review of observational studies with meta-analysis. *Infect Dis Ther.* 2016; 48(11–12): 813–822
7. Ni YN, Luo J, Yu H et al. Can body mass index predict clinical outcomes for patients with acute lung injury/acute respiratory distress syndrome? A metaanalysis. *Crit Care* 2017; 21(1):36
8. Maier HE, Lopez R, Sanchez N, et al. Obesity increases the duration of influenza A virus shedding in adults. *The Journal of infectious diseases* 2018; 218(9):1378–1382
9. Kassir R. Risk of COVID-19 for patients with obesity. *Obesity Reviews.* 2020; 21(6)
10. Misumi I, Starmer J, Uchimura T, Beck MA, Magnuson T, Whitmire JK. Obesity expands a distinct population of T cells in adipose tissue and increases vulnerability to infection. *Cell Rep.* 2019;27(2):514-524
11. Parameswaran K, Todd DC, Soth M. Altered respiratory physiology in obesity. *Canadian respiratory journal* 2006; 13(4), 203-210
12. Phung DT, Wang Z, Rutherford S, Huang C, Chu C. Body mass index and risk of pneumonia: a systematic review and meta-analysis. *Obes Rev* 2013; 14(10): 839- 857
13. Fang Y, Zhang H, Xe J, Ln M, Yng L, Pang P, J W. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. *Radology.* 2020; 200432

14. Ribeiro TFG, Rstom RA, Barbosa PN, et al. Tomographic score (RAD-Covid Score) to assess the clinical severity of the novel coronavirus infection. *Brazilian Journal of Infectious Diseases*, 2021; 25
15. Colombi D, Bodini FC, Petrini M, et al. Well-aerated lung on admitting chest CT to predict adverse outcome in COVID-19 pneumonia. *Radiology* 2020
16. Choi H, Qi X, Yoon SH, et al. Extension of coronavirus disease 2019 (COVID-19) on chest CT and implications for chest radiograph interpretation. *Radiology: Cardiothoracic Imaging*. 2020; 2(2)
17. World Health Organization. Regional Office for the Western Pacific. *The Asia-Pacific perspective: redefining obesity and its treatment*, 2000
18. Strissel KJ, DeFuria J, Shaul ME, Bennett G, Greenberg AS, Obin MS. T-cell recruitment and Th1 polarization in adipose tissue during diet-induced obesity in C57BL/6 mice. *Obesity (Silver Spring)*. 2010;18(10):1918-25
19. McGonagle D, Sharif K, O'Regan A, Bridgewood C. The Role of Cytokines including Interleukin-6 in COVID-19 induced Pneumonia and Macrophage Activation Syndrome-Like Disease. *Autoimmun Rev*. 2020;19(6):102537
20. Pranata, R, Lim, MA, Huang I, Raharjo SB, Lukito AA. Hypertension is associated with increased mortality and severity of disease in COVID-19 pneumonia: a systematic review, meta-analysis and meta-regression. *Journal of the renin-angiotensin-aldosterone system: JRAAS* 2020; 21(2)
21. Simonnet A, Chetboun M, Poissy J, et al. High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. *Obesity (Silver Spring)* 2020; 28:1195–9
22. Cai Q, Chen F, Wang T, et al. Obesity and COVID-19 severity in a designated hospital in Shenzhen, China. *Diabetes Care*. 2020; 43:1392–98
23. Pranata R, Lim MA, Yonas E, et al. Body mass index and outcome in patients with COVID-19: A dose-response meta-analysis. *Diabetes Metab* 2020; S1262-3636(20)30097-5
24. Jayanama K, Srichatrapimuk S, Thammavaranucupt K, et al. The association between body mass index and severity of Coronavirus Disease 2019 (COVID-19): A cohort study. *PLoS One* 2021; 16(2), e0247023

25. Samuels JD. Obesity and severe COVID-19 disease: a strong association. *Obesity (Silver Spring)* 2020; 28, 1368.
26. Finer N, Garnett SP, Bruun JM. COVID 19 e obesidade. *Obesidade Clinica* 2020; 10(3)

KUDRET NARI (*Momordica Charantia* L.) Ve GIDA ÜRÜNLERİNDE KULLANIMI

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ÖZET

Günümüzde tüketiciler, sağlığa yönelik koruyucu önlem olarak veya beslenme yetersizliklerinden kaynaklanan rahatsızlıkları gidermek amacıyla sağlığa faydalı olduğu bilinen bitkileri tedavi veya takviye edici olarak tüketme eğilimindedirler. Yüksek besin değerlerine sahip bitkiler, bilinçli tüketicilerin ve üreticilerin dikkatini çekmektedir. Bu bitkiler farklı istek ve ihtiyaçlara yönelik olarak tüketilmektedir. Kudret narı (*Momordica charantia*) meyvesi; kökeni Çin ve Hindistan'a dayanan, tropikal bölgelerde doğal olarak yetişebilen, kabakgiller familyasına ait bir meyvedir. Dünyanın birçok bölgesinde kudret narı meyvesi; dolması yapılarak, zeytinyağında macun yapılarak, farklı meyve veya sebzelerle birlikte sotelenerek, suyu sıkılarak, ham veya işlenmiş olarak tüketilmektedir. Uluslararası piyasada ilgi görmekte olan kudret narı meyvesinin ticareti yapılmakta böylece yetiştirildiği veya işlendiği bölgelerin ekonomisine katkı sağlamaktadır. Tıp, beslenme ve gıda alanında birçok çalışmaya konu olan kudret narının; vitamin, mineral, protein, konjuge linolenik asit izomerleri, biyoaktif bileşikler açısından oldukça zengin olduğu ve iyi bir antioksidan kaynağı olduğu bilinmektedir. Bitki antiviral, antibakteriyel, antikanser özellik taşımaktadır. Bitkinin; gastrit, ülser, reflü gibi mide rahatsızlıklarına, şeker hastalığına, açık yaralara iyi geldiği bilinmektedir. Diyabet tedavisinde kan şekeri kontrolünde kullanılmaktadır. Bu çalışmada kudret narı meyvesinin genel özelliklerinden, besin değerinden, sağlık üzerindeki etkilerinden ve gıda ürünlerinde kullanımından ve alternatif tüketim şekillerinden bahsedilmiştir. Kudret narı meyvesinin gıdalarda kullanımına yönelik yapılmış çalışmaların literatür cetveli hazırlanmış; çalışmalar amaçları, yöntemleri ve sonuçları bakımından incelenmiştir. Sonuç olarak, kudret narının farklı kısımlarının fonksiyonel ve besleyici özelliklerinden yararlanabilmek için gıda, tıp, eczacılık gibi alanlarda yeni çalışmaların yapılması gerekmektedir.

Anahtar Kelimeler: Kudret Narı, Acı Kavun, Gıda, Sağlık, Beslenme

***Bu çalışma yüksek lisans tez çalışması kapsamında üretilmiştir.**

USAGE OF BITTER MELON (*Momordica charantia*) IN FOOD PRODUCTS

ABSTRACT

In today's world, consumers tend to consume plants known to have health benefits as a preventive measure for health or to address discomfort caused by nutritional deficiencies, either as a treatment or as a dietary supplement. Plants with high nutritional values attract the attention of conscious consumers and producers. These plants are consumed for different desires and needs. Bitter melon is a fruit belonging to the cucurbit family which is native to China and India and naturally grows in tropical regions. In many parts of the world, bitter melon is consumed raw or processed, by stuffing it, making paste with olive oil, stir-frying it with different fruits or vegetables, and squeezing its juice. The trade of bitter melon, which attracts international attention, contributes to the economy of the regions where it is grown or processed. Bitter melon, which has been the subject of numerous studies in the fields of medicine, nutrition, and food, is known to be rich in vitamins, minerals, proteins, conjugated linolenic acid isomers, and bioactive compounds, and is a good source of antioxidants. The plant possesses antiviral, antibacterial, and anticancer properties. It is known to be beneficial for stomach disorders such as gastritis, ulcers, and reflux, as well as diabetes and open wounds. It is used for blood sugar control in the treatment of diabetes. In this study, the general characteristics, nutritional value, health effects, and usage in food products, as well as alternative consumption methods, of bitter melon were discussed. A literature review was conducted on studies related to the use of bitter melon in food, and relevant studies were examined in terms of their objectives, methods, and results. As a result, it was determined that further research was needed in fields such as food, medicine, and pharmacy to take advantage of the functional and nutritional properties of different parts of bitter melon.

Keywords: Bitter gourd, Bitter melon, Food, Health, Nutrition

1. INTRODUCTION

A sedentary lifestyle and poor eating habits cause various illnesses such as diabetes, cardiovascular diseases, and hypertension. Plants are improving health and treating these diseases due to their dietary components and phytochemicals. Therefore, plants and their products are consumed not only to meet basic nutritional needs but also to contribute to the prevention and treatment of diseases (Saeed, et al. 2021). Bitter melon, has been considered a medicinal plant for a very long time. Bitter melon, with its high nutritional value and antioxidant properties, shows protective effects against many chronic diseases. This fruit, which promotes health, attracts consumer attention due to the positive research conducted on it and the increasing awareness level (Kumari, et al. 2017). Bitter melon is consumed as a fruit, tea, or added to dishes in many regions of the world, especially in tropical areas. However, the bitter taste and lack of widespread availability limit the consumption of bitter melon. Therefore, this study aims to provide information about bitter melon, discuss its use in food products, and encourage consumers to consume the fruit. This study examines the general characteristics, nutritional value, and health effects of bitter melon. In addition, the use of bitter melon in food products is discussed, and the results of studies conducted in this field are presented.

2. GENERAL CHARACTERISTICS OF BITTER MELON

Bitter melon, is a member of the Cucurbitaceae family. It has a rectangular shape, ranging from 9-60 cm in length, and looks similar to a cucumber, but with a very rough outer appearance (Tan et al., 2014). Bitter melon is a tropical and subtropical fruit that originated in China and India. It is widely cultivated in China, Malaysia, India, Africa, the Amazon, and the Caribbean. Bitter melon can be grown up to an altitude of 1500m. In the hot season, from April to July, the seeds are planted in a pit to grow. The seeds should be planted half a meter apart (Gupta et al. 2011). In Turkiye, bitter melon is commonly grown in Yalova, Bursa, and the Aegean Region (Kızılaslan et al. 2022). Fruits of bitter melon can be protruding, blunt, pointed, short, or long. The fruit is green in the early stages and turns yellow and orange as it ripens. After ripening, the shiny red seeds of the fruit are revealed by splitting into three from their tips and curving backward. Bitter melon, which belongs to the Cucurbitaceae family, needs a minimum temperature of 15-18°C and should be grown under the same conditions as other plants in the same family (Arslanoğlu et al., 2012).

2.1. Nutritional Value of the Bitter Melon Fruit

The bitter melon fruit provides health benefits against various diseases to enhance the quality of life. It is a nutritious plant that contains alkaloids, polypeptides, vitamins, minerals (Saeed et al., 2021). The bitter melon fruit is rich source of carotene, iron, phosphorus, and potassium (İnce et al., 2019). Bitter melon fruit contains antioxidants. In addition, it contains high amounts of vitamins A, B, and C (Arslanoğlu et al., 2012). The bitter melon fruit is the most nutritionally valuable fruit in the Cucurbitaceae family. Its nutritional value is enhanced by the presence of phenolic acids, triterpenes, flavonoids (Sur et al., 2021).

2.2 The Effects of Bitter Melon on Health

Bitter melon grows in many countries in Asia. Its fruit, juice, and dried powder are widely used as traditional medicines to lower blood sugar levels, treat obesity, and prevent the proliferation of various cancer cells (Yoon et al., 2019). Many studies have shown that bitter melon, a medicinal plant, contains more than 30 natural products, some of which have antitumor potentials and also bitter melon, against diabetes and HIV virus (Fang et al., 2019). The increased consumption of bitter melon fruit in developed countries is thought to be effective in the treatment of obesity and type II diabetes. Additionally, the fruit is known to have anthelmintic properties, and contraceptive effects, and to be beneficial for ailments such as gout, kidney stones, hemorrhoids, and rheumatism (Raina et al., 2016).

Bitter melon is an antioxidant, anti-allergic fruit, and therefore, consumption of bitter melon extract is increasing day by day. The fruit is known to have a therapeutic effect on diabetes, cancer, and cardiovascular diseases in both humans and animals. Moreover, due to the presence of β -carotene, it is effective in the treatment of eye disorders and in improving visual ability. In addition, some studies have shown that bitter melon fruit is effective against gastrointestinal parasites (Muronga et al., 2021). Bitter melon fruit, leaves, and stems are used as herbal medicine and dietary supplements for the treatment of gout, graying of hair, skin infections, and respiratory diseases (Clardy, 2018). Bitter melon fruit is traditionally used for the treatment of wounds and stomach ailments. The fruit should be taken orally for the treatment of peptic ulcers that cause stomach discomfort and applied externally for the treatment of wounds. Bitter melon fruit is also preventive against *Helicobacter pylori*, a bacterium that grows in the stomach and increases stomach acid. Moreover, it has been observed in studies to be effective in preventing diseases such as reflux and gastritis (Kızılaslan et al., 2022).

3. USAGE OF BITTER MELON FRUIT IN FOOD PRODUCTS

In the regions where it is grown, bitter melon is consumed as a vegetable by boiling it in salty water to remove the bitterness. The consumption of its seeds is not recommended due to their laxative effect. Since ripe fruits are bitter, the consumption of unripe fruits is more common. Bitter melon fruit is also added to drinks either raw, cooked, or fried (Arslanoğlu et al., 2012). The leaves and seeds of bitter melon fruit are used in tea making. Additionally, the fruits can be dried, pickled, or canned. To add a slightly bitter taste to food, it can be added to curries and other spices. For traditional medicinal purposes, fruit juice is traditionally consumed on an empty stomach in the early morning to control glucose levels in hyperglycemic conditions (Raina et al., 2016).

Bitter melon fruit is a commonly consumed product in Asian and Indian cuisines. In Chinese cuisine, it is usually fried with pork, used in soups, and consumed as tea. In the northern region of India, the inside of the bitter melon fruit is filled with spicy mixtures and fried in oil. It is served with yogurt to reduce its bitterness. In the southern region of India, bitter melon fruit is mixed with coconut and various spices for flavoring. In the Caribbean, bitter melon is consumed by sauteing it with onions and garlic. Additionally, bitter melon can be consumed as juice either alone or in combination with other fruits and vegetables (Clardy, 2018).

4. LITERATURE REVIEW: USAGE OF BITTER MELON (*MOMORDICA CHARANTIA*) IN FOOD PRODUCTS

This section includes studies on the use of bitter melon fruit in food products. Table 1 contains 2 Turkish studies and 8 foreign studies that have been examined in terms of their objectives, methods, and results, and literature tables have been created.

	References	Purpose, Method, and Results of the Study
1	Aydos (2022)	<ul style="list-style-type: none">➤ This study aims to produce functional biscuits using dried bitter melon and medlar powders with different techniques and to determine the physical, chemical, nutritional, and sensory properties of the obtained products.➤ In this study, bitter melon fruit powder, which was dried by vacuum, tray, and microwave methods, was used as a flour substitute at ratios of 0%, 3%, 6%, and 9%.➤ As a result, the biscuit samples with bitter melon addition had the highest L* value with tray drying and the highest a*, b* values with vacuum drying.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

		<ul style="list-style-type: none"> ➤ With the increase in the ratio of bitter melon powder, an increase in moisture, ash, protein, and fat values was observed in the products, while a decrease in energy and carbohydrate values was observed. Total phenolic compound and antioxidant activity values increased with the increase in bitter melon powder ratio and reached the highest values with microwave drying method. ➤ It is suggested that bitter melon, as a functional food, can be used in the food industry according to the results of this study.
2	Maria et al., (2021)	<ul style="list-style-type: none"> ➤ This study aims to investigate the effect of bitter melon powder on the quality of whole wheat bread. ➤ Bitter melon powder was added to the bread dough in 1.5%, 2%, 2.5%, and 3% ratios. The physical-chemical, antioxidant, and sensory properties of the bread were analyzed. ➤ The study found that as the bitter melon powder content in the bread increased, the ash, protein, and fat content also increased. ➤ Additionally, the addition of 3% bitter melon powder had a positive effect on the total phenolic content and antioxidant activity of the bread. ➤ According to the research results, the addition of 2.5% bitter melon powder did not affect the taste profile of the bread. This finding indicates that bitter melon could be a promising and nutritious alternative for consumers.
3	Snee et al., (2011)	<ul style="list-style-type: none"> ➤ The aim of this study was to develop formulations containing bitter melon and test their acceptability in terms of taste. Additionally, the study investigated the effect of consuming bitter melon on health benefits. ➤ Fifty healthy individuals participated as panelists in the study. ➤ Bitter melon fruit added to dishes with hot sauce, as it was thought that the fruit's bitter taste could be suppressed in this way. ➤ It was observed that health information about bitter melon did not show significant effect on the desire to consume. ➤ In conclusion, it is thought that including spicy foods in meals can suppress the bitter taste of bitter melon.
4	An (2014)	<ul style="list-style-type: none"> ➤ The objective of this research was to create muffins that incorporate bitter melon and assess their quality. ➤ To achieve this, muffins were made with various formulations, including 0%, 3%, 6%, 9%, and 12% bitter melon powder. ➤ The findings of the study revealed that muffins made with the addition of bitter melon powder had a higher specific gravity compared to the control group. ➤ The moisture content of the samples containing bitter melon powder was found to be higher than the control group, while their pH was lower. ➤ The inclusion of bitter melon also resulted in an increase in the antioxidant properties of the muffins.

		<ul style="list-style-type: none"> ➤ Furthermore, the inner color of the muffins became darker with the addition of bitter melon powder, as indicated by the decrease in the L value, while the a and b values significantly increased. ➤ When examining the texture properties of the muffins, the incorporation of bitter melon powder resulted in a significant decrease in hardness, spreadability, adhesiveness, chewiness, and brittleness. ➤ The sensory evaluation scores indicated that the appearance, taste, texture, and overall preference of the muffins containing 3% and 6% bitter melon powder did not differ significantly from those of the control group. ➤ Based on the results, it was concluded that using less than 6% bitter melon powder would be a practical choice for producing muffins with the desired characteristics.
5	Zakaria (2007)	<ul style="list-style-type: none"> ➤ This study aims to make jam from bitter melon fruit and determine its physical, sensory, and chemical properties. ➤ For this purpose, the jam was produced in three different formulations containing 40%, 50%, and 60% bitter melon. ➤ The sample containing 40% bitter melon was determined to have the highest score in terms of total soluble solids (Brix) and spreadability with values of 73.00 ± 2.0 and 102.17 ± 1.31, respectively. ➤ The sample containing 60% bitter melon had the highest moisture, protein, carbohydrate, and fiber content compared to the other samples. ➤ Sensory evaluation was performed on sweetness, bitterness, and overall acceptance, and as a result, the jam containing 40% bitter melon received the highest score.
6	Kızılaslan et al., (2022)	<ul style="list-style-type: none"> ➤ This study aims to convert the bitter melon fruit into a gelatin capsule, in order to overcome the difficulties in the consumption of the fruit due to its bitter taste and smell. ➤ The fruit was transformed into a product using the soft gel technology to facilitate its use and prevent oxidation, while preserving its valuable components. ➤ To produce the gelatin capsules, the seeds of the bitter melon fruit were removed and the fruit was crushed. The separated juice of the bitter melons was macerated in olive oil for six months. The capsule shell is made of gelatin and water. The materials were heated and mixed in the gelatin melting system. The products underwent the necessary tests before being put into production. ➤ With this study, the bitter melon fruit has been produced as a gelatin capsule, thus facilitating its use. The product, which was released to the market as a food supplement, received significant feedback and achieved high sales.
7	Fu et al., (2021)	<ul style="list-style-type: none"> ➤ This study aims to develop a tea containing the main ingredients known to be good for diabetes, bitter melon fruit, and green tea

		<p>extract.</p> <ul style="list-style-type: none"> ➤ The study aimed to develop formulations with varying proportions of green tea extract and bitter melon juice and subject them to sensory analysis. ➤ The formulation with 7% bitter melon juice and 20% green tea extract received the highest sensory score. ➤ The resulting low-sugar formulation with this combination of bitter melon and green tea had a pleasing green color, balanced aroma, moderate acidity, sweetness, and clear texture. ➤ As a result of the study, this tea, which does not cause post-meal spikes in blood sugar levels, can be a healthy alternative for individuals with diabetes and obesity looking to diversify their diet.
8	Moreno et al., (2020)	<ul style="list-style-type: none"> ➤ This study aims to measure the acceptability level by producing cakes with the addition of bitter melon fruit, which is used as medicine in many countries. ➤ Cakes were produced with the addition of bitter melon and sensory analyses were carried out for this purpose. ➤ As a result of the study, it was revealed that the cakes produced with bitter melon were generally acceptable products.
9	Moon et al., (2014)	<ul style="list-style-type: none"> ➤ This study aims to determine the quality properties of cookies produced using bitter melon powder. ➤ Cookies containing bitter melon powder were produced and subjected to chemical and sensory analysis. ➤ The cookies containing bitter melon powder showed higher antioxidant properties compared to the control group. Furthermore, the sensory evaluation scores of the group containing 3% bitter melon powder were significantly higher than those of the control group in terms of appearance, taste, texture, and overall preference.
10	Sharma et al., (2016)	<ul style="list-style-type: none"> ➤ This study aims to produce a fruit juice that combines kiwi and bitter melon, which is high in nutritional value but has not received much attention in terms of its use in food products. ➤ Fruit juices containing different ratios of kiwi and bitter melon were produced for this purpose and subjected to sensory and chemical analyses. ➤ According to sensory analysis results, the product containing 80% bitter melon and 20% kiwi juice received the highest score. ➤ During storage, the products showed only minor changes in their physicochemical, nutritional, and sensory properties. ➤ The high antioxidant potential of the developed product compared to the control sample has demonstrated the health benefits of the product.

5. RESULTS

For many years, herbal products have been used as dietary supplements and therapeutic remedies due to their contributions to improving health. bitter melon is a beneficial plant that

is considered a functional food due to its rich nutrient content. Thanks to the components it contains, the bitter melon effective treatment of many diseases. For this reason, it is frequently consumed by consumers for the purpose of preventing and healing diseases.

This study focuses on the general characteristics of bitter melon, its nutritional value, and its effects on health, as well as providing information on the use of bitter melon in the food industry. In addition, studies on the use of bitter melon in the food industry have been reviewed. A literature review table was created that included the objectives, methods, and results of these studies. In this study, 10 studies on the usage of bitter melon as a food product were examined. Two of these studies were Turkish and eight were foreign. One of the common goals of these studies was to create a sensory acceptable product that would allow bitter melon to be added to daily diets. To achieve this goal, methods were used to reduce the bitter taste of bitter melon. Sensory, chemical, and physical analyses were conducted on the obtained products. In all of the studies, an increase in the nutritional value of the products obtained with the addition of bitter melon was observed. These studies are important in demonstrating that reasonable products can be obtained using bitter melon, in terms of taste and overall acceptability.

As a result of the research conducted, it was observed that bitter melon has become a popular research topic in the fields of nutrition and medicine. Many studies have been conducted on the health benefits, therapeutic effects on diseases, and chemical and nutritional properties of bitter melon. However, compared to these areas, the number of studies on the usage of bitter melon as a food product is much lower. Therefore, it is recommended that more studies be conducted on the usage of bitter melon as a food product, which is known as a functional food.

REFERENCES

- An, S. H. (2014). Quality Characteristics Of Muffin Added With Bitter Melon (*Momordica Charantia* L.) Powder. *Korean Journal Of Food And Cookery Science*, 30(5), 499-508.
- Arslanoğlu, F., & Hendekçi, A. (2012). Ilıman İklim Koşullarında Kudret Narının (*Momordica Charantia* L.) Yetiştirilebilmesi Üzerine Bir Araştırma. *Biyoloji Bilimleri Araştırma Dergisi*, 5(2), 1-5.
- Aydos, M. (2022). Muşmula (*Mespilus Germanica*) Ve Kudret Narı (*Momordica charantia*) Meyvelerinin Fonksiyonel Bisküvi Üretiminde Kullanım İmkanları (Master's Thesis, Necmettin Erbakan Üniversitesi Fen Bilimleri Enstitüsü).
- Clardy, A. (2018). Bitter Melon Fact Sheet.
- Fang, E. F., Froetscher, L., Scheibye-Knudsen, M., Bohr, V. A., Wong, J. H., & Ng, T. B. (2019). Emerging Antitumor Activities Of The Bitter Melon (*Momordica Charantia*). *Current Protein And Peptide Science*, 20(3), 296-301.
- Fu, X., Zhang, R., & Fu, Y. (2021). The development of low sugar bitter melon-green tea compound beverage. *Trends in Horticulture*, 4(1), 68-74.
- Gupta, M., Sharma, S., Gautam, A. K., & Bhadauria, R. (2011). *Momordica Charantia* Linn.(Karela): Nature's Silent Healer. *International Journal Of Pharmaceutical Sciences Review And Research*, 11(1), 32-37.
- İnce, İ., Çığırıl, N., Gümüştas, B., Güldü, Ö. K., Karaman, D., Medine, E. İ., ... & Karasulu, E. (2019). *Momordica Charantia* L. Meyveleri Kullanılarak Krem Hazırlanması, Kalite Kontrolü ve In Vitro Yara İyileşim Etkisinin Araştırılması. *Fen Bilimleri Enstitüsü Dergisi*, 12(1), 38-48.
- Kızılaslan, Y., Koç, F. E., Kulu, Ç., Merkezi, A. D. Ü. A. G., & Beylikdüzü, İ. (2022). Zeytinyağlı Kudret Narı Soft Jel.
- Kumari, P., Verma, R. B., Nayik, G. A., & Solankey, S. S. (2017). Antioxidant Potential And Health Benefits Of Bitter Gourd (*Momordica Charantia* L.). *J. Postharvest Technol*, 5, 1-8.
- Maria, M. S., Păucean, A., Chiş, M. S., Purice, E., Şerban, L. R., & Mureşan, I. E. (2021). The Effects Of Bitter Melon (*Momordica Charantia* L.) Powder On The Quality Characteristics Of Dark Bread.
- Moon, S. L., & Choi, S. H. (2014). Characteristics of cookies quality containing bitter melon (*Momordica charantia* L.) powder. *Culinary science and hospitality research*, 20(6), 80-90.
- Moreno, J., Omapas, J., Dantes, R. A., Cristinor, A. P., Torculas, G., & Paul Vincent Quinto, L. P. T. (2020). Level of Acceptability of Bitter Melon Cupcakes. *Ascendens Asia Singapore–Bestlink College of the Philippines Journal of Multidisciplinary Research*, 2(1)
- Muronga, M., Quispe, C., Tshikhudo, P. P., Msagati, T. A. M., Mudau, F. N., Martorell, M., ... & Sharifi-Rad, J. (2021). Three Selected Edible Crops Of The Genus *Momordica* As Potential Sources Of Phytochemicals: Biochemical, Nutritional, And Medicinal Values. *Frontiers In Pharmacology*, 12, 625546.
- Raina, K., Kumar, D., & Agarwal, R. (2016). Promise Of Bitter Melon (*Momordica Charantia*) Bioactives In Cancer Prevention And Therapy. In *Seminars In Cancer Biology* (Vol. 40, Pp. 116-129). Academic Press.
- Saeed, F., Sultan, M. T., Riaz, A., Ahmed, S., Bigiu, N., Amarowicz, R., & Manea, R. (2021). Bitter Melon (*Momordica Charantia* L.) Fruit Bioactives Charantin And Vicine Potential For Diabetes Prophylaxis And Treatment. *Plants*, 10(4), 730.
- Sharma, R., Thakur, A., Joshi, V. K., & Sharma, V. (2016). Development And Quality Evaluation Of Bitter Gourd-Kiwi Blended Squash During Storage. *International Journal of Food and Fermentation Technology*, 6(2), 327-336.
- Snee, L. S., Nerurkar, V. R., Dooley, D. A., Efirid, J. T., Shovic, A. C., & Nerurkar, P. V. (2011). Strategies To Improve Palatability And Increase Consumption Intentions For *Momordica Charantia* (Bitter Melon): A Vegetable Commonly Used For Diabetes Management. *Nutrition Journal*, 10, 1-11.
- Sur, S., Steele, R., Isbell, T. S., Venkata, K. N., Rateb, M. E., & Ray, R. B. (2021). *Momordicine-I*, a Bitter Melon Bioactive Metabolite, Displays Anti-Tumor Activity In Head And Neck Cancer Involving c-Met And Downstream Signaling. *Cancers*, 13(6), 1432.
- Tan, S. P., Parks, S. E., Stathopoulos, C. E., & Roach, P. D. (2014). Extraction Of Flavonoids From Bitter Melon. *Food And Nutrition Sciences*, 2014.
- Yoon, N. A., Park, J., Jeong, J. Y., Rashidova, N., Ryu, J., Roh, G. S., ... & Kang, S. S. (2019). Anti-Obesity Activity Of Ethanol Extract From Bitter Melon In Mice Fed High-Fat Diet. *Development & Reproduction*, 23(2), 129.
- Zakaria, N. Z. (2007). Development Of Bitter Gourd Jam (*Momordica Charantia*).

**NO_x MODELING OF AIRCRAFT WITH MIXED FLOW TURBOFAN ENGINES
USING CUCKOO SEARCH ALGORITHM**

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ABSTRACT

Depending on the continuous development of aviation, air traffic and therefore the total fuel consumption of aircraft engines are increasing. The harmful effects of the increase in emissions caused by increased fuel consumption on the environment and people have caused engineers, academicians and relevant authorities to focus more on this issue. In this study, NO_x modeling was performed for 50 different mixed flow turbofan engines. For modelling, the cuckoo search algorithm method, which has proven itself in many optimization problems, has been used. The aim of the model is to create an empirical formula that can predict real NO_x values for three different flight stages according to 3 different input parameters (by-pass ratio, fuel consumption and pressure ratio). As a result of modeling, the R² value was found to be 0.94 for take-off, 0.8744 for climb-out and 0.6937 for approach. Important design parameters were used as model inputs. In addition, the model gave good results for take-off and climb-out, although NO_x data exhibited a rather non-linear structure according to the input parameters. For these reasons, it is thought that the model obtained as a result of the study will help in estimating emissions in new engine designs and in estimating the environmental impact caused by turbofan engines around the airport.

Keywords: Cuckoo search algorithm, emission, mixed flow turbofan engine, optimization

Introduction

Global warming has become an important problem not only for the scientific community but also for the society (Florides & Christodoulides, 2009). Although the machines that come into our lives due to the development of technology make our lives easier, the greenhouse gases released by many machines to the environment are one of the main sources of global warming. The increase in greenhouse gases is an undesirable situation for the environment and human health. In this context, relevant authorities and individuals are working hard to reduce greenhouse gas emissions.

Air transportation is developing rapidly, especially since it is the most preferred mode of transportation in the international sense. As a matter of fact, it is estimated that air transportation will grow by approximately 3.6%-3.8% on an annual basis between 2019-2041 (Airbus, 2022; Boeing, 2022). Increasing air traffic and the number of aircraft increase the amount of emissions due to fuel consumption of aircraft engines is one of the biggest problems that the aviation community has focused on. For this reason, suggestions have been made to reduce emissions, such as producing more efficient aircraft engines, creating new air traffic applications in order to ensure that aircraft stay in the air and on the ground less, and a tendency to alternative fuels (Baklacioglu, 2016, 2021; Khandelwal et al., 2013; Oruc et al., 2022; Oruc & Baklacioglu, 2020b). In the literature, there are many studies on the calculation, optimization and modeling of emissions caused by different types of aircraft engines for the stated purpose. An example of this is the modeling study for 51 different mixed-flow turbofan engines using International Civil Aviation Organization (ICAO) data. The main purpose of the study is to estimate the real NO_x emission index value for take-off with high accuracy by using the by-pass ratio, fuel flow and overall pressure ratio parameters of the specified engines. In this context, a multiple regression model was created for mixed flow turbofan engines, and the error was tried to be reduced by simulated annealing and genetic algorithm. The created model was also used in the estimation of different exergy parameters. The fact that the R^2 value between the model data and the actual NO_x emission index value is close to 1, such as 0.862, shows the accuracy of the model (Ucar et al., 2023). The estimation study for the take-off phase for 171 different turbofan engines using ICAO data is another relevant example. In addition to emission estimation, different parameters related to exergy were also estimated in the study. In this context, support vector regression (SVR) and long short-term memory (LSTM) methods were used for optimization. Within the scope of the study, four different input parameters were used for the estimation of

HC, NO_x, CO emission index parameters. These are the actual by-pass ratio, thrust, combustion type and overall pressure ratio design parameters. As a result of the analysis, although the R² value was slightly low (around 0.63-0.65) for HC, the fact that the R² value for NO_x and CO was very close to 1 with both methods indicates the accuracy of the model. This is the first study to estimate emission index and exergy environmental parameters for aircraft with high bypass ratio using SVR and LSTM methods(Dursun et al., 2023).

To the author's knowledge, there is no study using the cuckoo search algorithm (CSA) for the NO_x emission index estimation of mixed-flow turbofan engines at different flight stages. This is the main motivation for this study. In this context, NO_x modeling was carried out for 50 different mixed flow turbofan engines. For modelling, the CSA method, which is relatively new but has proven itself in many optimization problems, is used. The aim of the model is to create an empirical formula that can predict the actual NO_x values for three different flight stages (take-off (T/O), climb out (C/O), approach (App)) according to 3 different input parameters (by-pass ratio, fuel flow and overall pressure ratio). As a result of the analyzes made, it was seen that the model created predicts the real emission index values with high accuracy.

Cuckoo Search Algorithm

The CSA was created in 2009 and its main inspiration is brood parasitism, the reproductive strategy of some cuckoos. Although the algorithm is new, it has given good results in optimization studies in many areas. In this context, it is frequently used in the literature. The analyzes show that the CSA method gives better results than the genetic algorithm and PSO methods. There are three basic rules in the algorithm (Oruc et al., 2022).

- Each cuckoo lays one egg in a randomly selected nest at one time.
- The best nests with high-quality eggs will be passed on to future generations.
- In CSA, the number of nests is fixed and the egg laid will be found by the host bird with a probability between 0 and 1. If the host bird notices the cuckoo egg, it will either get rid of it or leave its current nest to build a new nest (Joshi et al., 2017; Oruc & Baklacioglu, 2020a; Yang, 2014)

CSA uses a combination of local and global random walk controlled by the parameter p_a given in Equation (1). The local random walk can be written as:

$$x_i^{t+1} = x_i^t + \alpha s \otimes H(p_a - \epsilon) \otimes (x_j^t - x_k^t) \quad (1)$$

Here, x_i^t denotes the current solution, and the term x_i^{t+1} denotes the new solution obtained. From other terms, x_j^t and x_k^t are randomly selected two different solutions by random permutation, s

is the step size, $\alpha > 0$ is the step size scaling factor that should be related to the scales of the problem of interest, ϵ is a random number drawn from a uniform distribution, \otimes is the entry-wise product, and $H(u)$ is the heaviside function. Finally p_a denotes switching factor.

The global random walk, shown in Equation (2), uses Lévy flights, unlike the local random walk.

$$x_i^{t+1} = x_i^t + \alpha L(s, \lambda), \quad (2)$$

and

$$L(s, \lambda) = \frac{\lambda \Gamma(\lambda) \sin(\pi\lambda/2)}{\pi} \frac{1}{s^{1+\lambda}}, (s \gg s_0 > 0) \quad (3)$$

where, Γ is a constant given for the Lévy flight parameter λ of the function. In Equation (2), the first term on the right-hand side of the equation represents the current solution and the second term represents the transition probability (Gandomi et al., 2013; Yang & Deb, 2009, 2014).

Methodology of the Model

Within the scope of this study, a mathematical model was created to estimate the NO_x emission index value for 50 different mixed flow turbofan engines using ICAO emission databank data. In this context, by-pass ratio, fuel flow and overall pressure ratio parameters, which have important effects on engine performance, were determined as model input values. Modeling was carried out for three different flight stages, namely T/O, C/O and App. The CSA method was used in the whole modeling and optimization process. Although the NO_x values exhibited a rather non-linear structure for different engines, the model created predicted the real values with high accuracy. The mathematical formula obtained as a result of the study is shown in Equation (4).

$$f(\text{FFR}, \alpha, \pi) = (a_1 + a_2 \text{FFR} + a_3 \text{FFR}^2 + a_4 \text{FFR}^3) + (a_5 + a_6 \text{FFR} + a_7 \text{FFR}^2 + a_8 \text{FFR}^3) e^\alpha + (a_9 + a_{10} \text{FFR} + a_{11} \text{FFR}^2 + a_{12} \text{FFR}^3) e^\pi \quad (4)$$

where, FFR is the fuel flow, α is the by-pass ratio, π is the overall pressure ratio and symbols from a_1 to a_{12} denote model coefficients. The model was found as a result of a trial and error process. Namely; First, a mathematical formula was created, and then the coefficients of the mathematical formula were optimized using the CSA method. Until the mean square error (MSE) between the model values and the actual NO_x values was at the desired level the formula was modified and the optimization of the model coefficients continued. When the desired result was obtained, the same process was performed for the other flight stages and the formula given above was obtained. The main reason for using the exponential function in the formula is that

it gives better results. In the CSA method, the lower and upper limits of the coefficients were determined as -100 and +100, respectively. The iteration number, which is the stopping criterion of the algorithm, was determined as 250000, the number of nests from the CSA parameters was determined as 25, and the switching factor (p_a) was determined as 0.25. In studies on CSA performance, it has been seen that the number of nests gives good results in the range of 15 to 25, p_a 0.15-0.30. In this context, the above-mentioned values were given to these parameters and it was observed that they gave good results. Finally, the model data has been reduced to the 0-1 range in order to get better results. In order to reduce the values to the specified range, the formula given in Equation (5) was used.

$$x' = \frac{x - x_{\min}}{x_{\max} - x_{\min}} \quad (5)$$

Results and Discussion

The comparison of the values obtained for three different flight stages with the actual values is shown in Figure 1-3, the coefficients are shown in Table 1. When the specified figures are examined, it is seen that the model values are in great agreement with the actual values. Although the NO_x values for different engine types exhibit a rather non-linear structure, the fact that the model data is largely similar to the real data shows the model accuracy.

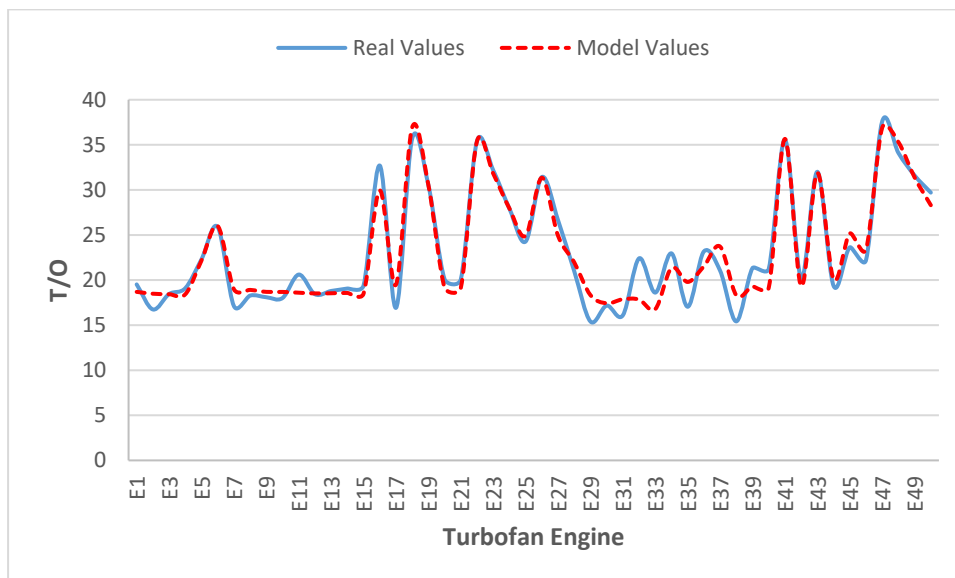


Figure 1. Comparison of actual and model NO_x values by engine types for T/O

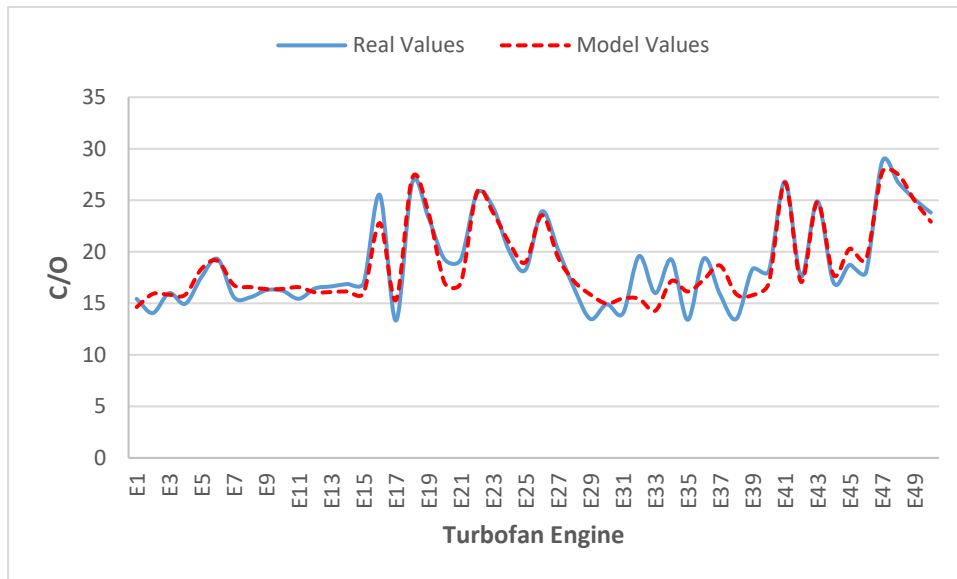


Figure 2. Comparison of actual and model NO_x values by engine types for C/O

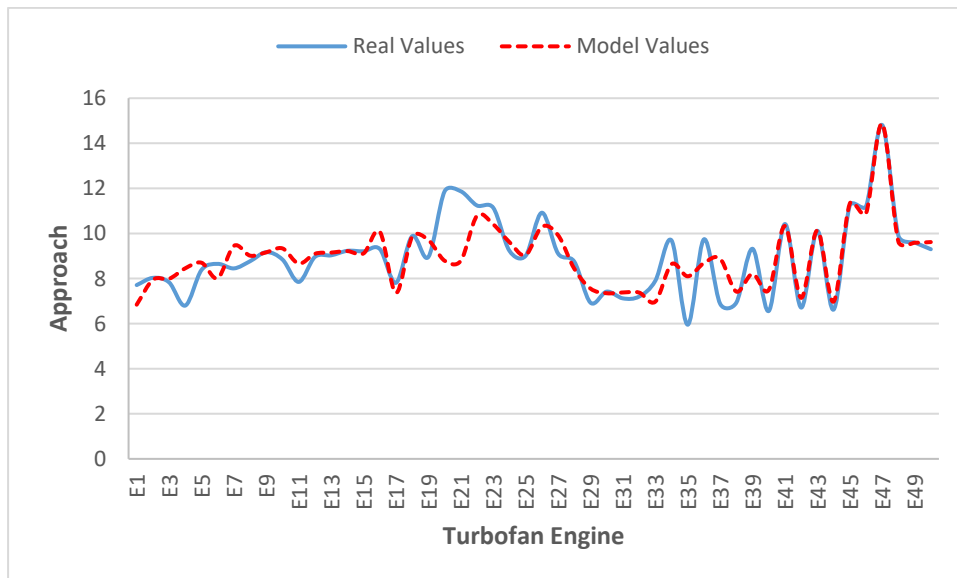


Figure 3. Comparison of actual and model NO_x values by engine types for approach

Table 1. CSA model coefficients

	T/O	C/O	Approach
a₁	0.2032	0.0443	0.5275
a₂	-5.7989	-8.0048	-17.5638
a₃	0.9783	20.6771	65.0487
a₄	4.1758	-22.4159	-63.3167
a₅	0.0507	0.1199	-0.4853
a₆	-3.0507	-2.2714	7.8885
a₇	14.4371	8.4611	-27.8499
a₈	-14.1862	-4.8248	27.1618
a₉	-0.0694	0.0609	0.3257
a₁₀	6.072	5.4751	3.1342
a₁₁	-10.1365	-12.9468	-12.1835
a₁₂	6.5016	11.1987	11.5078

The error rates between the model data and the actual data are given in Table 2. When the specified table is examined, values close to one for R² value T/O and C/O were found. For the Approach flight stage, although the value was a little low, the model's coverage of 50 different engines and good results for the other two flight stages demonstrate the accuracy of the study.

	MSE	R²
T/O	2.361462	0.940005
C/O	2.177443	0.874397
App	0.871201	0.693683

Conclusion

Aviation engines account for 2% of global greenhouse gas emissions. Its share in the transportation sector is around 10% (Atilgan et al., 2013; Aydin et al., 2012). This rate seems low at first glance. However, the values stated today, where the rapid development of aviation and the reduction of emissions even at a very low rate are very valuable, are also important. In this context, this model study for different flight stages is important.

It is thought that the model obtained can be used for emission estimation in new engine designs, since the parameters that significantly affect the engine performance are used for

modeling and the results are generally good. Since the flight stages modeled are flight profiles with relatively low altitude, it is thought that the model will help in estimating the environmental impact caused by turbofan engines around the airport.

As a result of the error analysis, the R^2 value for T/O and C/O was 0.940005 and 0.874397, respectively, which indicates the accuracy of the model in this case where the number of engines and non linearity are high.

References

- Airbus. (2022). *Global Market Forecast 2022*. <https://www.airbus.com/en/products-services/commercial-aircraft/market/global-market-forecast>
- Atilgan, R., Turan, O., Altuntas, O., Aydın, H., & Synylo, K. (2013). Environmental impact assessment of a turboprop engine with the aid of exergy. *Energy*, 58, 664–671. <https://doi.org/https://doi.org/10.1016/j.energy.2013.05.064>
- Aydın, H., Turan, O., Midilli, A., & Karakoc, T. H. (2012). Exergetic and exergo-economic analysis of a turboprop engine: a case study for CT7–9C. *International Journal of Exergy*, 11(1), 69–88. <https://doi.org/https://doi.org/10.1504/IJEX.2012.049089>
- Baklacioglu, T. (2016). Modeling the fuel flow-rate of transport aircraft during flight phases using genetic algorithm-optimized neural networks. *Aerospace Science and Technology*, 49, 52–62. <https://doi.org/10.1016/j.ast.2015.11.031>
- Baklacioglu, T. (2021). Predicting the fuel flow rate of commercial aircraft via multilayer perceptron, radial basis function and ANFIS artificial neural networks. *Aeronautical Journal*, 125(1285), 453–471. <https://doi.org/10.1017/aer.2020.119>
- Boeing. (2022). *Commercial Market Outlook 2022–2041*. <https://www.boeing.com/commercial/market/commercial-market-outlook/index.page>
- Dursun, O. O., Toraman, S., & Aygun, H. (2023). Deep learning approach for prediction of exergy and emission parameters of commercial high by-pass turbofan engines. *Environmental Science and Pollution Research*, 30, 27539–27559. <https://doi.org/https://doi.org/10.1007/s11356-022-24109-y>
- Florides, G. A., & Christodoulides, P. (2009). Global warming and carbon dioxide through sciences. *Environment International*, 35(2), 390–401.
- Gandomi, A. H., Yang, X. S., & Alavi, A. H. (2013). Cuckoo search algorithm: A metaheuristic approach to solve structural optimization problems. *Engineering with Computers*, 29(1), 17–35. <https://doi.org/10.1007/s00366-011-0241-y>
- Joshi, A. S., Kulkarni, O., Kakandikar, G. M., & Nandedkar, V. M. (2017). Cuckoo Search Optimization- A Review. *Materials Today: Proceedings*, 4(8), 7262–7269. <https://doi.org/10.1016/j.matpr.2017.07.055>
- Khandelwal, B., Karakurt, A., & Sekaran, P. R. (2013). Hydrogen powered aircraft : The future of air transport. *Progress in Aerospace Sciences*, 60, 45–59. <https://doi.org/https://doi.org/10.1016/j.paerosci.2012.12.002>
- Oruc, R., & Baklacioglu, T. (2020a). Modelling of fuel flow-rate of commercial aircraft for the climbing flight using cuckoo search algorithm. *Aircraft Engineering and Aerospace Technology*, 92(3), 495–501. <https://doi.org/10.1108/AEAT-10-2019-0202>
- Oruc, R., & Baklacioglu, T. (2020b). Propulsive modelling for JT9D-3, JT15D-4C and TF-30 turbofan engines using particle swarm optimization. *Aircraft Engineering and Aerospace Technology*, 92(6), 939–946. <https://doi.org/10.1108/AEAT-02-2020-0031>
- Oruc, R., Baklacioglu, T., Turan, O., & Aydın, H. (2022). Modeling of environmental effect factor and exergetic sustainability index with cuckoo search algorithm for a business jet. *Aircraft Engineering and Aerospace Technology*. <https://doi.org/10.1108/AEAT-08-2021-0251>
- Ucar, U. U., Aygun, H., & Tanyeri, B. (2023). Optimized modeling of energy and environmental metrics of mixed flow turbofan engine used regional aircraft. *Journal of Thermal Analysis and Calorimetry*. <https://doi.org/https://doi.org/10.1007/s10973-023-11996-7>
- Yang, X. S. (2014). *Nature-Inspired Optimization Algorithms*. Elsevier.

- Yang, X. S., & Deb, S. (2009). Cuckoo search via Lévy flights. *2009 World Congress on Nature and Biologically Inspired Computing, NABIC 2009 - Proceedings*, 210–214. <https://doi.org/10.1109/NABIC.2009.5393690>
- Yang, X. S., & Deb, S. (2014). Cuckoo search: Recent advances and applications. *Neural Computing and Applications*, 24(1), 169–174. <https://doi.org/10.1007/s00521-013-1367-1>

**EXPLORING FACTORS INFLUENCING TOURIST SATISFACTION WITH
FLOATING MARKET CUISINE IN CAN THO CITY, VIETNAM**

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ABSTRACT

Floating markets are a unique feature of the Mekong Delta region in Vietnam, attracting both local and international tourists. Can Tho, as the largest city in this region, is famous for its floating markets and local cuisine. Understanding factors that contribute to tourists' satisfaction with the culinary experiences in these markets is crucial for tourism development. This study aimed to explore the factors affecting tourist satisfaction with the culinary offerings at floating markets in Can Tho City, Vietnam, and provided insights for local authorities and businesses to enhance gastronomic experiences and boost tourism in the area. A mixed-methods research design was employed, utilizing a quantitative survey of tourists visiting Can Tho's floating markets and qualitative interviews with local vendors and tourism stakeholders. The survey assessed tourists' satisfaction with taste, presentation, variety, hygiene standards, and overall experience of the local cuisine, while the interviews explored the perspectives of vendors and stakeholders on the challenges and opportunities in enhancing culinary experiences. The findings revealed that several factors significantly contributed to tourist satisfaction, including (1) food quality, encompassing taste, presentation, and authenticity of the dishes; (2) food pricing; (3) staff attitudes; and (4) the unique atmosphere of the floating markets. Nonetheless, the study identified specific challenges, including (1) maintaining hygiene standards, (2) enhancing food variety, and (3) addressing the need for improved marketing efforts. To address these issues, local authorities and businesses could collaborate on developing targeted strategies, including better hygiene management, promotion of culinary diversity, and enhanced marketing efforts. The culinary offerings at Can Tho's floating markets play a vital role in attracting tourists and ensuring their satisfaction. By addressing the identified challenges and capitalizing on the unique features of the floating markets, Can Tho can further enhance its gastronomic tourism potential and contribute to the overall development of the region.

Keywords: floating markets, culinary experiences, tourist satisfaction, Can Tho, Mekong Delta, gastronomic tourism

INTRODUCTION

The global tourism industry is continuously growing, with international tourist arrivals reaching 1.5 billion in 2019, a 4% increase from the previous year (UNWTO, 2021). Gastronomic tourism, or food tourism, has emerged as a significant niche within the industry, accounting for 88% of leisure travelers actively seeking unique food and beverage experiences while traveling (World Food Travel Association, 2020). This trend has led to the recognition of local culinary experiences as an essential factor in tourist satisfaction and destination marketing.

Floating markets, a distinctive feature of the Mekong Delta region in Vietnam, have long been an attraction for both local and international tourists. Can Tho, the largest city in the Mekong Delta, is particularly famous for its floating markets and local cuisine. According to the Can Tho Tourism Association, in 2019, the city welcomed 8.8 million visitors, up 4.6% over the same period in 2018, contributing significantly to the total number of international visitors to Vietnam (Hoang Tung, 2020). However, despite the growing interest in gastronomic tourism, there has been limited research on the factors that contribute to tourist satisfaction with the culinary experiences offered in Can Tho's floating markets.

The increasing competition among tourist destinations has made it vital for local authorities and businesses to understand the factors influencing tourist satisfaction to provide exceptional experiences and boost tourism. Research has demonstrated that satisfying gastronomic experiences positively impact destination image, revisit intention, and word-of-mouth marketing (Henderson, 2009; López-Guzmán et al., 2014). In this context, a comprehensive study of the factors affecting tourist satisfaction with the culinary offerings at Can Tho's floating markets is of paramount importance.

This study aimed to fill the research gap by investigating the factors that contribute to tourist satisfaction with the culinary experiences in Can Tho's floating markets. By employing a mixed-methods research design, the study sought to provide valuable insights for local authorities, businesses, and tourism stakeholders. The findings can be used to develop targeted strategies that address the identified challenges, capitalize on the unique features of the floating markets, and enhance the gastronomic tourism potential of Can Tho and the Mekong Delta region. In light of the research gap and the importance of understanding the factors influencing tourist satisfaction with culinary experiences in Can Tho's floating markets, the following research questions have been formulated:

Research Question 1 (RQ1): What are the key factors that contribute to tourist satisfaction with the culinary offerings at floating markets in Can Tho City, Vietnam?

Research Question 2 (RQ2): How do food quality, pricing, staff attitudes, and the unique atmosphere of the floating markets impact tourist satisfaction?

Research Question 3 (RQ3): What challenges do local vendors and tourism stakeholders face in enhancing the culinary experiences at Can Tho's floating markets?

Research Question 4 (RQ4): What strategies can local authorities and businesses adopt to address these challenges and improve the gastronomic experiences offered to tourists in Can Tho's floating markets?

In the upcoming sections of this research paper, readers will be guided through a systematic exploration of the factors influencing tourist satisfaction with the culinary experiences in Can Tho's floating markets. The paper is structured as follows: first, a comprehensive literature review will provide the theoretical background and context for the study; next, the research methodology, including the mixed-methods approach and data collection procedures, will be detailed; following this, the results and findings of the study will be presented and discussed; and finally, the paper will conclude with recommendations for local authorities and businesses to enhance gastronomic experiences, along with the potential implications and future research directions.

RESEARCH DESIGN

Literature Review

This section covered the following key topics, providing a solid theoretical foundation and context for the study:

Gastronomic Tourism: An Overview

Gastronomic or food tourism refers to the pursuit of unique and memorable culinary experiences by travelers, often involving the exploration of local food cultures, traditions, and flavors (Hall & Sharples, 2008). The significance of gastronomic tourism in the global tourism industry has grown rapidly in recent years, with food and beverage experiences becoming a primary motivation for many leisure travelers (Björk & Kauppinen-Räsänen, 2016). According to the World Food Travel Association (2020), 88% of leisure travelers actively seek out unique food and beverage experiences while traveling, demonstrating the growing prominence of gastronomic tourism as a niche market.

The role of local culinary experiences in shaping tourist satisfaction and destination marketing has been widely acknowledged in the literature (Ellis et al., 2018; López-Guzmán et al., 2014). Gastronomic experiences can enhance the overall perception of a destination, as they contribute to the sensory and emotional aspects of the tourist experience (Quan & Wang, 2004). Moreover, satisfying gastronomic experiences have been found to positively impact destination image, revisit intention, and word-of-mouth marketing, further emphasizing the importance of local culinary experiences in tourism development (Henderson, 2009; López-Guzmán et al., 2014).

Several studies have identified the key dimensions of gastronomic experiences that influence tourist satisfaction, such as food quality, authenticity, variety, presentation, and atmosphere (Kim et al., 2009; Tse & Crofts, 2005). Additionally, factors such as food pricing, staff attitudes, and cultural elements have been found to play a significant role in shaping tourists' satisfaction with culinary experiences (Okumus et al., 2007; Mak et al., 2012). As such, understanding the dynamics of gastronomic tourism and the factors that contribute to tourist satisfaction is crucial for destination marketing and the enhancement of local culinary offerings.

In summary, the concept of gastronomic tourism has gained considerable importance in the global tourism industry, with local culinary experiences playing a vital role in shaping tourist satisfaction and destination marketing. Future research should continue to explore factors influencing gastronomic experiences, particularly in unique contexts such as floating markets, which possess the valuable cultural characteristics of destinations. For example, Can Tho City, which possesses a system of rivers, canals, and traditional floating markets are typical features of the city in particular and of the Mekong Delta region in general. In-depth research in this area will provide better information for stakeholders involved in tourism and contribute to the development of gastronomic tourism in the city.

Tourist Satisfaction: Determinants and Factors

Tourist satisfaction has been widely studied in the literature, as it plays a crucial role in determining tourists' intentions to revisit, recommend, and share positive experiences with others (Alegre & Garau, 2010; Chen & Chen, 2010). Researchers have identified numerous determinants of tourist satisfaction, ranging from destination attributes to service quality and personal factors (Kozak & Rimmington, 2000; Prayag, 2009).

With regard to culinary experiences, several factors have been found to significantly influence tourist satisfaction. Food quality, encompassing aspects such as taste, freshness, presentation, and diversity is considered one of the most critical factors affecting satisfaction with culinary experiences (Namkung & Jang, 2007; Ryu et al., 2010). Authenticity, or the degree to which local dishes represent the cultural and historical characteristics of a destination, has also been recognized as an essential determinant of tourist satisfaction (Rand et al., 2003; Lin et al., 2011). Pricing is another crucial factor influencing tourists' satisfaction with culinary experiences. Studies have shown that perceptions of value for money, or the extent to which the price paid for a meal is perceived as fair, can significantly impact satisfaction and future intentions (Heung & Quf, 2000; Kim et al., 2013). Similarly, staff attitudes, including friendliness, responsiveness, and professionalism, play a vital role in shaping tourists' satisfaction with culinary experiences (Kivela et al., 2000; Stevens et al., 1995).

Ambiance, or the physical environment of a dining establishment, has also been found to influence tourists' satisfaction with culinary experiences. Factors such as cleanliness, “décor”, and layout can contribute to the overall atmosphere and directly impact tourists' enjoyment of a meal (Ryu & Jang, 2007; Wakefield & Blodgett, 1996). In the context of floating markets, the unique setting and atmosphere may be particularly influential in shaping satisfaction with the culinary experience (Lertputtarak, 2011).

Last but not least, factor marketing also plays a crucial role. According to recent research, effective marketing efforts can significantly impact tourists' satisfaction and their overall experience (Chenini & Touaiti, 2018). Marketing strategies that promote local culinary specialties and emphasize their unique cultural aspects can enhance tourists' awareness and contribute to their satisfaction (Lai & Vinh, 2013). It is essential to use up-to-date marketing channels, such as social media, to reach potential visitors and showcase the authentic culinary experiences offered at floating markets (Kim et al., 2017). By implementing well-planned and targeted marketing strategies, tourist satisfaction with floating market cuisine can be improved and contribute to the sustainable development of the local tourism industry (Schimperna et al., 2021).

In conclusion, the literature on tourist satisfaction highlights the importance of various factors, including food quality, pricing, staff attitudes, and ambiance, in shaping tourists' satisfaction

with culinary experiences. Understanding these determinants and their interrelationships is essential for enhancing gastronomic tourism and ensuring memorable experiences for travelers.

Floating Markets and Culinary Experiences

Floating markets have long been an essential aspect of life in the Mekong Delta region, particularly in Can Tho City, where they serve as a critical economic and cultural hub (Nguyen & Huynh, 2023). These markets are characterized by their unique setting on waterways, where vendors sell goods from boats, creating an atmosphere that attracts both domestic and international tourists (Scott et al., 2011).

In recent years, the tourism potential of floating markets has been increasingly recognized, with local cuisine playing a crucial role in attracting visitors and ensuring their satisfaction (Bessiere, 1998; Agyeiwaah et al., 2019). Food is considered a vital component of the overall tourist experience, as it allows visitors to immerse themselves in the local culture and understand the historical and social context of a destination (Rand et al., 2003; Cohen & Avieli, 2004).

Can Tho City, in particular, has become a hotspot for culinary tourism, with its floating markets offering a diverse range of traditional Vietnamese dishes and varied agricultural products from the abundant Mekong Delta region that showcase the region's rich gastronomic heritage (Avieli, 2013; Nguyen, 2018; Nguyen & Nguyen, 2021; Nguyen, 2022). The unique atmosphere of these markets, combined with the variety and authenticity of the local cuisine, has been found to significantly contribute to tourist satisfaction and destination appeal (Nguyen, 2018; Lertputtarak, 2011; Nguyen & Huynh, 2023).

However, despite the growing interest in the role of floating markets and culinary experiences in tourism, there remains a gap in the literature regarding the specific factors that influence tourist satisfaction with the cuisine offered at these markets. Furthermore, while the importance of food in tourism has been widely acknowledged, few studies have specifically focused on the floating markets of Can Tho City and their culinary offerings (Avieli, 2013; Nguyen, 2018; Nguyen & Nguyen, 2021; Nguyen & Huynh, 2023).

In conclusion, the literature on floating markets and culinary experiences highlights the unique features of these markets, particularly in Can Tho City, and the importance of local cuisine in attracting tourists and ensuring their satisfaction. However, there is a need for further research to explore the specific factors influencing tourist satisfaction with the culinary experiences at

these markets, as well as the challenges and opportunities for enhancing gastronomic tourism in the region.

Challenges and Opportunities in Enhancing Culinary Experiences

The literature on gastronomic tourism has identified several challenges that local vendors and tourism stakeholders face in improving culinary experiences, as well as potential opportunities for enhancing the appeal of food-related attractions in a destination (Boyne et al., 2003; Okumus et al., 2007).

One of the main challenges identified in the literature is maintaining hygiene standards, which have a direct impact on tourist satisfaction and destination reputation (Telfer & Wall, 2000; Wall & Mathieson, 2006). Ensuring cleanliness and proper food handling practices is critical in attracting tourists and ensuring their satisfaction with the culinary experience. However, local vendors in floating markets, such as those in Can Tho City, may face difficulties in adhering to strict hygiene standards due to the unique setting and limited resources (Nguyen, 2018).

Another challenge is enhancing food variety, as tourists increasingly demand diverse and authentic culinary experiences (Henderson, 2009; Sims, 2009). Although floating markets in Can Tho City offer a wide range of traditional Vietnamese dishes, there may be room for further diversification and innovation in the culinary offerings to cater to different tastes and preferences (Avieli, 2013; Nguyen & Nguyen, 2021; Nguyen, 2022).

Marketing efforts also play a crucial role in promoting gastronomic tourism, with researchers highlighting the importance of effective destination branding and promotion strategies to attract food tourists (Hall & Mitchell, 2007; Mak et al., 2012). However, local vendors and tourism stakeholders in Can Tho City may lack the resources and expertise to develop and implement successful marketing campaigns, which could limit the potential growth of gastronomic tourism in the area (Nguyen, 2018; Nguyen & Huynh, 2023).

Despite these challenges, there are several opportunities for enhancing culinary experiences and promoting gastronomic tourism in the region. Collaboration between local authorities, businesses, and tourism stakeholders can lead to the development of targeted strategies, such as better hygiene management, promotion of culinary diversity, and enhanced marketing efforts (Bessiere, 1998; Telfer & Wall, 2000). Additionally, capitalizing on the unique features of floating markets, such as their distinctive atmosphere and cultural significance, can further

boost the appeal of gastronomic tourism in Can Tho City and the broader Mekong Delta region (Lertputtarak, 2011; Nguyen & Huynh, 2023).

In conclusion, the literature on challenges and opportunities in enhancing culinary experiences highlights the importance of addressing hygiene standards, food variety, and marketing efforts to ensure a memorable and satisfying gastronomic experience for tourists. Collaborative efforts and targeted strategies can help to overcome these challenges and capitalize on the unique features of floating markets, ultimately contributing to the growth of gastronomic tourism in the city.

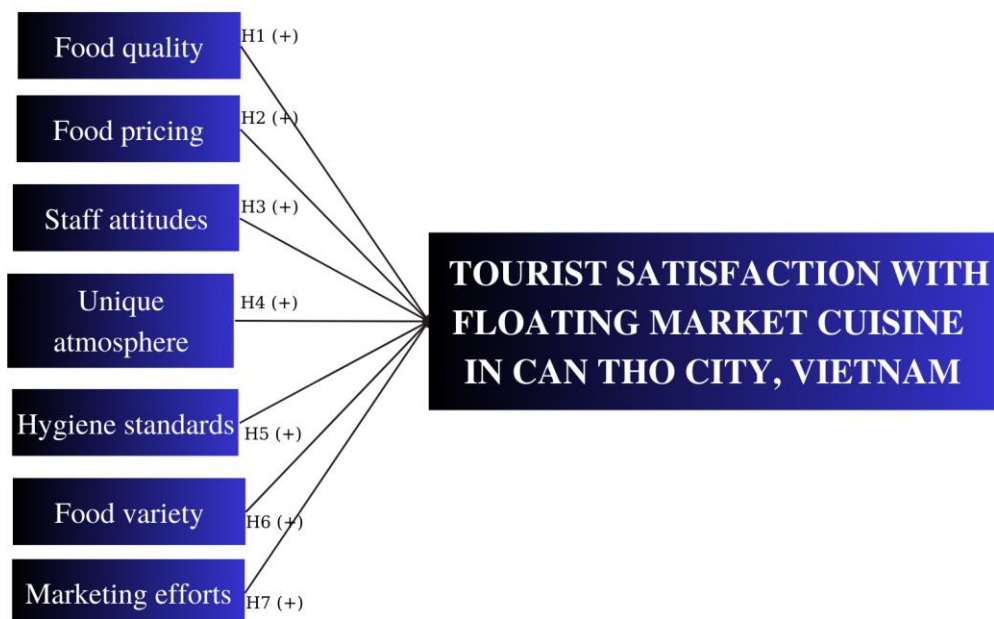
By reviewing these topics, the "Literature Review" section established a comprehensive understanding of the research context, facilitating the subsequent analysis of the factors affecting tourist satisfaction with the culinary experiences at Can Tho's floating markets.

Research Methodology

Research Model

Then, the author created the research model, which was grounded in the existing literature and was appropriate for the purposes of this study:

Figure 1. Research Model.



Source: From the author (2023)

Research Hypotheses

The author proposed seven research hypotheses for this study:

Hypothesis 1 (H1): Food quality, including taste, presentation, and authenticity, has a significant positive impact on tourist satisfaction with the culinary experiences in Can Tho's floating markets.

Hypothesis 2 (H2): Food pricing has a significant positive influence on tourist satisfaction with the culinary experiences in Can Tho's floating markets.

Hypothesis 3 (H3): Staff attitudes, such as friendliness, responsiveness, and professionalism, have a significant positive effect on tourist satisfaction with the culinary experiences in Can Tho's floating markets.

Hypothesis 4 (H4): The unique atmosphere of the floating markets has a significant positive impact on tourist satisfaction with the culinary experiences in Can Tho's floating markets.

Hypothesis 5 (H5): Improving hygiene standards will result in increased tourist satisfaction with the culinary experiences in Can Tho's floating markets.

Hypothesis 6 (H6): Enhancing food variety will lead to increased tourist satisfaction with the culinary experiences in Can Tho's floating markets.

Hypothesis 7 (H7): Improved marketing efforts will positively affect tourist satisfaction with the culinary experiences in Can Tho's floating markets.

These hypotheses were tested and analyzed through the quantitative survey and qualitative interviews, as presented in the findings and discussion of this study. The results provided insights into the factors that contribute to tourist satisfaction with the culinary experiences at floating markets in Can Tho City, Vietnam, and informed strategies for enhancing gastronomic tourism in the area.

Mixed-Methods Approach

In this study, the researcher adopted a mixed-methods research design to comprehensively investigate tourists' satisfaction with the culinary experiences at Can Tho's floating markets and to gain insights into the challenges and opportunities faced by local vendors and tourism stakeholders. By combining quantitative and qualitative methods, the author aimed to triangulate the findings and offer a more nuanced understanding of the research problem.

Quantitative research

The quantitative component of the study involved administering a structured survey to a random sample of tourists visiting Can Tho's floating markets (n=182). The survey assessed participants' satisfaction with various aspects of their culinary experiences, such as taste, presentation, variety, hygiene standards, and overall enjoyment. The author utilized a 5-point Likert scale for participants to assess their satisfaction levels, ranging from "very dissatisfied" to "very satisfied." The names of those interviewed and surveyed have been changed or anonymized to protect privacy. The survey data were examined using descriptive statistics to calculate mean satisfaction scores for each factor and inferential statistics to detect any significant connections between the factors and overall satisfaction levels. The data analysis process consisted of several stages:

- (1) Verifying the primary data: This stage ensured the data collected was accurate, reliable, and pertinent to the research goals.
- (2) Storing data in Excel: Excel was used as a preliminary tool for organizing and preparing the data for further analysis.
- (3) Transferring data to SPSS 20.0: SPSS, a potent statistical software, enabled the performance of various data analysis types, including descriptive statistics in this instance.
- (4) Implementing Structural Equation Modeling (SEM) with SMARTPLS 3.0: SEM, a multivariate analysis method, was used to examine relationships between multiple variables, while SMARTPLS was employed for Partial Least Squares (PLS) path modeling, a component of SEM.

By utilizing these tools and techniques, the author effectively analyzed the data, assessed the relationships between variables, and tested the research hypotheses in a thorough and robust manner.

Quantitative Research

In addition to the survey, qualitative interviews were conducted with a purposive sample of local vendors (n=12) and tourism stakeholders (n=18). These semi-structured interviews aimed to explore their perspectives on the challenges and opportunities in enhancing the culinary experiences offered at the floating markets. The interview data were transcribed, coded, and analyzed using thematic analysis, a widely used qualitative data analysis technique. This allowed the author to identify common themes and patterns in the participants' responses, providing a deeper understanding of the study's context and the factors influencing culinary experiences at the floating markets.

By integrating the results from both quantitative and qualitative data, the researcher was able to provide a comprehensive picture of tourists' satisfaction and the issues faced by local vendors and stakeholders. This mixed-methods approach enabled the author to not only identify the areas of improvement but also to suggest practical strategies for enhancing culinary experiences at Can Tho's floating markets.

The author of this present study focused on the two most popular and busiest floating markets of Can Tho city, including Cai Rang Floating Market and Phong Dien Floating Market to ensure a diverse and representative sample of participants.

(1) Cai Rang Floating Market: As the largest and most renowned floating market in Can Tho, Cai Rang attracts a significant number of tourists daily. Its vibrant atmosphere and extensive array of food offerings make it an ideal location for the study.

(2) Phong Dien Floating Market: Located 20 kilometers from Cai Rang, one of the oldest floating markets in Can Tho City, Phong Dien Floating Market is another bustling and popular destination for tourists. Known for its authenticity and variety of local products, this market also provides an excellent setting for research.

By conducting the study at both Cai Rang and Phong Dien floating markets, the researcher can gather comprehensive data and gain valuable insights into the culinary experiences of tourists and the challenges faced by local vendors and tourism stakeholders.

This study was conducted over six months, from October 2022 to March 2023. Interviews and surveys were carried out between December and February, which is the most suitable time for conducting such research in Can Tho City, Vietnam, as tourist arrivals typically reach their peak during this period. During these months, the weather is generally cool and dry, attracting a significant number of international and domestic tourists. This period would provide an ideal opportunity to gather a diverse and representative sample of participants for the study of culinary experiences at Can Tho's floating markets.

FINDINGS AND DISCUSSION

Demographics of Survey Respondents (n=182)

The total number of valid survey responses collected was 182, out of the 189 surveys that were distributed. The author provided information about the actual sample structure (n=182) in Table 1. As a result, the actual sample size exceeded the minimum requirement, ensuring that further analytical methods could be performed with confidence.

Table 1. Demographic Composition of the Quantitative Research Sample (n=182).

		Frequency	Percent (%)
Gender	Female	90	49.5
	Male	86	47.3
	Other/Prefer not to say	6	3.2
Age	18-25 years old	43	23.7
	26-35 years old	54	29.7
	36-50 years old	42	23.1
	51-60 years old	35	19.2
	> 61 years old	8	4.3
Occupation	Student	16	8.8
	Professional	47	25.8
	Educator	39	21.4
	Entrepreneur	48	26.4
	Homemaker	15	8.2
	Retired	13	7.1
	Other	4	2.3
Origin	Domestic tourists	142	78

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Turkish Republic of Northern Cyprus, April 28-30, 2023

	International tourists	40	22
Annual Income	Under \$25,000	57	31.3
	\$25,000 - \$49,999	55	30.2
	\$50,000 - \$74,999	40	22
	\$75,000 - \$99,999	28	15.4
	Other	2	1.1
First-time visitor to Can-Tho City	Yes	127	69.8
	No	55	30.2
Length of the stay	A short trip: 3-4 days	139	76.4
	A week-long vacation	40	22
	An extended stay: more than two weeks	3	1.6
Travel group	Couple	26	14.3
	Solo	4	2.2
	Family	80	44
	Friends	72	39.5
Total		182	100.0

Source: From the author (2023)

Demographics of Interview Participants (n=30)

The qualitative research results provided in-depth insights into the demographics of the interview participants. Out of the 30 interviewees, 40% (n=12) were local vendors operating at Can Tho's floating markets. These vendors comprised a mix of food sellers, offering traditional and authentic dishes from the Mekong Delta region, as well as beverage and snack providers catering to the diverse tastes of tourists.

The remaining 60% (n=18) of interviewees were tourism stakeholders, who represented a variety of sectors related to gastronomic tourism in Can Tho. These stakeholders included local government officials responsible for tourism development, representatives from tourism agencies promoting the floating markets, and hospitality business owners such as hotel and restaurant managers. They were actively involved in enhancing the culinary experiences at the floating markets and played a crucial role in shaping the future of gastronomic tourism in the region.

By incorporating the perspectives of both local vendors and tourism stakeholders, the study was able to capture a comprehensive understanding of the factors affecting tourist satisfaction with the culinary offerings at Can Tho's floating markets, as well as the challenges and opportunities for enhancing the city's gastronomic tourism potential.

Quantitative Survey Results

Evaluating the Measurement Model

The validation of the measurement model was supported by the results. Factor loading coefficients of the observed variables met the convergent validity condition, with all coefficients exceeding 0.7. Scale reliability was acceptable, as the Composite Reliability (CR) values ranged from 0.876 to 0.966, and the Average Variance Extracted (AVE) values ranged between 0.588 and 0.769. Discriminant validity was established, as the square root of AVE values were higher than the respective correlation coefficients of each construct in relation to others in the research model. Furthermore, the constructs demonstrated discriminant value, with cross-load coefficients higher than those of other constructs. The Heterotrait-Monotrait Ratio (HTMT) values for each construct were below 0.9, confirming the discriminant validity criterion for the HTMT.

Assessing the Structural Model

Examining Multicollinearity in Partial Least Squares Structural Equation Modeling (PLS-SEM): The results revealed no multicollinearity issues among latent variables, with Variance Inflation Factor (VIF) coefficients below the recommended threshold of 5 (maximum VIF=2.174, minimum VIF=1.915). The "tourist satisfaction with floating market cuisine in Can Tho City, Vietnam" exerted a substantial impact on the research model, as evidenced by an R2 value of 0.497 (surpassing 0.26).

Communality Value: The AVE values (greater than 0.5) demonstrated a strong alignment between the structural model and the observed data.

Goodness of Fit (GoF): The GoF index (0.525, which is higher than 0.36) significantly influenced the model.

In conclusion, the PLS model was well-aligned with the empirical data, as supported by the data analysis outcomes.

Examining the Research Hypotheses and Establishing the Relative Significance of the Identified Factors

Evaluating the Research Hypotheses: Examining the Relationships and Impacts: all seven hypotheses were confirmed, with significant correlations observed between the variables in each hypothesis, as evidenced by the β coefficients and p-values. The research model accounts for 49.7% of tourist satisfaction variation ($R^2 = 0.497$).

The factors affecting satisfaction, ranked in descending order of significance, included:

- (1) Food quality, which encompasses taste, presentation, and authenticity, emerges as the most crucial determinant of satisfaction.
- (2) Hygiene standards play a vital role in shaping tourists' overall satisfaction.
- (3) The unique atmosphere of floating markets significantly contributes to visitors' enjoyment.
- (4) Staff attitudes also have a notable impact on satisfaction levels, including aspects like cordiality, attentiveness, and expertise.
- (5) Food pricing is an essential aspect to consider for customer satisfaction.
- (6) Food variety, while less influential than the other factors, still holds importance.
- (7) Lastly, marketing efforts play a role in shaping tourists' satisfaction.

As for the identified challenges:

- a) Ensuring hygiene standards are maintained remains a crucial obstacle to overcome.
- b) Enhancing food variety is another area that requires improvement.
- c) Strengthening marketing efforts will further contribute to overall satisfaction.

Qualitative Interview Findings

Factors contributing to tourist satisfaction

From the qualitative interviews conducted with local vendors and tourism stakeholders, the findings indicated insights into their perspectives regarding factors contributing to tourist satisfaction at the floating markets. The major factors identified in the study results included food quality (e.g. taste, presentation, and authenticity), food pricing, staff attitudes, and the unique atmosphere of the floating markets.

Food quality (taste, presentation, and authenticity): Participants emphasized the importance of food quality in contributing to tourist satisfaction. A local vendor shared, "Our customers expect flavorful, well-presented, and authentic dishes that represent our culture" (Vendor A). Tourism stakeholders also acknowledged the significance of food quality, with one stakeholder stating, "Tourists often seek out unique and authentic culinary experiences, which can greatly impact their overall satisfaction" (Stakeholder B).

Food pricing: Affordable and reasonable food pricing was identified as a crucial factor in tourist satisfaction. One vendor noted, "We try to offer competitive prices, as we understand that tourists are price-sensitive and appreciate good value for their money" (Vendor C). A tourism stakeholder supported this notion, explaining, "Affordability is essential for tourists, especially when considering the diverse backgrounds and budgets of those visiting the floating markets" (Stakeholder D).

Staff attitudes: Positive and friendly staff attitudes were recognized as a vital component in enhancing tourist satisfaction. A local vendor mentioned, "We always strive to provide excellent service with a smile, as it creates a welcoming atmosphere for our customers" (Vendor E). Similarly, a tourism stakeholder highlighted the importance of staff attitudes, stating,

"Tourists appreciate engaging with friendly and helpful staff, which contributes to their overall experience" (Stakeholder F).

Unique atmosphere of the floating markets: The interviews revealed that the distinctive ambiance of the floating markets plays a significant role in attracting tourists and ensuring their satisfaction. A vendor shared, "The floating markets offer a one-of-a-kind experience, where tourists can enjoy delicious food while immersing themselves in the local culture" (Vendor G). A tourism stakeholder added, "The vibrant and lively atmosphere of the floating markets greatly appeals to tourists, making it a memorable and enjoyable experience" (Stakeholder H).

In conclusion, the qualitative interviews with local vendors and tourism stakeholders have provided valuable insights into the factors contributing to tourist satisfaction at the floating markets. By focusing on these factors, including food quality, pricing, staff attitudes, and the unique atmosphere, the floating markets can continue to attract and satisfy tourists, ultimately benefiting both the local vendors and the wider tourism industry of the city.

Challenges and opportunities:

From the qualitative interviews conducted with local vendors and tourism stakeholders, the findings revealed insights into their perspectives regarding challenges and opportunities in enhancing culinary experiences at the floating markets.

Challenges:

Limited variety of food offerings: Local vendors and tourism stakeholders acknowledged that the food offerings at the floating markets are often limited and repetitive. As one vendor mentioned, "We tend to serve the same dishes every day, which might not appeal to tourists seeking diverse culinary experiences" (Vendor A). Another vendor candidly revealed, "Since these floating markets typically operate only during the morning hours, we mostly serve breakfast dishes to our customers. This sometimes results in tourists not having the opportunity to experience the diverse local specialty dishes.

Food quality and hygiene concerns: A recurring concern among the participants was the need for improved food quality and hygiene standards. One tourism stakeholder explained, "Many

tourists are hesitant to try local dishes at the floating markets due to concerns about food safety" (Stakeholder B).

Lack of culinary innovation: The interviews revealed that the floating markets lack innovation in their culinary offerings. A local vendor shared, "We have been serving traditional dishes for years, and there's little incentive to innovate or introduce new items" (Vendor C).

Inadequate promotion and marketing: Another challenge identified was the lack of effective promotion and marketing of the floating markets' culinary experiences. As one tourism stakeholder noted, "The floating markets are not well-marketed as gastronomic destinations, leading to missed opportunities" (Stakeholder D).

Opportunities:

Collaboration between vendors and stakeholders: Participants emphasized the importance of collaboration between local vendors and tourism stakeholders to enhance culinary experiences. One stakeholder suggested, "By working together, we can develop a diverse and innovative menu that caters to different tastes" (Stakeholder E).

Capacity building and skills development: The interviews highlighted the need for capacity building and skills development among local vendors. As one vendor stated, "Training programs in food safety and culinary skills would help us to better serve our customers" (Vendor F).

Emphasis on local and sustainable ingredients: Participants identified the potential to promote local and sustainable ingredients to attract more tourists. A tourism stakeholder noted, "We can enhance the culinary experience by emphasizing the use of fresh, locally sourced ingredients" (Stakeholder G).

Improved marketing and promotion: The interviews revealed opportunities for better marketing and promotion of the culinary offerings at the floating markets. One vendor suggested, "We should collaborate with tourism agencies to promote our unique food experiences and attract more visitors" (Vendor H).

In conclusion, the qualitative interviews with local vendors and tourism stakeholders have provided valuable insights into the challenges and opportunities in enhancing culinary experiences at the floating markets. By addressing these challenges and capitalizing on the identified opportunities, the floating markets can significantly improve their culinary offerings, ultimately benefiting both the local vendors and the wider tourism industry.

Discussion

The present study aimed to explore the factors affecting tourist satisfaction at the floating markets in Can Tho City, Vietnam, and identify challenges and opportunities for enhancing the culinary experience. By employing both quantitative and qualitative research methods, the study provided comprehensive insights into the significant factors and barriers, as well as potential strategies for improvement.

The quantitative findings confirmed all seven hypotheses, indicating that food quality, hygiene standards, unique atmosphere, staff attitudes, food pricing, food variety, and marketing efforts significantly influence tourist satisfaction. Notably, food quality emerged as the most crucial determinant of satisfaction, followed by hygiene standards and the unique atmosphere of the floating markets. These findings align with the qualitative results, which highlighted the importance of food quality, pricing, staff attitudes, and the unique atmosphere from the perspectives of local vendors and tourism stakeholders.

Furthermore, the qualitative interviews revealed challenges in the form of limited food variety, food quality and hygiene concerns, lack of culinary innovation, and inadequate promotion and marketing. In contrast, opportunities included collaboration between vendors and stakeholders, capacity building and skills development, emphasis on local and sustainable ingredients, and improved marketing and promotion. These insights can serve as a guide for policymakers and stakeholders in enhancing the overall culinary experience at the floating markets.

Comparing the quantitative and qualitative findings, it is evident that both data sources complement each other in identifying the key factors affecting tourist satisfaction. The consistency between the results reinforces the validity and reliability of the study. However, the study also highlights the importance of addressing the identified challenges and capitalizing on the available opportunities to foster the development of the floating markets as a gastronomic destination.

The implications of this research extend beyond the floating markets in Can Tho City. By understanding and addressing the factors affecting tourist satisfaction, similar destinations worldwide can enhance their appeal and competitiveness in the Mekong Delta and beyond in the global tourism industry. Moreover, fostering collaboration among local vendors, tourism stakeholders, and policymakers can facilitate the creation of innovative and sustainable culinary experiences that cater to diverse tourist preferences. In turn, this can contribute to the economic growth and development of local communities reliant on tourism.

In conclusion, this study offers valuable insights into the factors affecting tourist satisfaction at the floating markets and provides a comprehensive understanding of the challenges and opportunities in enhancing the culinary experience. By addressing these aspects and promoting collaboration among stakeholders, the floating markets can continue to attract and satisfy tourists, ultimately benefiting the local vendors and the wider tourism industry.

CONCLUSION

In summary, this study has successfully addressed the research questions posed, providing valuable insights into the key factors contributing to tourist satisfaction at the floating markets in Can Tho City, Vietnam, and shedding light on the challenges faced by local vendors and tourism stakeholders in enhancing the culinary experiences at these markets.

The findings of this study have confirmed that food quality, pricing, staff attitudes, the unique atmosphere of the floating markets, hygiene standards, food variety, and marketing efforts play a significant role in impacting tourist satisfaction (RQ1 and RQ2). *The order of importance was arranged as follows:* (1) food quality, encompassing taste, presentation, and authenticity of the dishes; (2) hygiene standards; (3) the unique atmosphere of the floating markets; (4) staff attitudes; (5) food pricing; (6) food variety; and (7) marketing efforts.

Through in-depth qualitative interviews, the challenges faced by local vendors and tourism stakeholders in enhancing the culinary experiences at Can Tho's floating markets have been identified, including issues related to hygiene standards, food diversity, and marketing (RQ3). Based on these findings, targeted recommendations for local authorities and businesses have been proposed to address these challenges and improve the gastronomic experiences offered to tourists in Can Tho's floating markets (RQ4). These recommendations focus on better hygiene management, promotion of culinary diversity, and enhanced marketing efforts, which, if implemented, can lead to a more satisfying and memorable experience for tourists. Furthermore, the study has highlighted the broader implications for gastronomic tourism development in Can Tho and the Mekong Delta region. By addressing the identified challenges and capitalizing on the unique features of the floating markets, the region's tourism potential can be enhanced, contributing to the overall development of the area.

Recommendations for Local Authorities and Businesses

Based on the findings from the quantitative surveys and the qualitative interviews that were conducted, several targeted strategies are proposed for local authorities and businesses to collaborate on, with the aim of boosting tourism in the area through the enhancement of the culinary experiences at the floating markets. The following recommendations focus on better hygiene management, promotion of culinary diversity, and enhanced marketing efforts:

Better hygiene management: It is crucial for local authorities and businesses to work together to improve food safety and hygiene standards at the floating markets. This can be achieved through regular inspections, implementation of strict food safety guidelines, and providing training programs for vendors to ensure compliance with hygiene regulations. By improving food safety and hygiene, tourist confidence in the culinary offerings at the floating markets will increase.

Promotion of culinary diversity: Local authorities and businesses are encouraged to collaborate on initiatives that promote culinary diversity at the floating markets. This can include the introduction of new, innovative dishes that represent the local culture, as well as providing incentives for vendors to diversify their menus. A more diverse and appealing range of food offerings will attract a wider variety of tourists and enhance their overall experience.

Enhanced marketing efforts: It is important for local authorities and businesses to join forces in promoting the floating markets as gastronomic destinations. This can involve creating targeted marketing campaigns, collaborating with travel agencies and influencers, and developing promotional materials that highlight the unique culinary experiences available at the floating markets. By raising awareness of the rich gastronomic offerings, the floating markets will attract more visitors, ultimately benefiting both the local vendors and the wider tourism industry.

By focusing on these targeted strategies, local authorities and businesses can effectively collaborate to address the challenges and capitalize on the opportunities identified in the study. In turn, this will boost tourism in the area and enhance the culinary experiences at the floating markets, benefiting all stakeholders involved.

Implications for Gastronomic Tourism Development

The broader implications of the study's findings for gastronomic tourism in Can Tho and the Mekong Delta region highlight the importance of addressing the identified challenges and capitalizing on the unique features of the floating markets to enhance tourism potential and contribute to the overall development of the region.

The floating markets are an integral part of the Mekong Delta's cultural heritage, providing visitors with a one-of-a-kind experience that blends traditional food offerings with a lively, picturesque atmosphere. By focusing on the enhancement of culinary experiences at these markets, local authorities and businesses can strengthen the region's gastronomic tourism appeal and attract a diverse range of tourists.

Addressing the challenges identified in the study, such as improving food quality, hygiene standards, culinary diversity, and marketing efforts, is crucial for maximizing the tourism potential of the floating markets. Ensuring high standards of food quality and hygiene will not only improve tourist satisfaction but also contribute to a positive image of the Mekong Delta region as a safe and enjoyable gastronomic destination.

Promoting culinary diversity by encouraging innovation and introducing a wider range of dishes will help to satisfy the diverse palates of tourists and enhance the overall appeal of the floating markets. Moreover, a focus on sustainability and the use of local, fresh ingredients can further elevate the culinary experiences at the floating markets, showcasing the region's unique gastronomic offerings and cultural heritage.

Collaboration between local authorities, businesses, and tourism stakeholders is essential for developing and implementing effective marketing strategies that promote the floating markets as gastronomic tourism destinations. By leveraging the power of targeted marketing campaigns, promotional materials, and partnerships with travel agencies and influencers, the floating markets can attract a wider audience, boosting tourism in the region and contributing to its overall economic growth.

In conclusion, the implications of the study's findings emphasize the importance of addressing the challenges and capitalizing on the unique features of the floating markets to enhance gastronomic tourism in Can Tho and the Mekong Delta region. By taking these steps, local authorities, businesses, and stakeholders can work together to realize the full potential of the

floating markets, ensuring their long-term success and contributing to the sustainable development of Can Tho city in particular and the Mekong Delta region in general.

The contributions of this study not only provide valuable insights for local authorities, businesses, and tourism stakeholders in Can Tho and the Mekong Delta region but also serve as a valuable reference for other destinations with similar cultural and gastronomic attractions. By fostering collaboration and implementing the suggested strategies, it is possible to improve the culinary experiences at floating markets, ultimately benefiting the local community, the tourism industry, and tourists alike.

Limitations and Future Research Directions

Despite the valuable insights provided by this study, several limitations should be acknowledged, as well as directions for future research to build upon the findings and further explore the gastronomic tourism potential in Can Tho and the Mekong Delta region.

Limited sample size: The study relied on a relatively small sample of tourists, local vendors and tourism stakeholders, which may not fully represent the diverse perspectives within the community. Future research could benefit from expanding the sample size and including a wider range of participants to gain a more comprehensive understanding of the challenges and opportunities in enhancing the culinary experiences at floating markets.

Limited geographical scope: The study focused on Can Tho City and its two typical floating markets, potentially limiting the generalizability of the findings to other regions. Future research could explore similar issues in other floating markets within the Mekong Delta or different cultural contexts, comparing and contrasting the findings to identify commonalities and differences.

Temporal limitations: The study was conducted at a specific point in time, and the dynamic nature of the tourism industry, as well as the evolving preferences of tourists, may affect the relevance of the findings in the future. Longitudinal research could be conducted to monitor changes in the factors contributing to tourist satisfaction and the effectiveness of the recommended strategies over time.

By addressing these limitations and exploring the suggested future research directions, scholars and practitioners can continue to deepen their understanding of gastronomic tourism development, particularly in the context of floating markets, and contribute to the sustainable growth of the tourism industry in Can Tho City, the Mekong Delta region, and beyond.

REFERENCES

English

- Alegre, J., & Garau, J. (2010). Tourist satisfaction and dissatisfaction. *Annals of Tourism Research*, 37(1), 52-73.
- Agyeiwaah, E., Otoo, F. E., Suntikul, W., & Huang, W. J. (2019). Understanding culinary tourist motivation, experience, satisfaction, and loyalty using a structural approach. *Journal of Travel & Tourism Marketing*, 36(3), 295-313.
- Avieli, N. (2013). What is 'local food?' Dynamic culinary heritage in the World Heritage Site of Hoi An, Vietnam. *Journal of Heritage Tourism*, 8(2-3), 120-132.
- Björk, P. and Kauppinen-Räsänen, H. (2016), "Local food: a source for destination attraction", *International Journal of Contemporary Hospitality Management*, Vol. 28 No. 1, pp. 177-194. <https://doi.org/10.1108/IJCHM-05-2014-0214>
- Boyne, S., Hall, D., & Williams, F. (2003). Policy, support and promotion for food-related tourism initiatives: A marketing approach to regional development. *Journal of Travel & Tourism Marketing*, 14(3-4), 131-154.
- Bessiere, J. (1998). Local development and heritage: Traditional food and cuisine as tourist attractions in rural areas. *Sociologia Ruralis*, 38(1), 21-34.
- Cohen, E., & Avieli, N. (2004). Food in tourism: Attraction and impediment. *Annals of Tourism Research*, 31(4), 755-778.
- Chen, C. F., & Chen, F. S. (2010). Experience quality, perceived value, satisfaction and behavioral intentions for heritage tourists. *Tourism Management*, 31(1), 29-35.
- Chenini, A., & Touaiti, M. (2018). Building destination loyalty using tourist satisfaction and destination image: A holistic conceptual framework. *Journal of Tourism, Heritage & Services Marketing*, 4(2), 37-43.
- Ellis, A., Park, E., Kim, S., & Yeoman, I. (2018). What is food tourism? *Tourism Management*, 68, 250-263.
- Hall, C. M., & Sharples, L. (2008). *Food and wine festivals and events around the world: Development, management and markets*. Routledge.
- Henderson, J. C. (2009). Food tourism reviewed. *British Food Journal*, 111(4), 317-326.
- Heung, V. C., & Quf, H. (2000). Hong Kong as a travel destination: An analysis of Japanese tourists' satisfaction levels and the likelihood of them recommending Hong Kong to others. *Journal of Travel & Tourism Marketing*, 9(1-2), 57-80.
- Hall, C. M., & Mitchell, R. (2007). Gastronomic tourism: Comparing food and wine tourism experiences. In *Niche tourism* (pp. 87-102). Routledge.
- Henderson, J. C. (2009). Food tourism reviewed. *British Food Journal*, 111(4), 317-326.
- Kim, Y. G., Eves, A., & Scarles, C. (2009). Building a model of local food consumption on trips and holidays: a grounded theory approach. *International Journal of Hospitality Management*, 28(3), 423-431.
- Kim, S. E., Lee, K. Y., Shin, S. I., & Yang, S. B. (2017). Effects of tourism information quality in social media on destination image formation: The case of Sina Weibo. *Information & management*, 54(6), 687-702.
- Kim, W. G., Ng, C. Y. N., & Kim, Y. S. (2009). Influence of institutional DINESERV on customer satisfaction, return intention, and word-of-mouth. *International Journal of Hospitality Management*, 28(1), 10-17.
- Kivela, J., Inbakaran, R. and Reece, J. (2000), "Consumer research in the restaurant environment. Part 3: analysis, findings and conclusions", *International Journal of Contemporary Hospitality Management*, Vol. 12 No. 1, pp. 13-30. <https://doi.org/10.1108/09596110010304984>
- Kozak, M., & Rimmington, M. (2000). Tourist satisfaction with Mallorca, Spain, as an off-season holiday destination. *Journal of Travel Research*, 38(3), 260-269.
- Lin, Y. C., Pearson, T. E., & Cai, L. A. (2011). Food as a form of destination identity: A tourism destination brand perspective. *Tourism and Hospitality Research*, 11(1), 30-48.
- López-Guzmán, T., Vieira-Rodríguez, A., & Rodríguez-García, J. (2014). Profile and motivations of European tourists on the Sherry wine route of Spain. *Tourism Management Perspectives*, 11, 63-68.
- Lai, W. H., & Vinh, N. Q. (2013). Online promotion and its influence on destination awareness and loyalty in the tourism industry. *Advances in Management and Applied Economics*, 3(3), 15.
- Lertputtarak, Sarunya, The Relationship between Destination Image, Food Image, and Revisiting Pattaya, Thailand (August 11, 2011). *International Journal of Business and Management*, Vol. 7, No. 5, pp.111-121, March 2012, Available at SSRN: <https://ssrn.com/abstract=2392148>
- Namkung, Y., & Jang, S. (2007). Does food quality really matter in restaurants? Its impact on customer satisfaction and behavioral intentions. *Journal of Hospitality & Tourism Research*, 31(3), 387-409.
- Nguyen, C. H. (2022). Factors affecting the development of cultural tourism in the Mekong Delta, Vietnam. *The Journal of Asian Finance, Economics and Business*, 9(3), 123-133.
- Nguyen, T. N., & Huynh, V. D. (2023). Floating market history, status, and changes: insights from Vietnam. *Tourism Culture & Communication*.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- Nguyen, K. T., & Nguyen, D. P. (2021). Research on solutions to improve destination competitiveness for tourism development in can tho city. In *Recent Developments in Vietnamese Business and Finance* (pp. 485-502).
- Nguyen, T., H., P. (2018). Floating market tourism in Can Tho City, Vietnam: towards sustainable development. In *Proceeding: 2nd International Conference on Social Sciences, Humanities and Technology (ICSHT 2018)* (p. 73).
- Okumus, B., Okumus, F., & McKercher, B. (2007). Incorporating local and international cuisines in the marketing of tourism destinations: The cases of Hong Kong and Turkey. *Tourism Management*, 28(1), 253-261.
- Prayag, G. (2009). Tourists' evaluations of destination image, satisfaction, and future behavioral intentions - the case of Mauritius. *Journal of Travel & Tourism Marketing*, 26(8), 836-853.
- Rand, G. E. D., Heath, E., & Alberts, N. (2003). The role of local and regional food in destination marketing: A South African situation analysis. *Journal of Travel & Tourism Marketing*, 14(3-4), 97-112.
- Ryu, K., Han, H., & Jang, S. (2010). Relationships among hedonic and utilitarian values, satisfaction and behavioral intentions in the fast-casual restaurant industry. *International journal of contemporary hospitality management*, 22(3), 416-432.
- Ryu, K., & Jang, S. (2007). The effect of environmental perceptions on behavioral intentions through emotions: The case of upscale restaurants. *Journal of Hospitality & Tourism Research*, 31(1), 56-72.
- Scott, N., Laws, E., Agrusa, J., & Richins, H. (2011). Tourist destination governance: some approaches and suggestions for future research. In *Tourist destination governance: Practice, theory and issues* (pp. 203-212). Wallingford UK: CABI.
- Schimperna, F., Lombardi, R., & Belyaeva, Z. (2021). Technological transformation, culinary tourism and stakeholder engagement: Emerging trends from a systematic literature review. *Journal of Place Management and Development*, 14(1), 66-80.
- Stevens, P., Knutson, B., & Patton, M. (1995). Dineserv: A tool for measuring service quality in restaurants. *Cornell Hotel & Restaurant Administration Quarterly*, 36(2), 56-60.
- Sims, R. (2009). Food, place and authenticity: local food and the sustainable tourism experience. *Journal of Sustainable Tourism*, 17(3), 321-336.
- Telfer, D. J., & Wall, G. (2000). Strengthening backward economic linkages: local food purchasing by three Indonesian hotels. *Tourism Geographies*, 2(4), 421-447.
- Wakefield, K. L., & Blodgett, J. G. (1996). The effect of the servicescape on customers' behavioral intentions in leisure service settings. *Journal of Services Marketing*, 10(6), 45-61.
- Wall, G., & Mathieson, A. (2006). *Tourism: Change, impacts, and opportunities*. Pearson Education.
- World Food Travel Association (2020). *State of the Food Travel Industry Report*. Retrieved from <https://www.worldfoodtravel.org/> on February 1, 2023.
- World Tourism Organization (2021), *International Tourism Highlights, 2020 Edition*, UNWTO, Madrid, DOI: <https://doi.org/10.18111/9789284422456>.

Vietnamese

- Hoang Tung. (2020). Can Tho tourism industry welcomed 8.8 million visitors in 2019. In *Dan Tri*. URL:<https://dantri.com.vn/du-lich/nam-2019-nganh-du-lich-can-tho-don-88-trieu-luot-khach-20200106101822273.htm>. Accessed February 3, 2022.

Websites

- www.canthotourism.vn
www.cantho.gov.vn
www.vietnamtourism.gov.vn

**BRÂNCOVENI MONASTERY – NATIONAL AND UNIVERSAL MOVABLE
CULTURAL HERITAGE. CASE STUDY: TREASURE AND FUND
CATEGORY.**

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ABSTRACT

Brâncoveni Monastery (end of the 16th-1699/1704), national architectural monument (OT-II-a-A-08687), it's located in Oltenia region. The ensemble is composed of the large church, the abbot's house (princely house), the bell tower, cells, annex buildings, enclosure wall, and the hospital church; Monastery was built at the end of the 16th century, the last constructive stage being due to Constantin Brâncoveanu [Theodorescu, 1987, 1992], who rebuilt the church in 1699. The abbot's house keeps the museum collection and the storehouses of the monastery's objects [URL 1].

The exhibition at the Brâncoveni Monastery (rebuilt in 2014) includes the most representative brancovean and post-brancovean cult objects of goldsmiths (oil candle wick, cross in filigree, discos etc.), but also religious prints (gospel, anthology, liturgy, rule book etc.). The novelty of the exhibition was the display for the first time of the Gospel, printed at the end of the 17th century, with the dedication of the ruler. To complete the museum collection, copies of valuable liturgical objects that belonged to the Monastery, and which, today, are in the custody of the National Art Museum of Romania, were exhibited in the large hall of the Abbot's House. They are representative of the brancovean style, being a synthesis between Byzantine, Late Renaissance and Baroque art [Giurescu, 2014]. The objects are listed in the National Cultural Heritage, according to Law 182/2000, and are part of the legal category *Treasure* (cultural goods of exceptional value for humanity) [URL4].

The collection consists of 5 movable heritage objects: oil candle wick, chalice cup, discos, gilded silver bookbinding and a chalice [URL2]. In addition to the 5 classified, there are in the monastery museum about 480 pieces that have movable heritage object sheets, of which 12 are likely to be classified in the *Fund* category (cultural goods of special value for Romania); 6 of them will be the subject of the article.

Keywords: cultural heritage, religious movable heritage, cultural assets, religious museum collection, cult objects

INTRODUCTION

Brâncoveni Monastery (end of the 16th-1699/1704), national architectural monument (OT-II-a-A-08687) is mentioned for the first time in 1582, by voivode (prince) Mihnea Turcitul (The Turkey). Monastery was built at the end of the 16th century, the last constructive stage being due to Constantin Brâncoveanu who rebuilt the church in 1699 [Mănăstirea Brâncoveni, Archive NIH, 2023]. The ensemble, located at the foot of a terrace of Olt river, Brâncoveni commune, Olt county, Oltenia region, is composed of the large church of the monastery, dedicated to "The Assumption of the Virgin Mary" (OT-II-m-A-08687.01), surrounded by the abbot's house (OT-II-m-A-08687.03), the bell tower (OT-II-m-A-08687.04), cells (OT-II-m-A-08687.05), annex buildings (OT-II-m-A-08687.06), and the wall of enclosure (OT-II-m-A-08687.07) forming a monastic settlement with a fortification aspect. The church of the hospital, dedicated to "St. Archangels" (OT-II-m-A-08687.02) is located south of the enclosure, on the bank of a pond (Figure 1, Figure 2, Figure 3, Figure 4).

The large church of the monastery has a triangular plan, an open porch and a polygonal spire, with 10 sides; on the nave (the one on the nave, collapsed in 1838, was never rebuilt). The apse of the altar, polygonal on the outside and circular on the inside, is covered with a dome. Proscomidia and diaconicon are practiced in the thickness of the walls. The pronaos is covered with a spherical dome and the porch with a semi-cylindrical vault, with penetrations [Popa, 2011].

The stone-carved portal of the entrance to the church bears, in a medallion, the coat of arms of the Wallachia and is overlaid by the pisanian framed between carved arches. The wooden iconostasis, dating from the 19th century, probably replaced a wall pediment. The window frames, with flat floral reliefs, were redone in 1842; only one original frame is preserved, with a Gothic profile, at the diaconicon. Carved plant reliefs also adorn the stone columns of the porch [Sacerdoțeanu, 1964].

In the porch, under tombstones placed in 1688 and 1699, rest members of the family of the ruler Constantin Brâncoveanu (Preda vel vornic - grandfather, Papa postelnic - father, Stanca Cantacuzino - mother and Barbu - brother); in the porch is the tomb of the last abbot of the monastery, priest Radu Șapcă from Celei, hero of the 1848 revolution [Iorga, 2000].

The abbot's house is located in the northwest corner of the premises. Square plan, with two levels, the house has a cellar at ground level, compartmentalized by pillars and arches, in three

vaulted bays "in a cradle". The research that preceded the restoration in 1985 made relevant the original system of covering the floor with spherical caps resting on corner pipes and masonry arches. The concrete staircase attached to the eastern facade of the house, for access to the first floor, is a result of the restoration. In 1989-1990, the cellar of the abbot's house was set up as a lapidary and houses pieces from the Văcărești and Pantelimon monasteries. A two-level body, attached to the enclosure wall, connects the abbot's house and the tower.

The gate tower, prismatic with eight sides, with 4 levels raised on a square base preserves many of the attributes of Matei Basarab's era, being similar to those from the Brebu (Prahova) and Codreni (Călărași) monasteries. The restoration phase of the 70s and 80s (1985-1988) is due to the last level, which is rebuilt according to the model of the Brebu monastery [Giurescu, 1946]. The annex buildings in the north-eastern corner and the outer building were built for household functions in the 19th century (after the earthquake of 1838 and rebuilt in 1842-1847) and during the period when the function of the monastery changed, in an asylum of old.

The enclosure wall preserves from the restoration and fortification stage of the pre-existing monastery due to Matei Basarab a fragment contained between the entrance tower and the abbot's house, a raised wall in the Constantin Brâncoveanu stage [Țighiliu, 1989]. Other portions of the wall belonging to the reinforced enclosure are located on the west and east sides, free or embedded in the body of the cells, and bear the signs of renovations from the 18th and 19th centuries [Giurescu, 1907].

The cells on the south side are attributed to the restoration stage during the time of Constantin Brâncoveanu (1699-1702). The rehabilitation works from 1957-1959 and the restoration from 1973-1977 mark today's appearance of the building with ground floor and upper floor, with rooms served by an open gallery on the ground floor and closed on the upper floor with a window. The end to the west is more developed, using it as an arhondaric and abbot's house. On the ground floor of this building, a narrow passage leads to an access door to the garden and to the hospital church [Drăguț, 1971].

The church of the hospital, built by Constantin Brâncoveanu in 1702, on the site of the wooden church of the Calea parish, is the only component of the ensemble that remained unaffected by the transformations. The place is a pure specimen of the triconch planimetric type, with a massive spire on the nave. The apses are semicircular on the inside and polygonal on the outside. The altar, framed by the pastophors, is covered with a dome, the nave with the pantocrator spire, on pendants, and the pronaos, separated from the nave by a full wall with a

dome on pendants. The facades are treated uniformly - stone plinth, walls surrounded by a median girdle, with a torus, cornice decorated with a register of two rows of brick dentils. The windows have frames carved in stone, as does the western entrance which is accentuated by the stone pisana and the niche of the icon of the patron saint. The prismatic, eight-sided spire stands on a cubical base and has cornices marked by jagged brick registers [Ionescu, 1969].

The original painting, from 1702, although very damaged in the altar shell, the west wall of the nave and the dome of the pronaos, allows the recomposition of the iconographic program dominated by the scenes of Descent into Hell and Deisis (Prayer for the salvation of souls) in connection with the funerary function of the hospital churches. The votive painting depicts Constantin Brâncoveanu and his grandfather, Preda Brâncoveanu, Papa Brâncoveanu, the ruler's father, and Danciu vel vel Vornic, the father of Matei Basarab [Ghika-Budești, 1936].

The abbot's house (formerly the Royal House) is located in the north-west corner of the premises and part of it houses the museum collection and the monastery's storage of objects. Square plan, with two levels, the house has a cellar at ground level, compartmentalized by pillars and arches, in three vaulted bays "in a cradle". In 1989-1990, the cellar of the abbot's house was set up as a lapidary and houses pieces from the Văcărești and Pantelimon monasteries [Vlasie, 1995], but also furniture - bishops', deacons' chairs, pews - from places of worship in the area, destroyed or without storage conditions, as well as from the church of the monastery hospital [Pippidi, 2001].

- Brâncoveni Monastery, 2022
- Brâncoveni Monastery, 1940
- Gate tower and large Church, 2022
- Church of the hospital, 2022

RESEARCH AND FINDINGS

The exhibition at the Brâncoveni Monastery, taking into account the state of restoration of the objects, tries to capture the most representative Brâncoveni and Posatbrâncoveni goldsmith objects (candle, anaornica, filigree cross, disk). Also, the attention given by the ruler to religious prints was also noted. A novelty of the exhibition is the display for the first time of the Gospel printed in the last quarter of the 17th century, with the ruler's dedication on it.

Among the prints preserved today at the Brâncoveni monastery, the best preserved are the post-Brâncoveni ones (18th century), also present in the exhibition: gospel, anthology, liturgy, catavasier, minei, pravila, pravalioara [[Theodorescu, 1989].

In order to enrich the museum collection at the Brâncoveni Monastery, copies of important liturgical objects that belonged to the Brâncoveni Monastery, and which, today, are in the custody of the National Art Museum of Romania, were exhibited in the large hall of the Abbot's House.

They are representative of the brancovean style, being a synthesis between Byzantine, Late Renaissance and Baroque art. The objects are listed in the National Cultural Heritage, according to Law 182/2000 [URL 3.], and are part of the legal category *Treasure* (cultural goods of exceptional value for humanity). The collection consists of 5 movable heritage objects: oil candle wick, chalice cup, discos, gilded silver bookbinding and a chalice [Theodorescu, 2006].

1.Wick (Figure 5)

1700, Brâncoveni Monastery

© The National Museum of Art of Romania

Made of hammered gilded silver, using the repoussé technique, it bears the hallmark of Georg May II, an artisan from Braşov at 1700. It has three registers: the upper register is decorated with heads of angels and tulips; middle register with angels and heliantus; last register is decorated with heliantus (sunflower decorative) and tulips. TREASURY item

2.Chalice Cup (Figure 6)

1686, Brâncoveni Monastery

© The National Museum of Art of Romania

According to the inscription, the chalice cup is offered to the monastery Brancoveni by Prince Constantin Brancovan, in 1686. Manufactured in a Wallachian workshop of hammered and engraved gilded silver, chalice cup have the shape of a bell. TREASURY item.

3.Discos (Figure 7)

1635, Brâncoveni Monastery

© The National Museum of Art of Romania

Manufactured in a Wallachian workshop of hammered and engraved gilded silver. It has an inscription in Greek, enriched with floral: "I Prince Matthew Basarab. Holy God, Holy Mighty, Holy Immortal, have mercy on us". TREASURY item

4. Gilded Silver Bookbinding (Figure 8)

1636, Brâncoveni Monastery

© The National Museum of Art of Romania

Manufactured in a Wallachian workshop of hammered and engraved gilded silver, in 1636. Is offered to the monastery Brancoveni by Prince Matthew Basarab and his wife, Helen. The bookbinding is made from gilded silver. Two themes are represented: in front – The Resurrection, back – The Crucifixion. TREASURY item.

5. Chalice (Figure 9)

1636, Brâncoveni Monastery

© The National Museum of Art of Romania

The chalice is offered to the monastery Brancoveni by Prince Matthew Basarab and his wife Helen. Made in 1636, of gilded silver, hammered au repoussé, and polished, has the signature of the craftsman Alexander's Acrivis from Trikke-Greece. The composition includes various themes: Dinner at Mamre, the head of an ox (symbol of the Evangelist Luke), the eagle (symbol of the Evangelist John), Our Lady Platitera, lion (symbol of the Evangelist Mark) and angel (Matthew's symbol). TREASURY item.

The classification of movable cultural assets is carried out according to the provisions of Law no. 182/2000 [URL 3], with subsequent amendments and additions, and to the present rules developed by the Ministry of Culture and Religion, with the approval of the National Commission of Museums and Collections. By classification is meant the procedure of establishing movable cultural assets that are part of the legal categories of movable national cultural heritage, fund and treasure, according to the law. The ranking criterion is a qualitative and quantitative standard based on which the significance or cultural importance of movable assets is evaluated and the legal category of the national cultural heritage of which these assets are a part is determined. In order to be classified in the fund and treasure categories, the two types of classification criteria, general and specific, provided in these rules will be taken into account. The general ranking criteria are standards based on which the significance or cultural importance of movable assets is evaluated and by which it is determined whether they are likely to be ranked.

For each of the 3 general criteria, the maximum score that can be awarded is 100 points. The general ranking criteria are:

- a) age - the criterion based on which it is analyzed whether a cultural asset was created in a more distant period, at least 50 years before the date of the expertise, and value points are awarded in an amount proportional to the determined age;
- b) frequency - the criterion based on which it is analyzed whether the cultural property belongs to a series of identical goods or a lot of goods of the same typology and the presence of the goods in question on the Romanian territory is determined; in relation to the artistic significance, it is analyzed whether they belong to a determined typology that includes works with a relatively similar theme and manner of artistic realization and whether such works are present in public or private collections or in the civil circuit;
- c) state of conservation - the criterion based on which the degree to which the cultural asset preserves its integrity and initial characteristics is analyzed or is in a state that allows its reconstitution or restoration.

The expertise according to the general classification criteria is carried out in order to establish whether the movable cultural goods are likely to be classified.

- a) the value points are awarded for each general criterion and are added up;
- b) if the realized amount is up to 150 value points, the expertized movable cultural asset is not susceptible to being ranked;
- c) if the amount realized is equal to or greater than 150 value points, the appraised movable cultural asset is likely to be classified and its appraisal is carried out by an expert accredited by the National Commission of Museums and Collections, depending on the field of which the cultural asset in question is a part;
- d) the expert validates or invalidates the score given according to the general criteria and expertizes the good according to the specific ranking criteria.

The specific ranking criteria are standards specific to a field, based on which the archaeological, historical-documentary, artistic, ethnographic, scientific or technical significance or importance of cultural goods is evaluated and through which the special or exceptional cultural value is determined, establishing the category legal status of the national cultural heritage of which they are a part.

The specific ranking criteria are: a) historical and documentary value; b) memorial value; c) authenticity; d) the author, the workshop or the school; e) formal quality .

The value score that can be awarded following the expertise according to the specific ranking criteria is differentiated according to the placement of the movable cultural asset in one of the fields: archaeological and historical-documentary, artistic, ethnographic, scientific or technical. For the article, it is about:

... Goods of scientific importance 100 | 25 | 100 | 25 | 100

Following the expertise, it is proposed to classify the mobile cultural asset that is susceptible to classification, according to the law:

- 1) if the final amount of value points is between 200 and 350 value points, the good in question is classified in the substantive legal category of the national cultural heritage;
- 2) if the final amount is more than 350 value points, the property in question is classified in the legal category treasure of the national cultural heritage.

In addition to the 5 classified, there are in the monastery museum about 480 pieces that have movable heritage object sheets; of which 11 are likely to be classified in the *Fund* category (cultural goods of special value for Romania). 6 of them are the subject of this article [Brâncoveni Monastery Archives: warehouse and exhibition, 2014, 2021].

1. Gospel (Figure 10, Figure 11, Figure 12), 1682, no. Inventory 299, with L=32, l=22, above text VELVET-WOOD, SILVER, GOLDEN. State of preservation - Loss of the book's unity, lack of locking tongues. Notes f[4], file guard 1 and 3, f[3] (F[4]),

"This holy Gospel beautifying itself with silver on the outside as seen I dedicated it to the holy Monastery of Brancoveni, where it is dedicated to the Dormition of the Mother of God to our Lady Mother la leat 7199, (1691)..."- the dedication of Prince from Valahia, Constantin Brâncoveanu (1688-1714).

Mirror of the title page. Category: Old Romanian book; Place of publication: Bucharest Black and red print. Language: Romanian (Cyrillic characters). Wooden cover dressed in red velvet with gilded silver fittings: in the corners the 4 evangelists, in the middle the Resurrection of the Lord. BRV,I, 74. Pagination 4, 175 file

2. Boyar charters (Figure 13), sec. XIX, anonymous, no. inventory 218, diameter = 12 cm, silver.

They have a circular shape, in the center they have a floral cross and around it two small arms, a row of flowers among grapes and two more arms with geometric motifs. The catch ring is masked by a heraldic emblem, the double-headed eagle.

3. Large Wick (Figure 14, Figure 15, Figure 16), 18th century, author Georg May II, inventory item 59, silver, manufacture, casting, h=21 o=15.6 cm, weight: 578 g.

Description: Manufacturing candle, assembled by riveting. Equipped with three support chains and three bells and a die-cut engraved brush cover. It is decorated with three floral registers, and the second register is separated from the third by a floral ring on the outside. Registers 2 and 3 are formed by different flowers included in the arches. The lower part is flattened and has the letters "GM" stamped on it. On the lid is a floral motif with a wavy edge.

4. Icon St. Great Martyr George (Figure 17), 1869, author Matei Zograful (Matthew The Painter), inventory object 173, wood, tempera painting, dimensions: 72.5/53.5/3 cm.

Description: The wood of the icon is made of three tops, not supported on the back. The icon is on a blue background with a brown border and red corners. St. George has a breastplate and is covered by a red cloak on his left shoulder. In his left hand he holds St. cross, and on the right a spear. He is young, with short, wavy hair. He has a dark green tunic underneath. It has traces of caries; pieces of the icon's wood are missing from the bottom left corner, top right and left side. The paint is chipped in several places. It was retouched with oil paint.

5. Double-faced icon (Figure 18, Figure 19), obverse *Last Supper*, reverse *Capture of the Savior*, 1815, post-Byzantine workshop, anonymous author, no. inventory 212, linden wood, tempera painting with emulsion, dimensions 24/19/0.5 cm.

Description: A navy blue curtain is painted at the top, all the apostles are painted with a halo, the background is beige at the top and orange at the bottom. The icon with the *Capture of the Savior* and the kissing of Judas is on a vernal background, the soldiers are tightly grouped, with spears and a red torch, St. Peter is with his sword raised and the fallen servant looking at him. The savior wears a dark pink garment with a blue cloak. Greek inscriptions, brown border on both sides.

The wood of the icon is slightly curved, from the center to the sides at the top and like a slight at the bottom, the paint has fine cracks and is slightly chipped at the corners and on some edges, the icon is perforated in the center at the top.

6. Flag (Figure 20, Figure 21), 1844, author Gheorghe Zograful, academic workshop, no. inventory 119, canvas, primer, tempera painting with emulsion, dimensions L=103 l=90 cm.

Description: It is rectangular in shape, painted on both sides, obverse with the *Dormition of the Mother of God*, reverse with the *Baptism of the Savior*. The inscriptions are in Romanian with

Cyrillic characters. At the top it has a wooden crossbar, and at the bottom are sewn cream fringes.

CONCLUSION

The restoration of the exhibition at Brâncoveni Monastery aimed to bring back to the memory of contemporaries the exceptional cultural dimension that Wallachia knew during the reign of Constantin Brâncoveanu. The exhibition preserves objects of great value belonging to the national cultural heritage from the mentioned era.

Starting with the middle of the 18th century, the style created during Brancoveanu's time will survive, in provincial formulas, in numerous local centers of painting and goldsmithing. The Brancovean style was reflected in the secular and cult silverware commissioned from renowned artists, the most well-known and appreciated being the Saxon silversmiths from Transylvania: Georg May II, Sebastian Hann, Johannes Henning, etc., appreciated for their style close to the Baroque: rich decorations, ornaments loaded, vegetable motifs (peony, tulip, narcissus, rose and carnation) and animals, and for the chiseling and "au repoussé" technique. The embroideries made in various workshops in Wallachia were true works of art in the Brancoveanu era, with gold and silver threads and natural silks used especially for religious objects.

The 6 objects of worship, presented above, are part of a batch of 12 specimens that are in the process of expertise and for which classification files will be drawn up, they being likely to be classified, depending on the sought score (according to Law 182/2000) in the FUND category (250-350 points) and possibly TREASURY (over 350 points; the Gospel with the autograph of ruler Constantin Brâncoveanu).

REFERENCES

- [1] Mănăstirea Brâncoveni, Archive National Institute of Heritage (NIH), Bucharest, Romania, 2023
- [2] Brâncoveni Monastery Archives: warehouse and exhibition [Accesed: 2014, May 2021].
- [3] Drăguț, Vasile, Săndulescu, Nicolae (1971), *Arta brâncovenească*, București.
- [4] Ghika-Budești, Nicolae (1936), *Evoluția arhitecturii în Muntenia și în Oltenia*, BCMI, IV, București.
- [5] Giurescu, Constantin; Dobrescu, N. (1907), *Documente și regeste privitoare la Constantin Brâncoveanu*, Institutul de Arte Grafice Carol Göbl, București.
- [6] Giurescu, Constantin C. (1946), *Istoria Românilor. Volumul III, Partea întâi. Dela moartea lui Mihai Viteazul până la sfârșitul Epocii fanariote (1601-1821)*, Ediția a doua, revăzută și adăugită, Fundația Regală pentru Literatură și Artă, București.
- [7] Giurescu, Constantin (2014), *Viața și domnia lui Constantin-Vodă Brâncoveanu*, Editura SAECULUM VIZUAL, București.
- [8] Ionescu, Ștefan; Panait, Panait I.(1969), *Constantin Vodă Brâncoveanu: Viața. Domnia. Epoca*, Editura științifică, București.
- [9] Iorga, Nicolae (2000), *Byzantium After Byzantium*, Center for Romanian Studies, București.
- [10] Pippidi, Andrei, (2001), *Tradiția politică bizantină în Țările Române, în secolele XVI-XVIII*, București.
- [11] Popa, Corina (2011), *Monumente medievale din Oltenia*, ACS, București.
- [12] Sacerdoțeanu, Aurelian (1964), *250 de ani de la moartea voievodului Constantin Brâncoveanu. Constantin Brâncoveanu și ctitoriile sale în Oltenia*, Mitropolia Olteniei, nr. 9, p. 713-720, nr.10, p.721-724, Craiova.
- [13] Theodorescu, Răzvan (1989), *Dunga cea mare a rodului și neamului său. Note istorice în arta brâncovenească*, în *Constantin Brâncoveanu*, coord. Paul Cernovodeanu și Florin Constantiniu, București.
- [14] Idem., *Civilizația românilor între medieval și modern. Orizontul imaginii (1550-1800)*, vol. I, II, Editura Meridiane: 1987, 1992, București.
- [15] Idem., (2006), *Constantin Brâncoveanu. Între „Casa cărților” și „Ievropa”*, Editura Rao, București.
- [16] Țighiliu, Iolanda (1989), *Domeniul lui Constantin Brâncoveanu, în Cernovodeanu, Paul și Constantiniu, Florin, Constantin Brâncoveanu*, Editura Academiei Republicii Socialiste România, pp. 74–94, București.
- [17] Vlășie, Mihai (1995), *Drumuri spre mănăstiri. Ghid al așezămintelor ortodoxe din România*, Editura Schitul Crasna-Prahova, p.176, București.
- [18] URL1. https://ro.wikipedia.org/wiki/Constantin_Br%C3%A2ncoveanu [Accesed: April, 18, 2023]
- [19] URL2. <https://muzee-religioase-hurezi-brancoveni.ro> [Accesed: April, 18, 2023]
- [20]URL3. <http://www.cimec.ro/Legislatie/L-182-2000-Patrimoniu-mobil-republicata-2014.pdf> [Accesed: April, 18, 2023]
- [21] URL4. <http://europeana.cimec.ro/lista.asp> [Accesed: April, 18, 2023]

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Table of illustrations

Figure	Name
1	Brâncoveni Monastery, 2021
2	Large church, 2021
3	Gate tower, 2021
4	Church of the hospital, 2021
5	Wick, 2014
6	Chalice Cup, 2014
7	Discos, 2014
8 (1,2)	Gilded Silver Bookbinding (1_2)
9	Chalice, 2014
10	Gospel, 2014, 2021
11	Gospel, 2014, 2021 (autograph of Prince Constantin Brâncoveanu)
12	Gospel, 2014, 2021
13	Boyar charters, 2021
14	Large Wick, 2021
15	Large Wick, 2021
16	Large Wick, GM author's stamp, 2021
17	Icon St. Great Martyr George, 2021
18	Double-faced icon, obverse <i>Last Supper, 2021</i>
19	Double-faced icon, reverse <i>Capture of the Savior, 2021</i>
20	Flag, obverse <i>Dormition of the Mother of God,</i>
21	Flag, reverse <i>Baptism of the Savior</i>

TOTAL PHENOLIC, TOTAL FLAVONOID AND ANTIOXIDANT ACTIVITIES OF
ARTEMISIA ABSINTHIUM EXTRACTS: A MINI REVIEW

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Abstract

In recent years, a huge amount of scientific research have been carried out on plant extracts with pharmacological importance and their compound analysis. Despite the great advances in modern medicine, plants still make an important contribution to the field of health and pharmacy. A large number of plants are being researched worldwide in terms of their phenolic, flavonoid and antioxidant activity. *Artemisia* is a genus which has a great chemistry and biological activities as a medicinal plant comprises of about 500 species. Historically *Artemisia absinthium* is known as wormwood which is a perennial shrubby. It belongs to the plant family Asteraceae. It has displayed several pharmacological activities like anti-cancer, anti-microbial, anti-viral, anti-oxidant, wound healing, anti-inflammatory, insecticidal, hypoglycemic, hepatoprotective properties in most researches. Artemisinin, absinthin, quercetin, artemetin, coumarin, chlorogenic acid, rosmarinic acid, gallic acid are the main compounds which are reported for this plant. Thujyl alcohol esters, α -thujone, β -thujone, camphene, γ -terpinene are the major constituents for *Artemisia absinthium* essential oil. In this paper, it was aimed to examine the total phenolic, total flavonoid and antioxidant activity of *Artemisia absinthium* according to the extraction conditions from a pharmacological point of view and to create a review of the recently published scientific literature. It was determined that different extraction conditions had a significant effect on the phenolic, flavonoid and antioxidant capacity of *Artemisia absinthium* and a comprehensive analysis was carried out.

Keywords: *Artemisia absinthium*, chemical composition, antioxidant activity, bioactive compounds.

Introduction

Many factors such as industrial lifestyle, smoking, infectious diseases, stress, toxins, drugs cause the development of oxidative stress on people [1]. Oxidative stress triggers the formation of free radicals such as free oxygen species. Free radicals, which play a role in the etiology of many diseases, are an important part of aerobic life and metabolism [2]. Antioxidants are substances that protect the cells from damage caused by free radicals via terminate the chain reactions and prevent or slow down the oxidation of other molecules [3]. These antioxidants can be provided by the body system such as superoxide dismutase, catalase or external sources such as ascorbic acid, polyphenols. Flavonoids and phenolics that are secondary metabolites found in plants, are the bioactive components, protect health and act as a bridge between the food and pharmaceutical industries [4].

Since ancient times, herbs have played a vital role as a standard therapy in the treatment of many diseases. Today, scientists focus on the healing abilities and roles of plants and their contribution to the therapeutic properties of diseases and encourage the use of natural products [5,6]. In several studies conducted on both adults and children in Turkey, it has been determined that the use of herbal-based treatments has an increasing trend and is approximately 77% in the data [7,8]. In the study by Özlü et al., it was determined that approximately 54% of individuals in Turkey believed that treatment approaches on phytotherapy were beneficial in prevention and recovery from the COVID-19 epidemic [9]. Many studies have shown the positive effects of various herbs and medicinal plants on cancer [10], wound healing [11], obesity [12], hormone disorders [13], liver disorders [14], cardiovascular disorders [15], and anemia [16]. According to the World Health Organization (WHO), around 80% of people worldwide rely on the benefits of traditional medicine and herbs [17].

Artemisia absinthium is the most common and dominant species of the Asteraceae family [18]. Scientific classification of *A. absinthium* is given in Table 1. It is a herbaceous perennial herb native to the Middle East, North Africa and Asia, and known by many vernacular names, often referred to as wormwood [20]. *A. absinthium* is a perennial woody plant with a hard root, long and leafy stem, round flower head with bitter aroma [6,21]. The aerial parts and flowers of *A. absinthium* are shown in Figure 1. Many current pharmacological studies have focused on confirming and determining the mechanism of this herb. Many experimental studies have shown that *A. absinthium* has antioxidant [23], antibacterial [24], anticancer [25], antiviral [26],

hypoglycemic [27], wound healing[28], anti-inflammatory [29], antimalarial [30], antipyretic [31], treatment for chronic fever [32], cardiovascular diseases [33] and aromatic ingredient for beverage [34].

Table1. Scientific classification of *A. absinthium* [19].

Taxonomy	
Kingdom	Plantea
Division	Magnoliophyta
Class	Magnaliopsida
Order	Asterales
Family	Asteraceae
Genus	<i>Artemisia</i> L-
Species	<i>absinthium</i>

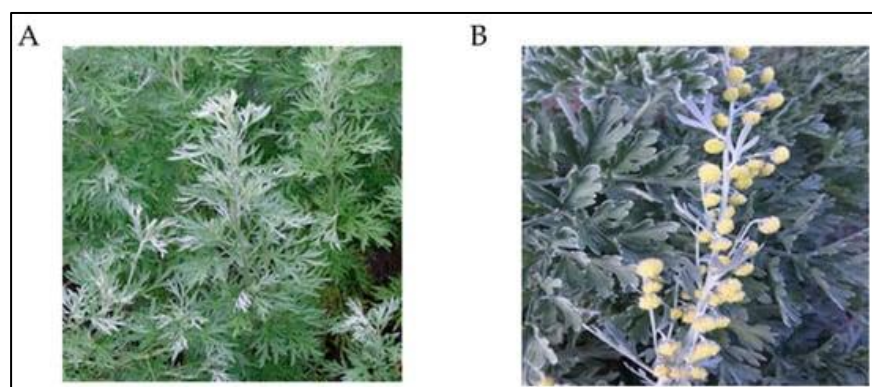


Figure 1. Aerial parts and flowers of *Artemisia absinthium* [6, 22].

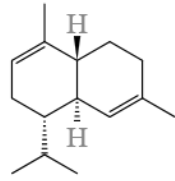
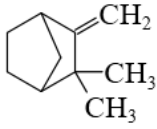
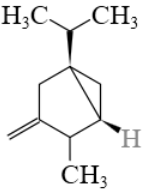
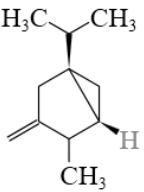
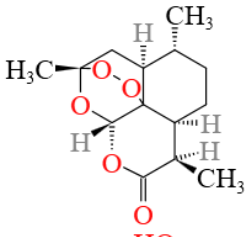
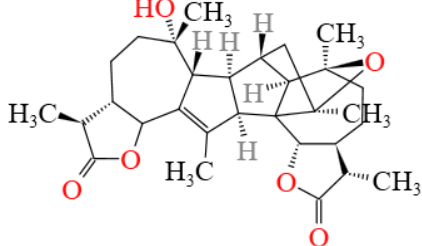
In this review article, the present findings regarding the antioxidant capacity of *A. absinthium* and the total phenolic and flavonoid contents of these various bioactive components were tried to be outlined. A comprehensive search was performed by using keywords such as “*Artemisia absinthium*,” ‘Antioxidant’, ‘Bioactive compounds’, and “Pharmacological activities” in the following databases: PubMed, Web of Science, and Google Scholar.

Bioactive components of *Artemisia absinthium*

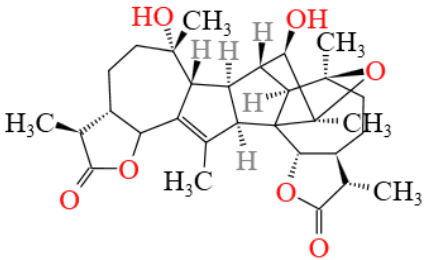
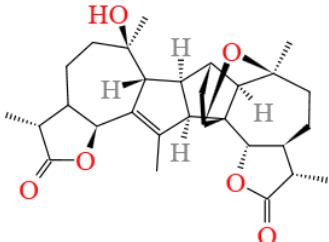
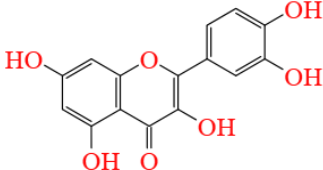
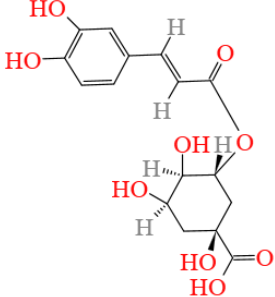
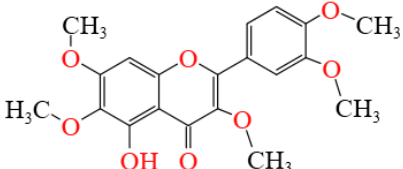
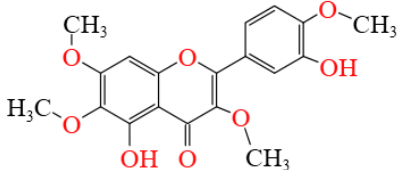
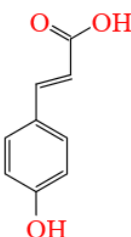
A. absinthium contains numerous valuable compounds responsible for its biological activities. These components may have different chemotypes depending on the location of the plant and growing conditions. *A. absinthium* contains many phytochemical compounds such as flavonoids, phenolic compounds, tannins, terpenoids, essential oils, lactones, organic acids [6].

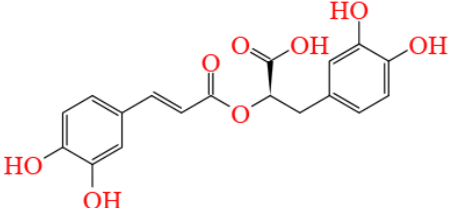
The main active constituents isolated from the *A. absinthium* are shown in Table 1 and total phenolic and flavonoid contents of *A. absinthium* are summarized in Table 2.

Table 1. The main constituents of *A. absinthium* [6].

Compound	Chemical Groups	Chemical Structure
α -cadinene	Essential oil	
camphene	Essential oil	
β -thujone	Monoterpenoids	
α -Thujone	Monoterpenoids	
Artemisinin	Sesquiterpenoid lactones	
Anabsinthin	Sesquiterpenoid lactones	

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Anabsin	Sesquiterpenoid lactones	
Caruifolin D	Sesquiterpenoid lactones	
Quercetin	Flavonoids	
Chlorogenic acid	Phenolic acids	
Artemetin	Flavonoids	
Casticin	Flavonoids	
Coumaric acid	Phenolic acids	

Rosmaniric acid	Phenolic acids	
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In the studies in the table 2, the total phenolic content values were reported as gallic acid equivalents, using gallic acid as the reference standard substance.

Table 2. Total Phenolic and Flavonoid of *A. absinthium*.

Types of extraction and solvents	Total Phenolic		Total Flavonoid		Year / Ref.
	Method	Amount	Method	Amount	
Maceration (Methanol/Water: 80/20)	Folin-Ciocalteu	177,29±9,25 (GAE/mg)	Colorimetric Assay	28,86±3,4 (QE mg/g)	2018 [35]
Ultrasound-assisted extraction (Acidic methanol solution HCl (0.4–1.6 mol/L) and methanol volume (20–80%, v/v)).	Folin–Ciocalteu	42.59-55.87 (GAE/mg)	-	-	2013 [36]
Soxhlet Apparatus (Methanol)	Folin–Ciocalteu	123±0.82 (GAE/mg)	Colorimetric Assay	24 ± 0.96 (rutin mg/g)	2011 [37]
Ultrasound-assisted extraction 25 ± 2 °C for 1 h	Folin–Ciocalteu	171.77 ± 5.8 (GAE/mg)	Colorimetric Assay	136.25 ± 5.5 (QE mg/g)	2019 [38]
Soxhlet Apparatus (Methanol)		220.69 ± 6.3 (GAE/mg)	Colorimetric Assay	136.45 ± 4.9(QE mg/g)	
Maceration (Ethanol/Water: 80/20) 48 h at 25 °C	Folin–Ciocalteu	3.607±0.025 (GAE/mg)	Colorimetric Assay	25.86±0.2 (QE mg/g)	2021 [39]
Ultrasound-assisted extraction (Ethanol/Water: 80/20) Time: 1h, Temperature: room	Folin–Ciocalteu	54.68±1.93 mg GAE/g leaves- 44.15±1.12 mg GAE/g stems	Colorimetric Assay	43.08±2.5 mgCE/g leaves- 34.14±2.1 mg CE/g stems	2019 [40]
Soxhlet extraction Methanol Time:30 min	Folin–Ciocalteu	9.79 µg GAE/mg	-	-	2011 [41]

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Maceration Water Time:20 min, Temperature:100°C	Folin– Ciocalteu	58.66 ±2.16 (µg GAE/mg)	Colorimetric Assay	6.85±00 (EQ µg/mg)	2020 [42]
Maceration Ethylacetate, Time:48 h, Temperature: room	Folin– Ciocalteu	Flowers: 96.17±3.41 (mg GAEs/g) Leaves: 86.35 ± 2.11 (mg GAEs/g) Stems: 78.42 ± 3.55 (mg GAEs/g) Roots 81.28 ± 5.42 (mg GAEs/g)	Colorimetric Assay	Flowers: 88.92±2.21 (mg QEs/g) Leaves: 45.47±1.15 (mg QEs/g) Stems: 58.45 ± 2.91 (mg QEs/g) Roots 68.22 ± 1.03 (mg QEs/g)	2019 [43]
Maceration Ethanol, Time:48 h, Temperature: room	Folin– Ciocalteu	Flowers: 105.42±2.51 (mg GAEs/g) Leaves: 108.42±2.62 (mg GAEs/g) Stems: 91.12 ± 2.66 (mg GAEs/g) Roots: 103.36±2.14 (mg GAEs/g)	Colorimetric Assay	Flowers: 126.43±3.59 (mg QEs/g) Leaves: 59.46 ± 2.97 (mg QEs/g) Stems: 92.39 ± 1.01 (mg QEs/g) Roots 86.00 ± 1.74 (mg QEs/g)	2019 [43]
Maceration Distilled water Time:48 h, Temperature: room	Folin– Ciocalteu	Flowers: 104.17±3.21 (mg GAEs/g) Leaves: 88.49±5.53 (mg GAEs/g) Stems: 75.30 ± 2.77 (mg GAEs/g) Roots: 106.36±2.09 (mg GAEs/g)	Colorimetric Assay	Flowers: 96.45 ± 4.17 (mg QEs/g) Leaves: 43.58 ± 5.42 (mg QEs/g) Stems: 83.21 ± 2.47 (mg QEs/g) Roots 73.04 ± 3.39 (mg QEs/g)	2019 [43]
Soxhlet Apparatus (Methanol/Water: 85/15) Time:6h	Folin– Ciocalteu	180.33±16.2	Colorimetric Assay	165.47±13.3 mg RE/g DE	2020 [44]
Maceration (Ethanol/Water: 70/30) Time:26 h,	Folin– Ciocalteu	10.88 ± 0.62 mg GAE/g	Colorimetric Assay	4.42 ± 0.28 mg RE/g	2021 [45]

Temperature: room					
Soxhlet Apparatus (Methanol) Time:20 h	Folin– Ciocalteu	122±0.91 mg GAE/g	Colorimetric Assay	25 ± 0.74 mg RE/g	2010 [46]

Antioxidant activity of *Artemisia absinthium*

A. absinthium contains valuable flavonoids and phenolics components that determine its many antioxidant potentials that are considered important in protecting against disorders caused by oxidant damage. The data obtained on the antioxidant capacity of *A. absinthium* are summarized in Table 3.

Table 3. Antioxidant activity of *Artemisia absinthium*.

Type of extract	Method	Results	Year / Ref.
soxhlet extraction -Ethylacetate -Water	-DPPH -FRAP -β-Carotene Bleaching Test	In both DPPH and FRAP tests, it was determined that ethyl acetate extraction showed higher antioxidant activity than aquatic extraction. The β carotene test showed that the two extraction results delayed β carotene decolorization with a similar inhibition.	2022 [47]
maceration extraction -Ethanol	-DPPH -ABTS	It was observed that the vegetation year and the part (leaf/stem) of plant changed the antioxidant capacity. The data obtained from the second year has higher values than the data obtained in the first year. ABTS (μM Trolox/g dry weight) results were found to be higher than DPPH (μM Trolox/g dry weight) results.	2023 [48]
Maceration (Ethanol/Water: 80/20) 48 h at 25 °C	-DPPH -FRAP	It has been reported that the DPPH radical scavenging capacity of <i>A. absinthium</i> is much higher than that of <i>C. paradise</i> plant. Also was determined that the reducing capacity of ferric ion (III) to ferro ion (II) was high in <i>A. absinthium</i> .	2021 [39]
Maceration (Methanol/Water: 80/20)	-ABTS -CUPRAC	The results of <i>A. absinthium</i> plant according to ABTS method were found to be higher than trolox and BHT standard. It was determined that it was less in the CUPRAC method.	2018 [35]
Maceration ethanol/water (70/30)	-DPPH -ABTS -ORAC	<i>A. absinthium</i> exhibited significant activity towards scavenging of free radicals. <i>A.absinthium</i> extract had stronger	2012 [49]

		antioxidant activity than trolox with 0.57 ± 0.05 mg/mL IC50 value calculated for DPPH free radical scavenging activity. Its extract had higher values in ORAC and TEAC assays (917.89 μ mol and 690.62 Trolox equivalents/g extract, respectively)	
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Conclusions

In this study, it was revealed that using different extraction conditions and different solvents, the total phenolic content and flavonoid content varied greatly. This demonstrated the possible effect of the solvent used to extract the total phenolic and flavonoid content. Many studies confirmed the antioxidative effects of *A. absinthium*. Its results on antioxidant and radical scavenging effects have shown that it can be reliable in preventing and treating oxidative stress-related diseases. It is suggested that the structure of *A. absinthium* needs to be clarified by both phytochemical and pharmacological tests.

References

- Makhlouf, H., Saksouk, M., Habib, J., & Chahine, R. (2011). Determination of antioxidant activity of saffron taken from the flower of *Crocus sativus* grown in Lebanon. *African Journal of Biotechnology*, 10(41), 8093-8100.
- Nwozo, O. S., Effiong, E. M., Aja, P. M., & Awuchi, C. G. (2023). Antioxidant, phytochemical, and therapeutic properties of medicinal plants: a review. *International Journal of Food Properties*, 26(1), 359-388.
- Awuchi, C. G., & Okpala, C. O. R. (2022). Natural nutraceuticals, especially functional foods, their major bioactive components, formulation, and health benefits for disease prevention-An overview. *Journal of Food Bioactives*, 19.
- Nazer, M. R., Abbaszadeh, S., Anbari, K., & Shams, M. (2019). A review of the most important medicinal herbs affecting giardiasis. *Journal of Herbmed Pharmacology*, 8(2), 78-84.
- Miraj, S., Rafieian-Kopaei, & Kiani, S. (2017). *Melissa officinalis* L: A Review study with an antioxidant prospective. *Journal of evidence-based complementary & alternative medicine*, 22(3), 385-394.
- Batiha, G. E. S., Olatunde, A., El-Mleeh, A., Hetta, H. F., Al-Rejaie, S., Alghamdi, S., ... & Rivero-Perez, N. (2020). Bioactive compounds, pharmacological actions, and pharmacokinetics of wormwood (*Artemisia absinthium*). *Antibiotics*, 9(6), 353.
- Ozturk, C., & Karayagiz, G. (2008). Exploration of the use of complementary and alternative medicine among Turkish children. *Journal of clinical nursing*, 17(19), 2558-2564.
- Parildar, H., Serter, R., & Yesilada, E. (2011). Diabetes mellitus and phytotherapy in Turkey. *JPMA. The Journal of the Pakistan Medical Association*, 61(11), 1116–1120.
- Özlu, Z. K., Kılınç, T., Özlu, İ., Ünal, H., & Toraman, R. L. (2022). The relationship between individuals' use of complementary and alternative medicine during the pandemic in Turkey and their attitudes towards perceived COVID-19 risk. *European Journal of Integrative Medicine*, 56, 102194.
- Mughees, M., Wajid, S., & Samim, M. (2020). Cytotoxic potential of *Artemisia absinthium* extract loaded polymeric nanoparticles against breast cancer cells: Insight into the protein targets. *International Journal of Pharmaceutics*, 586, 119583.
- Mutlu, B., Erci, F., & Çakir Koç, R. (2022). Production of alginate films containing *Hypericum perforatum* extract as an antibacterial and antioxidant wound dressing material. *Journal of Bioactive and Compatible Polymers*, 37(2), 134-148.
- Bahmani, M., Eftekhari, Z., Saki, K., Fazeli-Moghadam, E., Jelodari, M., & Rafieian-Kopaei, M. (2016). Obesity phytotherapy: review of native herbs used in traditional medicine for obesity. *Journal of evidence-based complementary & alternative medicine*, 21(3), 228-234.
- Bashtian, M. H., Emami, S. A., Mousavifar, N., Esmaily, H. A., Mahmoudi, M., & Poor, A. H. M. (2013). Evaluation of fenugreek (*Trigonella foenum-graceum* L.), effects seeds extract on insulin resistance in women with polycystic ovarian syndrome. *Iranian journal of pharmaceutical research: IJPR*, 12(2), 475.
- Shaker, E., Mahmoud, H., & Mnaa, S. (2010). Silymarin, the antioxidant component and *Silybum marianum* extracts prevent liver damage. *Food and Chemical Toxicology*, 48(3), 803-806.
- Rouhi-Boroujeni, H., Heidarian, E., Rouhi-Boroujeni, H., Deris, F., & Rafieian-Kopaei, M. (2017). Medicinal plants with multiple effects on cardiovascular diseases: A systematic review. *Current pharmaceutical design*, 23(7), 999-1015.
- Onyeabo, C., Achi, N. K., Ekeleme-Egedigwe, C. A., Ebere, C. U., & Okoro, C. K. (2017). Haematological and biochemical studies on *Justicia carnea* leaves extract in

- phenylhydrazine induced-anemia in albino rats. *Acta Scientiarum Polonorum Technologia Alimentaria*, 16(2), 217-230.
- Robinson MM, Zhang X (2011) The world medicines situation 2011, traditional medicines: Global situation, issues and challenges. World Health Organ Geneva:1–2.
- Batiha, G. E. S., Olatunde, A., El-Mleeh, A., Hetta, H. F., Al-Rejaie, S., Alghamdi, S., ... & Rivero-Perez, N. (2020). Bioactive compounds, pharmacological actions, and pharmacokinetics of wormwood (*Artemisia absinthium*). *Antibiotics*, 9(6), 353.
- Bhat, R. R., Rehman, M. U., Shabir, A., Rahman Mir, M. U., Ahmad, A., Khan, R., ... & Ganaie, M. A. (2019). Chemical composition and biological uses of *Artemisia absinthium* (wormwood). *Plant and Human Health, Volume 3: Pharmacology and Therapeutic Uses*, 37-63.
- Hussain, M., Raja, N. I., Akram, A., Iftikhar, A., Ashfaq, D., Yasmeen, F., ... & Iqbal, M. (2017). A status review on the pharmacological implications of *Artemisia absinthium*: A critically endangered plant. *Asian Pac J Trop Dis*, 7(3), 185-192.
- Nin, S., Arfaoli, P., & Bosetto, M. (1995). Quantitative determination of some essential oil components of selected *Artemisia absinthium* plants. *Journal of Essential Oil Research*, 7(3), 271-277.
- Ahamad, J. (2019). A pharmacognostic review on *Artemisia absinthium*. *International research journal of pharmacy*, 10(1), 25-31.
- Mahmoudi, M.; Ebrahimzadeh, M.; Ansaroudi, F.; Nabavi, S.; Nabavi, S. Antidepressant and antioxidant activities of *Artemisia absinthium* L. at flowering stage. *Afr. J. Biotechnol.* 2009, 8, 7170–7175.
- Arage, M., Eguale, T., & Giday, M. (2022). Evaluation of Antibacterial Activity and Acute Toxicity of Methanol Extracts of *Artemisia absinthium*, *Datura stramonium*, and *Solanum anguivi*. *Infection and Drug Resistance*, 1267-1276.
- Mughees, M., Wajid, S., & Samim, M. (2020). Cytotoxic potential of *Artemisia absinthium* extract loaded polymeric nanoparticles against breast cancer cells: Insight into the protein targets. *International Journal of Pharmaceutics*, 586, 119583.
- Ansari, S., Siddiqui, M. A., Malhotra, S., & Maaz, M. (2018). Antiviral efficacy of qust (*Saussurea lappa*) and afsanteen (*Artemisia absinthium*) for chronic Hepatitis B: A prospective single-arm pilot clinical trial. *Pharmacognosy Research*, 10(3).
- Daradka, H. M., Abas, M. M., Mohammad, M. A., & Jaffar, M. M. (2014). Antidiabetic effect of *Artemisia absinthium* extracts on alloxan-induced diabetic rats. *Comparative Clinical Pathology*, 23, 1733-1742.
- Boudjelal, A., Smeriglio, A., Ginestra, G., Denaro, M., & Trombetta, D. (2020). Phytochemical profile, safety assessment and wound healing activity of *Artemisia absinthium* L. *Plants*, 9(12), 1744.
- Ahmad, F., Khan, R. A., & Rasheed, S. (1992). Study of analgesic and anti-inflammatory activity from plant extracts of *Lactuca scariola* and *Artemisia absinthium*. *Journal of Islamic Academy of Sciences*, 5(2), 111-114.
- Ali, S. I., Gopalakrishnan, B., & Venkatesalu, V. (2018). Chicory (*Cichorium intybus*) and wormwood (*Artemisia absinthium*) extracts exhibit strong larvicidal activity against mosquito vectors of malaria, dengue fever, and filariasis. *Parasitology international*, 67(6), 781-786.
- Khattak, S. G., Gilani, S. N., & Ikram, M. (1985). Antipyretic studies on some indigenous Pakistani medicinal plants. *Journal of ethnopharmacology*, 14(1), 45-51.

- Willcox, M. (2009). Artemisia species: from traditional medicines to modern antimalarials—and back again. *The Journal of Alternative and Complementary Medicine*, 15(2), 101-109.
- Grossini, E., Marotta, P., Farruggio, S., Sigaud, L., Qoqaiche, F., Raina, G., ... & Pollastro, F. (2015). Effects of artemetin on nitric oxide release and protection against peroxidative injuries in porcine coronary artery endothelial cells. *Phytotherapy Research*, 29(9), 1339-1348.
- Nguyen, H. T., & Németh, Z. É. (2016). Sources of variability of wormwood (*Artemisia absinthium* L.) essential oil. *Journal of applied research on medicinal and aromatic plants*, 3(4), 143-150.
- Koyuncu, I. (2018). Evaluation of anticancer, antioxidant activity and phenolic compounds of *Artemisia absinthium* L. extract. *Cellular and Molecular Biology*, 64(3), 25-34.
- Şahin, S., Aybastier, Ö., & Işık, E. (2013). Optimisation of ultrasonic-assisted extraction of antioxidant compounds from *Artemisia absinthium* using response surface methodology. *Food Chemistry*, 141(2), 1361-1368.
- Bora, K. S., & Sharma, A. (2011). Evaluation of antioxidant and free-radical scavenging potential of *Artemisia absinthium*. *Pharmaceutical biology*, 49(12), 1216-1223.
- Hashemi, Z., Ebrahimzadeh, M. A., & Khalili, M. (2019). Sun protection factor, total phenol, flavonoid contents and antioxidant activity of medicinal plants from Iran. *Tropical Journal of Pharmaceutical Research*, 18(7), 1443-1448.
- Ali, M., Iqbal, R., Safdar, M., Murtaza, S., Mustafa, G., Sajjad, M., ... & Huma, T. (2021). Antioxidant and antibacterial activities of *Artemisia absinthium* and *Citrus paradisi* extracts repress viability of aggressive liver cancer cell line. *Molecular Biology Reports*, 48, 7703-7710.
- Moacă, E. A., Pavel, I. Z., Danciu, C., Crăiniceanu, Z., Minda, D., Ardelean, F., ... & Dehelean, C. A. (2019). Romanian wormwood (*Artemisia absinthium* L.): Physicochemical and nutraceutical screening. *Molecules*, 24(17), 3087.
- Sengul, M., Ercisli, S., Yildiz, H., Gungor, N., Kavaz, A., & Cetin, B. (2011). Antioxidant, Antimicrobial Activity and Total Phenolic Content within the Aerial Parts of *Artemisia absinthium*, *Artemisia santonicum* and *Saponaria officinalis*. *Iranian journal of pharmaceutical research : IJPR*, 10(1), 49–56.
- Kaoudoune, C., Benchikh, F., Benabdallah, H., Loucif, K., Mehloos, S., & Amira, S. (2020). Gastroprotective effect and in vitro Antioxidant Activities of the Aqueous Extract from *Artemisia absinthium* L Aerial Parts. *Journal of drug delivery and therapeutics*, 10(4), 153-156.
- Liu, T. T., Wu, H. B., Wu, H. B., & Zhang, J. (2019). Wormwood (*Artemisia absinthium* L.) as a promising nematicidal and antifungal agent: Chemical composition, comparison of extraction techniques and bioassay-guided isolation. *Industrial crops and products*, 133, 295-303.
- Boudjelal, A., Smeriglio, A., Ginestra, G., Denaro, M., & Trombetta, D. (2020). Phytochemical profile, safety assessment and wound healing activity of *Artemisia absinthium* L. *Plants*, 9(12), 1744.
- Balciunaitiene, A., Viskelis, P., Viskelis, J., Streimikyte, P., Liaudanskas, M., Bartkiene, E., ... & Lele, V. (2021). Green synthesis of silver nanoparticles using extract of *Artemisia absinthium* L., *Humulus lupulus* L. and *Thymus vulgaris* L., physico-chemical characterization, antimicrobial and antioxidant activity. *Processes*, 9(8), 1304.

- Bora, K. S., & Sharma, A. (2010). Neuroprotective effect of *Artemisia absinthium* L. on focal ischemia and reperfusion-induced cerebral injury. *Journal of ethnopharmacology*, 129(3), 403-409.
- Hbika, A., Daoudi, N. E., Bouyanzer, A., Bouhrim, M., Mohti, H., Loukili, E. H., ... & Zaid, A. (2022). *Artemisia absinthium* L. Aqueous and ethyl acetate extracts: Antioxidant effect and potential activity in vitro and in vivo against pancreatic α -amylase and intestinal α -glucosidase. *Pharmaceutics*, 14(3), 481.
- Bordean, M. E., Ungur, R. A., Toc, D. A., Borda, I. M., Marțiș, G. S., Pop, C. R., ... & Muste, S. (2023). Antibacterial and Phytochemical Screening of *Artemisia* Species. *Antioxidants*, 12(3), 596.
- Craciunescu, O., Constantin, D., Gaspar, A., Toma, L., Utoiu, E., & Moldovan, L. (2012). Evaluation of antioxidant and cytoprotective activities of *Arnica montana* L. and *Artemisia absinthium* L. ethanolic extracts. *Chemistry Central Journal*, 6, 1-11.

THE EMERGING TECHNOLOGIES IN THE INSURANCE SECTOR

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ABSTRACT

Indian Insurance industries change over traditional into modern technology. In this way of approach, helps to adopt innovation using technology. Insurtech means insurance Technology. The recent development of internet connections, home computing, and mobile devices, applications help to increase the insurance industries' growth. Consumers access anything, everywhere at any time by using technologies. Payment processes, online inquiries processing are done through communication networks and processing. Industries provide lower transaction costs and processing fees for the services. The main role of insurance sector interactions with customers describes service is now processing through new distribution techniques and technology. It helps to reduce paperless transactions and access non-business hours. Using AI, software, mobile applications are a few emerging technologies in Insurance Technology. In this study discussed emerging technologies in the insurance sector. Firstly, insurance and its global market conditions. Secondly, insurtech revolution in India and its startup plans in India finally, emerging technologies in insurance like AI, mobile apps, etc.

Keywords: Insurance, Insurtech, Fintech, Blockchain Artificial Intelligent, Chatbot, Internet of Things, Mobile Apps.

INTRODUCTION

Insurance is an essential cost that one needs to make in order to secure the future of his/her family. Even the financial advisers suggest you to avail insurance before you start with your financial planning. Insurance is an important necessity for various reasons (Sejpal, A.,2020) and India is one of the world's largest and fastest-growing auto insurance markets – but until now, the sector has had to rely on traditional ways to renew lapsed policies or make repair claims. Both services have required inspectors to physically look over vehicles and make damage assessments.(<https://news.microsoft.com/en-in/features/icici-lombard-ai-enabled-car-inspection-appindia/>)Insurance has been a vital industry for the economic development of any country; however, it has seen a very low market penetration in India. The insurance penetration in India is 3.7% of the GDP while the world average is 6.31% (FY 2020)

<https://community.nasscom.in/communities/digital-transformation/fintech/insurtech-5-trends-thawill-redefine-the-industry-in-the-covid-era.html>.Digital technologies are rapidly changing every aspect of human life, including how we live, work and engage. Insurtech is having a similar impact on the insurance industry the world over. When supported by a conducive ecosystem, insurtech holds great promise to enhance customer experience, reduce claims response time, provide data-driven insights and support both customers and insurers to make informed decisions.(<https://www.livemint.com/money/personal-finance/opinion-is-an-insurtech-revolution-coming-our-way-1548099534499.html>) Integration of Big Data and AI in InsurTech to drive market growth. InsurTech companies are seeking the means to store, analyze, and search vast amounts of data. Such an analysis would help them in segmenting customer populations, identifying opportunities for new products and services, and optimizing pricing mechanisms. The use of Big Data and new data can improve investment decisions and help insurance companies in arriving at the comprehensive credit scoring mechanism. The analysts have predicted that the InsurTech market will register a CAGR of over 41% by 2023.India's 670 million internet users would rise to 914 million by 2027 according to a Morgan Stanley report. The overall Indian Insurance market is expected to grow at an annual rate of 15%-18% over the next 5yrs and is expected to reach a market size of approximately USD 200 – USD 250 billion by 2025.(C. T and Team, C,2020)

REVIEW OF LITERATURE

Lin, L. and Chen, C. C. (2019) the insurance sector, in riding the wave of the FinTech phenomenon, has been rapidly expanding, with a slew of firms having emerged to provide so-called 'InsurTech' services. These services incorporate concepts such as blockchain, artificial intelligence, digitalisation, and the sharing economy to various aspects of the insurance industry. Chen, C. C. (2018) This paper argues that, while technology does bring a lot of innovation to the insurance sector, it has not really challenge the existing framework by challenging the meaning of insurance or providing non-insurance risk management tools. Instead, most applications seem to be about refining and improving existing insurance products, the selling of insurance policies, and back-office operations (e.g. processing applications, information disclosure, or claim processing, etc.). Borselli, A. (2018) artificially intelligent algorithmic systems have the potential to transform large sectors of the economy, and the insurance sector makes no exception. Although the insurance industry might have been slow in recognizing and exploiting the value of artificial intelligence at first, today the applications of intelligent machines in insurance are growing. Chibvuri, I. (2012) The conditions for doing business are rapidly changing. The Internet and related advances in information technology significantly affect financial services in general and insurance markets and banks in particular. The growing importance of e-commerce represents a watershed event for insurance markets and banking institutions, as it does for most industries.

Definition of InsurTech

"Insurtech is technology that supports the digital evolution of insurers. It drives strategic and IT priorities while disrupting/collaborating the business processes and models of one of the world's largest industries."— Michael J. de Waal, Global IQX. (<https://4tifier.com/what-is-insurtech-what-you-should-know-about-emerging-technologies-in-the-insurance-sector/>)

INSURTECH

Insurtech—short for "insurance technology"—is a broad category of constantly changing technologies used in the insurance industry. Any technology that's used by an insurance company to increase the efficiency of its operations could be considered insurtech. (Bonner, M. 2020) Insurtech refers to the use of technology innovations designed to squeeze out savings and efficiency from the current insurance industry model. Insurtech is a combination of the words

“insurance” and “technology,” inspired by the term fintech(Hargrave, M.,2020) Insurtech companies have made the process of buying all types of insurance easier and more convenient, from consumer products to small business insurance. Customers can now research, compare policies, and make a purchase online whenever they want without having to physically visit a local agent. (<https://www.insureon.com/insurance-glossary/insurtech>)

Insurtech refers to the use of technology in the insurance industry to improve efficiency and more accurately assess risk. The value of capital being invested in insurance technology companies globally is on the rise. The insurance industry has always been very traditional, so these new developments have the potential to dramatically change the industry. The market for underwriting improvements is set to grow by over 60 percent by 2020.(Rudden, J,2019)

GLOBAL INSURTECH MARKET

Global Insurtech Market revenue is valued at 5.48 billion in 2019 and is expected to reach 10.14 billion by 2025, growing at a CAGR of 10.80% during the period 2019-2025. The insurance industry with global premiums exceeding US\$4.9 trillion in 2017, is one of the most complex businesses around. Although late, the industry now appears to be at a key inflection point with many experts viewing the digitization of insurance as the next big opportunity after FinTech. (<https://www.giiresearch.com/report/moi937853-global-insurtech-market-growth-trends-forecast.html>)

INDIA'S INSURTECH REVOLUTION

Insurance companies are unique — most of their interactions with customers happen through an agent. In effect, a chunk of technology investment goes into improving agent experience. Insurers have developed systems to advise agents on products tailored for specific customers, depending on their history with the insurer and income band (Revathi, P.,2020) New insurtech players now offer all critical 360-degree support and a marketplace to compare policies and prices. For instance, while some companies have become fully-digital general insurance companies, others offer rewards to insurers on being fit, or pay as you go insurance.(<https://www.financialexpress.com/>)Indian technology companies are leading InsurTech innovations and 6 firms have successfully secured a spot in the InsurTech100.(<https://www.mantralabsglobal.com/>)

The insurance sector in India is expected to grow to \$150 billion by 2023. One of the factors

boosting this growth is the increasing customer reach and growing customer sophistication on service levels which is creating a new wave of InsurTech companies changing how insurance is sold and serviced. The internet-first insurance platforms are receiving positive customer feedback because of the quick service they provide, coupled with mobile-first convenience, as compared to interaction with the agents. (<https://www.consultancy.in/news/2744/technology-acting-as-catalyst-for-indias-insurtech-revolution>)

INSURTECH STARTUPS IN INDIA

Policybazaar

Policybazaar is an online insurance aggregator for comparative analysis of products from various insurers based on price, quality and key benefits. Currently, the website offers information to users to help them make informed decisions along with solution driven customer service. They feature content in various forms such as top five features of a product, best sellers and conversion rates. Raised \$40M in April 2015 for Series D round from PremjiInvest. (<https://tracxn.com/explore/Insurance-Tech-Startups-in-India>)

ET Insure

Launched by the owners of India's largest English newspaper The Times Of India. ET Ensure claims to enable savings of up to 70% on premiums paid on vehicle insurance. The company is planning to soon introduce terms and health insurance for the Indian market. Visit their website to compare and buy from different policy providers. (N., Singh et al, 2020)

Artivatic

Artivatic provides an insurance SaaS platform to automate buyer onboarding, profiling, underwriting, and claims administration. Their solutions leverage cutting-edge technologies like NLP, ML, Deep Learning, Behavior Analysis, AI, and IoT. Currently, the company is working with 16 clients which include Deloitte, KPMG, HCL, and Cynopia, among others. (<https://www.mantralabsglobal.com/blog/insurtech-companies-in-india-insurtech100/>)

Digit Insurance

Digit is an internet-first general insurance startup company launched in the year 2016. It covers insurance for cars, mobile phones, travel, bikes, jewelry, and health. Headquartered in Bangalore, it has bagged total funding of \$100 Million from the time of its inception. (Patil, S. and Patil, S, 2020)

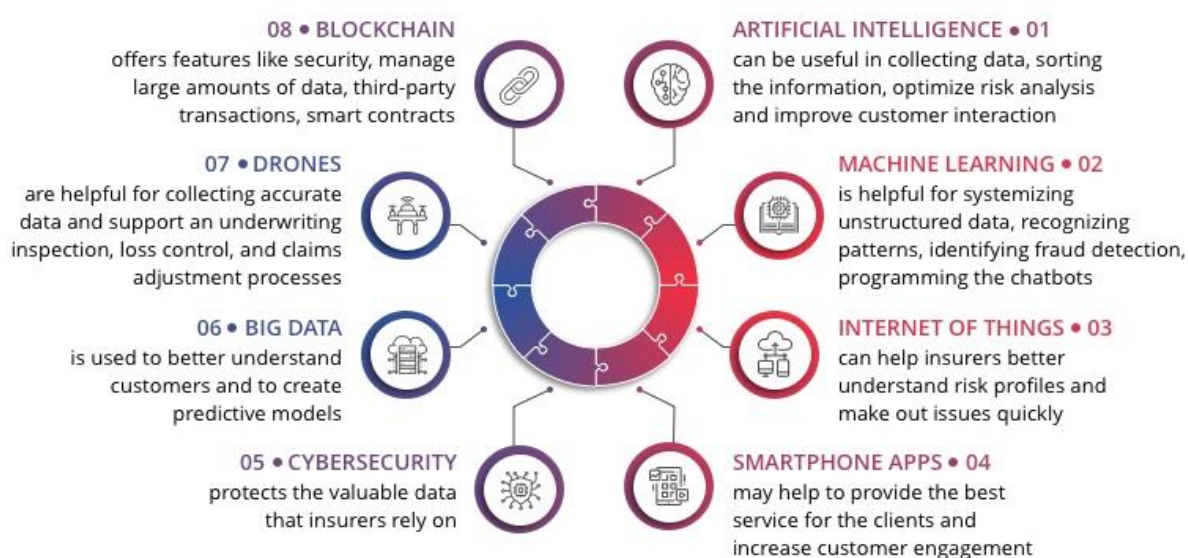
Key features of most of the emerging Insurtech startups in India (Kaur, P et al, 2020)

Promoting Usage Based Insurance: Wearable technology such as fitbit, Apple watch or Samsung gear is undoubtedly the new buzz in town. They have the potential to aid usage-based insurance. Large insurance companies have started using personalized data from these small wearable and fashionable devices to decide premium rates for your driving skills, and as a result, give you discounts if you follow a regular workout routine, etc.

Innovative Products: Promoting customized products as per individual needs and discovering new methods of pricing them effectively.

Online Coverage, Wider Reach: In a fast-paced world, it is very important to have an online presence and reach to build a faster connection with the client. It results in lower costs due to lesser land acquisition, low manpower requirements, etc. **Joint Venture with E-Commerce Giants:** Some Insurtech startups have ventured with e-commerce giants such as Amazon to provide point of sale insurance for various products to its customers.

Figure 1: Emerging Technologies in the InsurTech



source:<https://4tifier.com/what-is-insurtech-what-you-should-know-about-emerging-technologies-in-the-insurance-sector/>

AI Technology

AI technology has progressed immensely over the last few years and insurers are embracing its many facets from natural language processing, computer vision technology, machine learning and neural networks to robotic process automation to empower agents, brokers and employees to enhance customer experience by providing personalized services such as individual risk-based underwriting processes and faster claim settlement. The magic of AI will revolutionize four core capabilities that underlie the insurance value chain. (<https://www.expresscomputer.in/columns/ai-the-new-magic-in-insurance/57653/>)

Figure 2: Artificial Intelligence in Insurtech



Source:<https://towardsdatascience.com/how-are-insurance-companies-implementing-artificial-intelligence-ai-aaf845fce6a7>

Chatbot

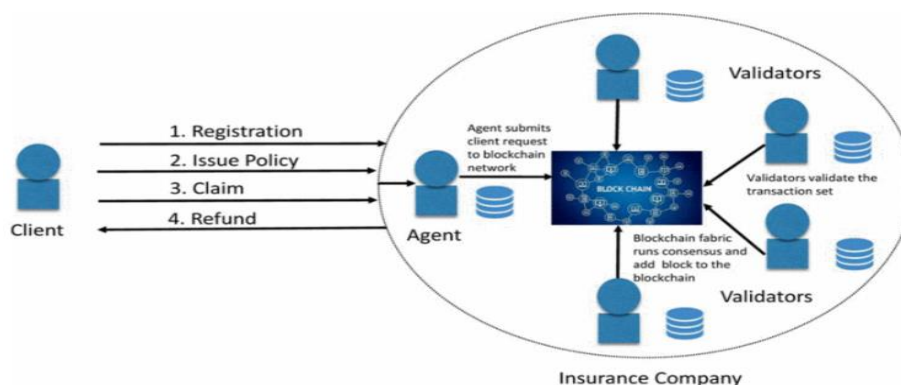
One of the most common technologies used in the insurance sector is chatbot. A chatbot is used by websites to allow conversation through audio or text methods. It's an AI based programme. A technological advancement made especially with the new-age group in the mind. Apart from being hassle-free, it's also cost-effective. (<https://www.outlookindia.com>)

Blockchain Technology

Blockchain technology in insurance is mainly utilized to enhance data security and build trust among all the parties of the contract, all while reducing operating costs associated with transaction processing. Insurtech blockchain startups leverage technology to free up human resources and make sure of prompt claims administration and reliable data sharing, particularly

in case of cataclysmic events (<https://www.dashdevs.com/blog/introduction-to-insurtech-business-models-challenges-trends-and-examples/>)

Figure 3: System model of the Insurtech Blockchain Framework



Source:<https://innovate.ieee.org/innovation-spotlight/blockchain-framework-insurance-processes-claims/>

Internet of Things

Future insurance is set to be completely transformed because of IoT. There are already some insurance companies that have adopted IoT and Insurance Tech such as Bajaj Allianz, ICICI Lombard, HDFC life. (<https://www.mantralabsglobal.com/blog/iot-in-insurance-sector/>)

Mobile Apps

With the explosive growth of smartphones and mobile devices, Insurers are eager to develop mobile applications and self-service portals to meet the growing expectation of policyholders, agents and internal users. These user groups seek to have anywhere, anytime and real-time access to the information stored in the backend systems. (<https://jarustech.com>)

INSURTECH MARKET LANDSCAPE: SEGMENTS

Aggregators/Policy Management

These companies provide digital tools that enable users to search compare and find affordable premiums from multiple carriers. These companies also assist users in managing policies and finance premiums from a single platform.

Online-first Insurance

These insurance providers sell their own insurance products such as life, property and casualty (P&C) and health premiums through their digital channels.

Internet of Things (IoT)

Companies use connected device (IoT) technologies, such as sensors and wearables, to identify and analyse risk to users. At present, this technology is widely used in the car insurance industry, under the usage-based or telematic insurance programme, which allows insurance companies to monitor and store driving-related data. Companies also offer custom insurance solutions for home and life insurance.

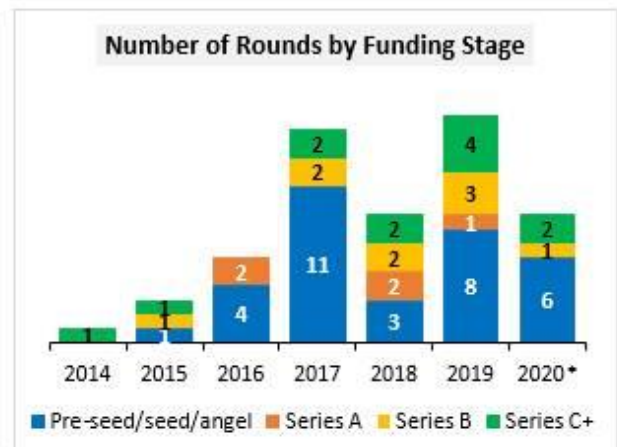
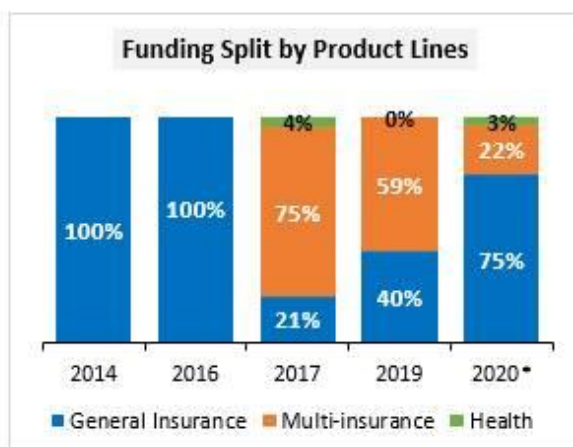
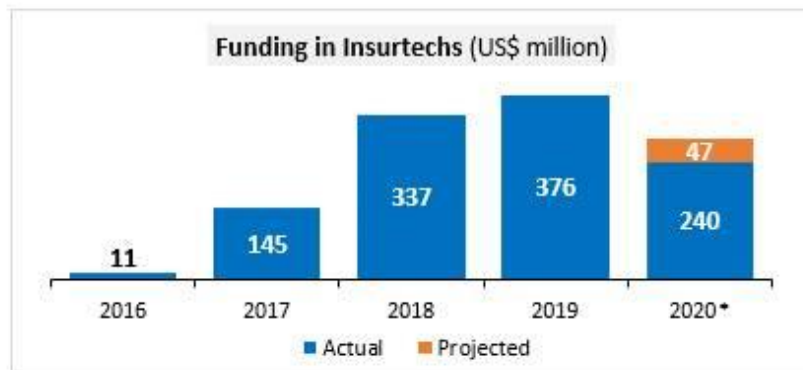
Software/White Label/Application Programming Interface (APIs)

These companies deliver software solutions to insurance companies and brokerages. They provide solutions such as risk assessment, underwriting, fraud detection, regulation, policy administration, marketing, sales, chatbots and customer relationship management (CRM) tools.

Claims

These start-ups create platforms to digitise claim processes by developing technological solutions such as video, mobile options and self-service. These companies leverage technologies such as ML and robotics to digitise payment systems to enable customers to effortlessly complete their payments by just a click of a button.

KEY TECHNOLOGIES IMPACTING THE INSURANCE INDUSTRY



Source: India Insurtech Annual Report 2021

Insurtech Unicorns in India

With two Insurtech unicorns, India stands shoulder-to-shoulder with China, but lags behind the US that comprises six Insurtech unicorns.

Policybazaar: Founded in 2008, the company became a unicorn in 2018. It announced plans for an initial public offering (IPO) in 2021 to raise US\$ 500 million and is targeting a valuation of US\$ 3.5 billion.

Digit Insurance: Founded in 2016, the company became India's first unicorn of 2021, with a valuation of US\$ 1.9 billion.

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Innovations	Select examples
Theme: Product innovation to address niche segments, contextual and new-age needs	
Introducing bite-sized insurance services to cater to a specific need or context	<ul style="list-style-type: none"> • Acko General Insurance joined forces with >20 digital platforms across retail, travel, finance, etc., to provide bite-sized insurance products. For example, the company offers insurance on Ola rides; through this, it has insured 23 million rides in <10 months. • Toffee Insurance offers bite-sized policies such as cycle theft insurance and fitness insurance
Launching products that meet niche segments and demands of the new age	<ul style="list-style-type: none"> • Toffee Insurance offers services such as 'Bicycle Protection' for cyclists and 'Mosquito Insurance' to cover seven mosquito-borne diseases • OneAssist launched cyberthreat insurance
Offering products that lead to a shift from protection to prevention	<ul style="list-style-type: none"> • BeatO offers comprehensive wellness plans, including connected glucose monitors and bands, for diabetic patients; provides unlimited medical consultations with insurance coverage. • Clover Health provides genomic testing for drug management
Non-exhaustive examples	Acko, BeatO, OneAssist, Kruzr, Toffee Insurance, Go Digit and TropoGo
Theme: Offering services and solutions beyond core insurance products	
Building an ecosystem to become one-stop shop for customers	<ul style="list-style-type: none"> • PayTM has built an ecosystem for its customers and provides numerous offerings such as e-commerce, mutual funds and insurance, in addition to payments
Exploring B2B opportunities beyond insurance	<ul style="list-style-type: none"> • Symbo's POS platform enables recruitment of agents and empowers them to sell insurance. • The company extends this capability to insurers in a white-labelled and customisable manner, for example, Cholamandalam MS General Insurance Ltd. partnered with Symbo to empower its 10,000 agents using data-driven solutions
Non-exhaustive examples	Docprime, CoverFox, Wellthy Therapeutics and Policybazaar
Theme: Data-enabled innovations across the value chain	
Introducing new underwriting and pricing models by utilising alternative sources of data	<ul style="list-style-type: none"> • CropIn provides crop insurance and covers >2 million farmers and >6 million acres of farmland across 52 countries. It processes farm-related information by combining ML, satellite monitoring and weather analytics to provide customised reports and information
Leveraging data to provide insights across the value chain	<ul style="list-style-type: none"> • Mantra Labs developed AI-based capabilities to optimise conversion across sales channels and leverage analytics to prioritise leads and assign them to the best suited sales team members
Non-exhaustive examples	Vymo, GOQii, Pentation Analytics, BeatO and Kruzr

Regulatory Tailwinds

In Union Budget 2021, the government increased the FDI limit in insurance from 49% to 74%. The following announcements by Insurance Regulatory and Development Authority (IRDAI) support innovation in the industry.

Topic	Timeline	Details
Approval for e-KYC via UIDAI	w.e.f. 23.04.2020	Due to COVID-19 lockdown, IRDAI allowed carriers to avail paperless KYC via <i>Aadhaar's</i> e-KYC facility
Launch of working group to study drone insurance	Announced on 24.06.2020 (6-week horizon)	<ul style="list-style-type: none"> Working group to explore insurance standards for remotely piloted aircraft systems (e.g., drones) Areas of research include third-party liability & reinsurance cover
Approval for teleconsultation	w.e.f. 11.06.2020	Approval for reimbursement of telemedicine procedures as per the policy benefits of the insured
Digital signatures on proposal forms (Life Insurance)	w.e.f. 05.08.2020	Insurance carriers can replace physical signatures with OTPs via email, mobile or other electronic means
Permission for electronic signatures (General Insurance)	w.e.f. 10.09.2020	Insurance companies can offer an e-signature option, including <i>Aadhaar</i> offline e-KYC
No physical signature in life insurance forms	w.e.f. 12.11.2020	Life Insurance 'proposal' (i.e., customer application) forms previously required a wet signature. The IRDAI had permitted e-signature until 31.12.2020 but extended it to 31.02.2021 with new notice

CONCLUSION

The revolution of the Internet has changes all industries, especially the insurance industry entering into the digital era. Insurtech considers consumer queries like the transparency of the contract agreement; improve claims management process, concentrate fraud detection, providing clarity premiums payment, etc., using technologies. Identification and evaluation of big data techniques and artificial intelligence provide risk-bearing capacity. It develops the cyber risk insurance market need to analyze data protection using data protecting interact with big data applications. Technologies provide better living and financial security through insurance coverage to people, especially middle and lower-middle-class people. Technology helps meet insurance regulations through extensive data protection and cyber security for consumer protection and follow safety standards to positive customer experience. Indian insurance industries remain a challenge for startup and sustain through new technology. The coverage area is undergoing a metamorphosis, with evolving client preferences and developing

importance of virtual offerings. With the energy of automation, cellphone apps, advanced analytics, artificial intelligence and IoT tools, digital coverage organizations are able to offer extra consumer delight with a small body of workers. These sorts of lean companies, with wider coverage, are ordinarily probable to will benefit prominence inside the future coverage ecosystem. Big era companies are vying to grow to be virtual intermediaries in the coverage area, for instance, AmazonPay has begun dispensing insurance products in India, at the same time as Google and Apple are interested by insurance. Moreover, start country. That could assist incumbents and big techs in making virtual transition are possibly to emerge as winners.

REFERENCES

- AI takes the pain out of car insurance in India. (n.d.). Retrieved from <https://news.microsoft.com/en-in/features/icici-lombard-ai-enabled-car-inspection-app-india/>
- Bonner, M. (n.d.). What Is Insurtech? Retrieved from <https://www.thebalancesmb.com/what-is-insurtech-4584490>
- Borselli, A. (2018, December 10). Insurance by Algorithm. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3284437
- Chen, C. C. (2018, November 26). Regulatory Sandbox and InsurTech: A Preliminary Survey in Selected Countries. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3275929
- Chibvuri, I. (2012, May 14). Information Technology Risks & the Extent of Their Impact: An Analysis of Zimbabwean Insurance Companies in the Context of E-Commerce. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2057449
- Consultancy.in. (2020, January 16). Technology acting as catalyst for India's InsurTech revolution. Retrieved from <https://www.consultancy.in/news/2744/technology-acting-as-catalyst-for-indias-insurtech-revolution>
- Express Computer. (2020, June 09). AI – the new magic in insurance. Retrieved from <https://www.expresscomputer.in/columns/ai-the-new-magic-in-insurance/57653/>
- Global Insurtech Market - Growth, Trends, and Forecast (2020 - 2025). (2020, May 01). Retrieved from <https://www.giiresearch.com/report/moi937853-global-insurtech-market-growth-trends-forecast.html>
- Hargrave, M. (2020, September 16). Will Insurtech Disrupt the Insurance Industry? Retrieved from <https://www.investopedia.com/terms/i/insurtech.asp>
- IOT in Insurance Sector: Home, Auto and Health Insurance. (2019, October 15). Retrieved from <https://www.mantralabsglobal.com/blog/iot-in-insurance-sector/>
- InsurTech: A New Wave Of Disruption. (2020, September 22). Retrieved from <https://www.outlookindia.com/outlookmoney/magazine/story/insurtech-a-new-wave-of-disruption-197>
- Insurance Tech Startups in India. (n.d.). Retrieved from <https://tracxn.com/explore/Insurance-Tech-Startups-in-India>
- Kaur, P. B., Kaur, A., Anmol Kaur Anmol Kaur is an actuarial graduate working as a Business Analyst(Actuarial) in a leading MNC <https://theactuarialclub.com/2020/06/21/insurtech-part-3-emerging-insurtech-models-in-india/>
- LLC, D. (2020, February 12). Business Models, Challenges, Trends, and Prominent Examples. Retrieved from <https://www.dashdevs.com/blog/introduction-to-insurtech-business-models-challenges-trends-and-examples/>
- Lin, L., & Chen, C. C. (2019, October 03). The Promise and Perils of InsurTech. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3463533
- Lin, L., & Chen, C. C. (2020, July 21). The Promise and Perils of Insurtech. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3646938
- Online, F. (2020, September 14). Unbundling insurance: How startups are reimagining the underpenetrated sector for a digital makeover. Retrieved from <https://www.financialexpress.com/industry/sme/cafesme/unbundling-insurance-how-startups-are-reimagining-the-underpenetrated-sector-for-a-digital-makeover/2082687/>
- Opinion: Is an insurtech revolution coming our way? (2019, January 22). Retrieved from

- <https://www.livemint.com/money/personal-finance/opinion-is-an-insurtech-revolution-coming-our-way-1548099534499.html>
- Patil, S., By, & Patil, S. (2020, September 08). Top 10 Insurance Startups of India: Best Insurtech Companies. Retrieved from <https://thingsinindia.in/top-10-insurance-startups-of-india/>
- Revathi, P. (2020, April 17). Technology and Innovation in Insurance – Present and Future Technology in Indian Insurance Industry. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3559980
- Rudden, J. (2019). Topic: Insurtech. Retrieved from <https://www.statista.com/topics/4116/insurtech/>
- Sejpal, A. (2020, September 18). Top 15 Life Insurance Companies in India: Updated List (2020). Retrieved from <https://www.turtlemint.com/life-insurance/articles/top-insurance-companies-in-india/>
- Top 6 InsurTech Companies in India (Recognized InsurTech100 2019). (2020, May 10). Retrieved from <https://www.mantralabsglobal.com/blog/insurtech-companies-in-india-insurtech100/>
- What Is Insurtech in Business Insurance? (n.d.). Retrieved from <https://www.insureon.com/insurance-glossary/insurtech>
- Retrieved from <https://jarustech.com/Solutions/MobileAppsForInsurance>
- #InsurTech - 5 Trends that will Redefine the Industry in the Covid Era - NASSCOM Community: The Official Community of Indian IT Industry. (2020, July 22). Retrieved from <https://community.nasscom.in/communities/digital-transformation/fintech/insurtech-5-trends-that-will-redefine-the-industry-in-the-covid-era.html>
- N., Singh, B., Singh, S., Singh, B., & Singh, P. (2020, August 08). InsurTech Startups In India. Retrieved from <https://indiamicrofinance.com/insurtech-startups-india/>
- N. (2019, September 30). What is InsurTech? Definition, Meaning, and the Role of Technology in the Insurance Industr. Retrieved from <https://4tifier.com/what-is-insurtech-what-you-should-know-about-emerging-technologies-in-the-insurance-sector/>
- C. T., By, -, & Team, C. (2020, July 20). Synergy announces entry into India insurtech market - CRN - India. Retrieved from <https://www.crn.in/news/synergy-announces-entry-into-india-insurtech-market/#:~:text=India's 670 million internet users,USD 250 billion by 2025.>

**DECENTRALIZED CONTROL ALGORITHM FOR EFFICIENT POWER
MANAGEMENT IN MICROGRIDS USING MULTI-AGENT SYSTEMS**

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ABSTRACT

The decentralized control systems possess the ability to manage and regulate small-scale power generation units that are connected to the main power grid. Such units include renewable energy generators and conventional ones like diesel generators. In this study, a control algorithm based on multi-agent systems is proposed to schedule the power flow from these distributed generators and the main grid to the loads based on the JADE (Java Agent Development Framework) platform for Multi-Agent Systems. This platform is used to implement the decentralized control algorithm, which enables autonomous agents to communicate and coordinate with each other to achieve the common goal of efficient power management in the microgrid. The algorithm considers various priorities, such as the geographic distances between the generators and the loads, load demands, costs associated with fuel, maintenance, and construction, as well as the power provided by the distributed generators. The proposed algorithm is evaluated through multiple scenarios, including changes in the loads and generator power variations, as well as some of the generators going out of service. The results indicate that the decentralized control systems based on multi agent system approach are capable of efficiently managing and regulating the power flow in the microgrid, minimizing the losses to a great extent.

Keywords: Decentralized Control Systems, Multi-Agent Systems, Microgrid, Renewable Energy Generators, Power Management

INTRODUCTION:

The modern electrical systems have been developed in recent years. Yet with this development they have sustained the same centralized structure which has one direction for energy flow, starts in electrical power stations –central generation- going through transformers to the high-voltage network which in return delivers the power to the distribution network through the distribution transformers until it reaches the consumers. However, in recent years a parallel development has appeared that connects small power units directly to the distribution network [1], they are called distributed generation units (DGs). So generated power was no longer just in power station level but also in distribution level, that is because there are DGs controlled by smart systems to work optimally to adjust the amount of generated power, storing it and feeding the loads with the lowest cost possible [2], and this is one of the features that smart grids have been built on. Fig1 demonstrates a typical diagram for a distributed generation system consists of DGs, loads, storage devices, and control system [3] [4].

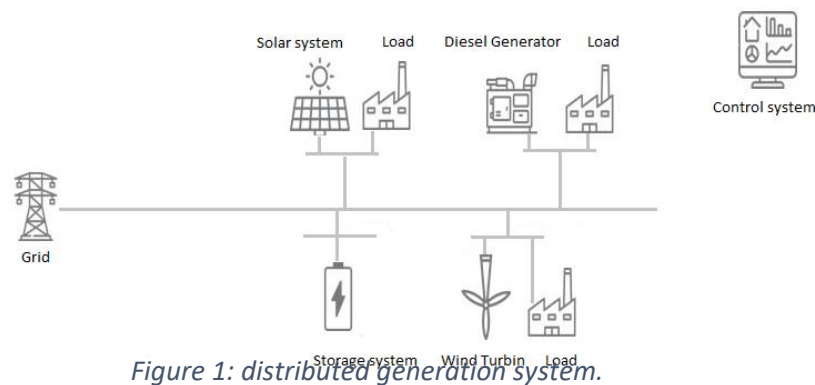


Figure 1: distributed generation system.

The purpose of this research is to build a control system for distributed generation system which its main goal is to achieve optimal distribution of power economically. The study was carried on a system consisted of three small DGs some of them depend on renewable energy (Wind and Solar) and one depends on traditional fuel (Diesel), by considering the maximum limit of power for each unit would not exceed 1MW which are connected to 20KV distributed network in addition to three static residential loads. The work focused on developing the control algorithms by using Multi Agent System (MAS) approach and linear programming to find the optimal solution to feed loads under operating circumstance like load needs, available power in units, and others.

The importance of this research lies in entering the concept of distribution generation systems and micro grids to the electrical power systems for its economical and positive environmental impact and also to improve the reliability of electrical grid.

The system was studied and modeled in only on-grid case. The control algorithm was applied to distribute the power in the system optimally according to virtual values for delivered and needed power, these values are compatible with grid parameters like voltage, frequency, and others. Power DIGsilent program has been chosen to build the system which is similar to Matlab but more suitable with power systems and for the management algorithm JADE platform including NeatBeans IDE has been chosen to build the algorithm.

BACKGROUND:

The control strategy of DGs that are connected with the grid has two approaches [5]:

Control and Coordinate Center (CCC): as shown in Fig2, this unit receives signals from the loads and processes them by a logical algorithm producing control signals sent to a controller, it is called distributed generator controller (DGC), its task is to adjust the output power of its own DG according to the received control signal from CCC. DGC is also responsible to adapt local generator with main grid this controller is in general a PI controller.

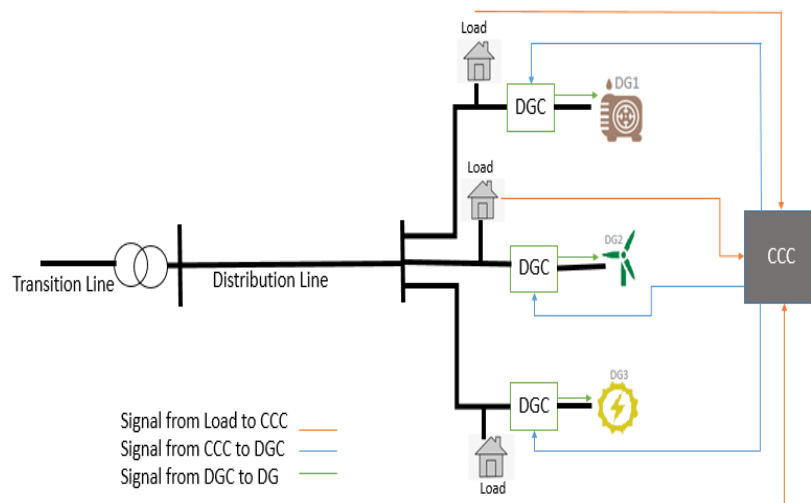


Figure 2 : Control and Coordinated Center (CCC).

Local controllers (LC): there is no central processing, but each DG is controlled locally by its own LC, and the actual power of each DG is adjusted by its DGC which is controlled by a LC that has its own logic control algorithm. As shown in Fig3.

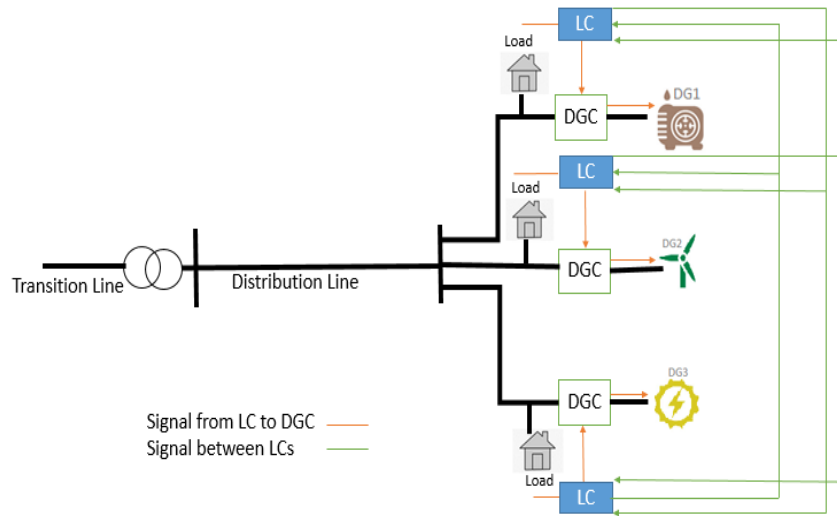


Figure 3 : Local controllers (LC).

In this paper, it is combined the two previous strategies by dividing the system to entities, each one has its local controller LC which is reasonable for many tasks. Even though, distributing power task still relates to one entity, that achieved by using multi agent systems (MAS) approach, it also gives the system flexibility by adding or removing entities like DGs, and loads. DGC of units depended on renewable energy [6], [3] [7]:The amount of injected power in the system by wind and PV DGs, is controlled by three phase converter is connected to grid and controlled by SPWM technique. Control pulses is generated by PQ controller. Fig.4 shows the steps of generation control pulses to control the injected power by inverter [8], [9].

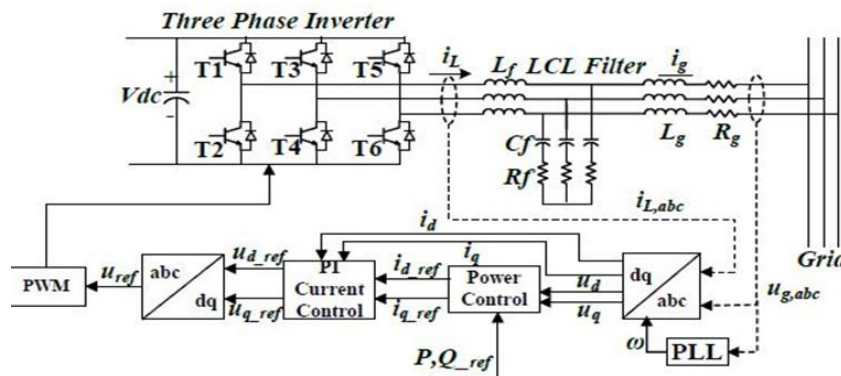
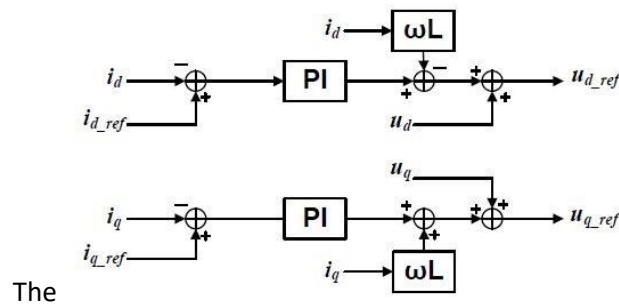


Figure 4 : Three phase controlled converter .



The
Figure 5: PI controller.

DGC of Diesel DG: The diesel unit is modelled as a three phase synchronous machine works in parallel with the grid after synchronization unit with grid by matching their parameters (voltage, frequency, and phase). When synchronous machines, which have power less than 1MW , work in parallel with the grid (infinite bus), they differ with their behaviors from that of which feed a single load [10].

By adjusting the output current in synchronous machine which is connected to infinite bus which is achieved by adjusting E_a through ϕ or n_s . Changing n_s rebuts the most important principle of the synchronous machines which is fixing of synchronous speed. Active power: It is adjusted by controlling the rotational torque for the generator's engine (prime mover), through governor which adjusts the amount of fuel, Fig 6. Reactive power: It is adjusted by controlling the current which feeds the excited induction to control ϕ , using AVR circuit (Automatic Voltage Regulator), Fig 6.

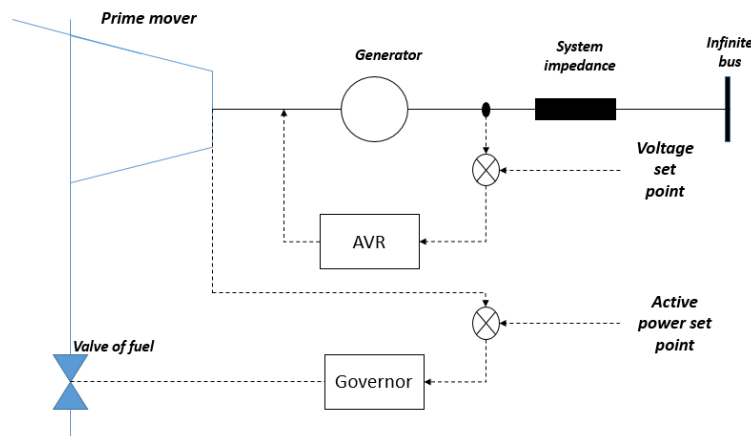


Figure 6 : control active and reactive power in diesel DG.

MULTI-AGENT SYSTEMS (MAS):

MAS is one of branches of distributed artificial intelligence. MAS is a connection network between groups of entities included software. The entities are called agents. Every agent has

its own goal and local knowledge of the environment. They are able to interact with one-another and with the environment to achieve their own goal [11] and as a result, achieving the main goal of the system. There are essentially four forms of interactions: cooperation, coordination, negotiation and competition [12]. These systems have high efficiency, reliability and robustness (the failure of one agents dose not lead to the failure of the entire system), flexibility (it is easy to add or remove agents), developing and re-using ability. Agent has three types shown in fig7:

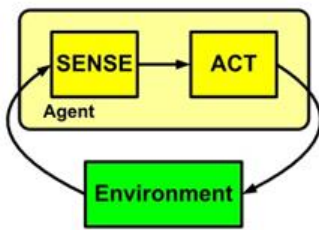


Fig (7-a): Interacting Agent

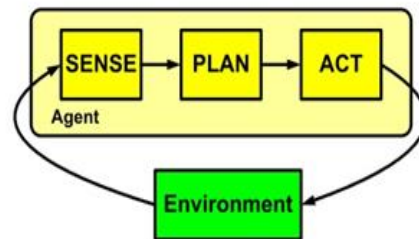


Fig (7-b): Planning Agent.

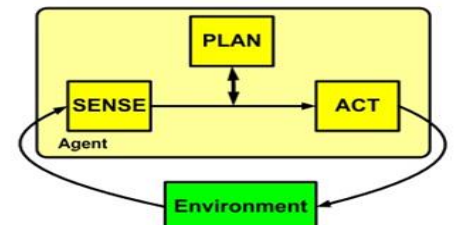


Fig (7-c): Hybrid Agent.

Figure 7 Agents Types .

PROPOSED ALGORITHM:

Distributing process goes under many considerations:

- Geographic distance between DGs and loads where losses can be limited as possible by transporting the power to the nearest load to a generation unit.
- Construction, maintains costs and fuel costs for diesel engine in addition to the power cost from utility.
- Load's needs and available power in each DG, which can vary based on wind speed and solar radiation for renewable DGs.

Problem formation: Transport cost for 1 kVA C_{ij} from source i to load j is determined according to the previous consideration as:

$$C_{ij} = C_f + C_m + C_t \tag{Eq.11}$$

Where:

C_f : Fuel cost for 1 KVA. It equals to zero in renewable units, it is only considered for power delivered from diesel unit or grid.

C_m : The station's construction and maintenance cost for each 1 kVA.

C_t : The losses cost for transmitting 1 kVA from i to j.

$\Delta P = I^2 R$: Losses for active power per 1 Km of transmitting line.

$\Delta Q = I^2 X$: Losses for reactive power per 1 Km of transmitting line.

I[A]: The current through transmitting line. R [Ω]: The resistance of 1 Km for transmitting line.

Losses for apparent power can be formulated:

$$\Delta S = \sqrt{\Delta P^2 + \Delta Q^2} \quad \text{Eq.12}$$

For length D of transmitting line, the losses equal to:

$$\Delta S_{all} = D * \Delta S \quad \text{Eq.13}$$

It is assumed that the shortest distance between source (i) and load (j) is given:

$$D = \sqrt{(X_i - X_j)^2 + (Y_i - Y_j)^2} \quad \text{Eq.14}$$

Where:

X_i, Y_i : The coordinates for generating unit (i).

X_j, Y_j : The coordinates for load (j).

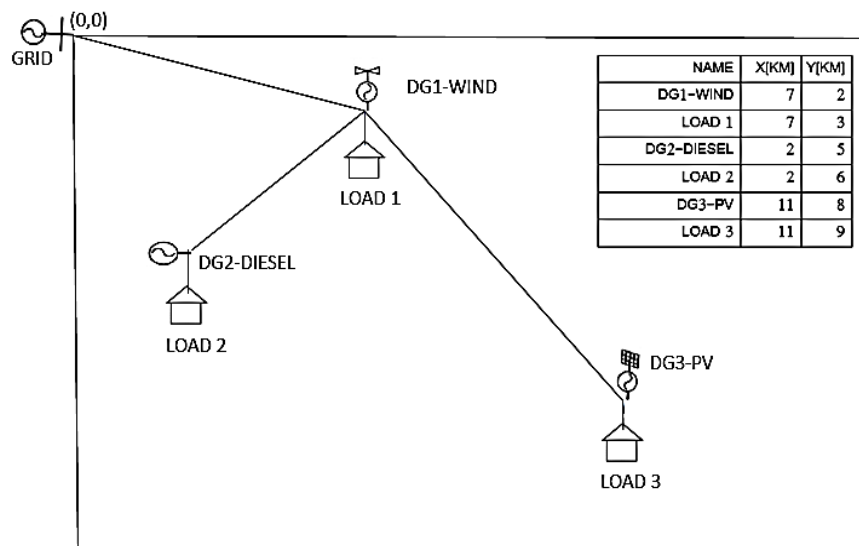


Figure 8: The positions of DGs and loads

Fig.8 illustrates the assumed positions for three loads and three generating units ,this system is connected to main grid .Linear equations (Eq.15) will be modified to express the costs of

generated power by each unit , losses during transmitting ,and consumed power by each load .By solving this formula by using Vogel’s approximating method , minimum cost of distribution of the power among the system id achieved .

$$\begin{aligned}
 C_{PV} &= C_{00} \cdot S_{L1} + C_{10} \cdot S_{L2} + C_{20} \cdot S_{L3} \\
 C_{WIND} &= C_{01} \cdot S_{L1} + C_{11} \cdot S_{L2} + C_{21} \cdot S_{L3} \\
 C_{DIESEL} &= C_{02} \cdot S_{L1} + C_{12} \cdot S_{L2} + C_{22} \cdot S_{L3} \\
 C_{GRID} &= C_{03} \cdot S_{L1} + C_{13} \cdot S_{L2} + C_{23} \cdot S_{L3}
 \end{aligned}$$

$$\begin{bmatrix} C_{WIND} \\ C_{PV} \\ C_{DIESEL} \\ C_{GRID} \end{bmatrix} = \begin{bmatrix} C_{00} & C_{10} & C_{20} \\ C_{01} & C_{11} & C_{21} \\ C_{02} & C_{12} & C_{22} \\ C_{03} & C_{13} & C_{23} \end{bmatrix} \begin{bmatrix} S_{L1} \\ S_{L2} \\ S_{L3} \end{bmatrix} \quad \text{Eq.15}$$

MAS FOR PROPOSED SYSTEM:

In this study the MAS approach will be applied by dividing the components of system to agents, that means every load and DG will be considered as an independent agent [13]. The structure of this system is compatible with hierarchical structure of MAS which is used commonly in electrical power system to administrate the micro grids Fig (9) [14]. The structure consists of three layer: Deliberative layer that has agents sorted as planning type (Loads agents and Load-management agent). Reactive layer, the agents here act directly without thinking, so the agents in this layer sorted as interacting type. Cooperative layer, cooperative between two previous layers.

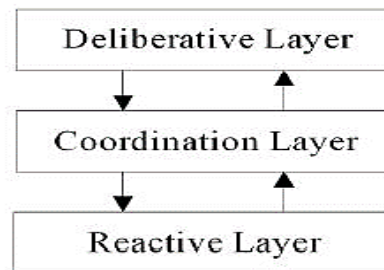


Figure 9 : MAS approach for electrical power system .

For the structure of every agent, hierarchical structured shown in Fig (10) are used [14].The functional layer represents the core functional attributes, those are the actions of agent to perform. The behavioral layer provides control, when an agent carries out specific tasks. When

the functional layer produces new data, the behavioral layer instructs the message handling layer to inform interested agents of the new data. Similarly, the action taken by an agent in response to the receipt of a new message is decided in the behavioral layer. The message handling layer is responsible for sending and receiving messages from other agents, implementing the relevant Agent Communication Language (ACL) and ontology parsers as well as the control functionalities of conversations with other agents.

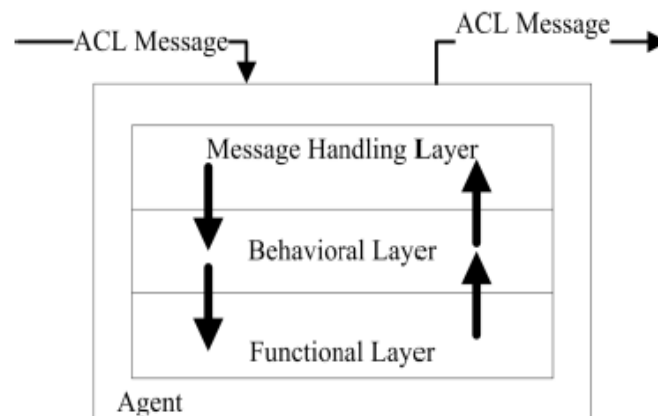
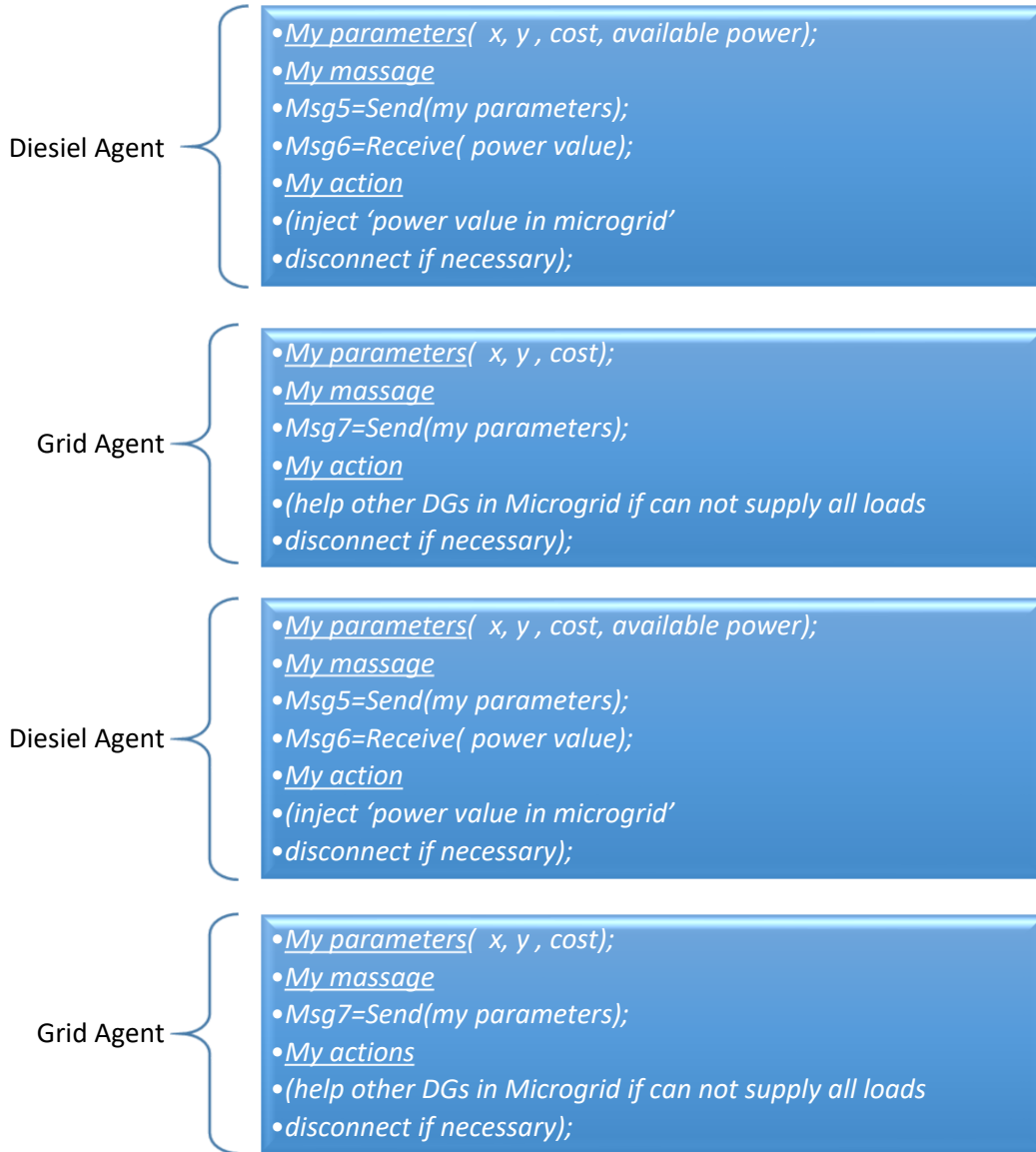


Figure 10 : Agent structure .

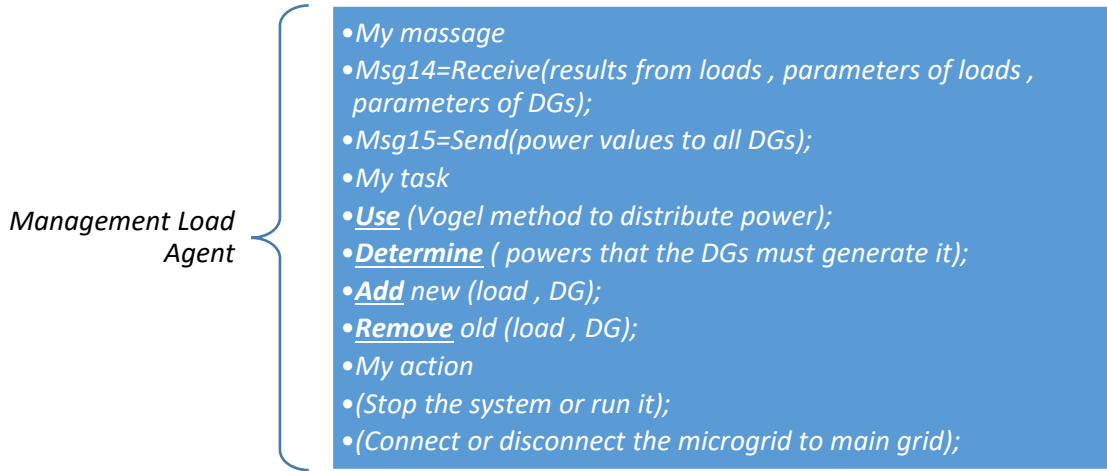
Depending on previous structures, the scheme for each agent is shown in the next chart. In general, every reactive (wind, PV, diesel, and grid) agent determines its main parameters and the messages which it receives and sends from and to other agents like geographical coordinates and the calculated cost, after that doing the actions which will make the changes in some parameters like amount of injected power to the microgrid.

DGs Agents (no plan- Reactive agents)



For loads entities they are considered as a deliberative kind they make some calculations and inferences for distances and losses according to parameters of DGs and send this information to management agent which in turns solve the problem as a set of linear equations and then send to the DGs the amount of power which must inject in the grid.

<u>Deliberative Agents</u>	
Load-1 Agent	<ul style="list-style-type: none"> • <u>My parameters</u>(x, y ,needed P, needed Q); • <u>My message</u> • $Msg8=Send$(Results of my calculates); • $Msg9=Receive$(all information from DGs-agent); • My plan • Calculate (Distance) between me and DGs[Di]); • Calculate (losses) in transman lines between me and DGs [$\Delta P, \Delta Q, \Delta S$]); • Results(the cost) of power from all DGs) • My action • (Get my power • disconnect if necessary).
Load-2 Agent	<ul style="list-style-type: none"> • <u>My parameters</u>(x, y ,needed P, needed Q); • <u>My message</u> • $Msg10=Send$(Results of my calculates); • $Msg11=Receive$(all information from DGs-agent); • My plan • Calculate (Distance) between me and DGs[Di]); • Calculate (losses) in transman lines between me and DGs [$\Delta P, \Delta Q, \Delta S$]); • Results(the cost) of power from all DGs) • My action • (Get my power • disconnect if necessary);
Load-3 Agent	<ul style="list-style-type: none"> • <u>My parameters</u>(x, y ,needed P, needed Q); • <u>My message</u> • $Mag12=Send$(Results of my calculates); • $Msg13=Receive$(all information from DGs-agent); • My plan • Calculate (Distance) between me and DGs[Di]); • Calculate (losses) in transman lines between me and DGs [$\Delta P, \Delta Q, \Delta S$]); • Results(the cost) of power from all DGs) • My action • (Get my power • disconnect if necessary);



Multi-agent simulation platform is developed for the control and energy management of distributed power systems based on IEEE FIPA standards using JADE. [15] IEEE Foundation for Intelligent Physical Agents (FIPA standards are become the mostly accepted standards for development and management of multi-agent systems. FIPA agent management reference model [16], which allows agents to communicate with each other by defining a standard for messaging. The fig (11) shows how the agents in the system interacts with one-another, and how the messages which are generated by agents' flow in the system to share some information so each one can make its process and interact effectively in entire system, so finally the global goal will be achieved by coordination work of the components of the system. The content of every agent is shown in previous pseudocode.

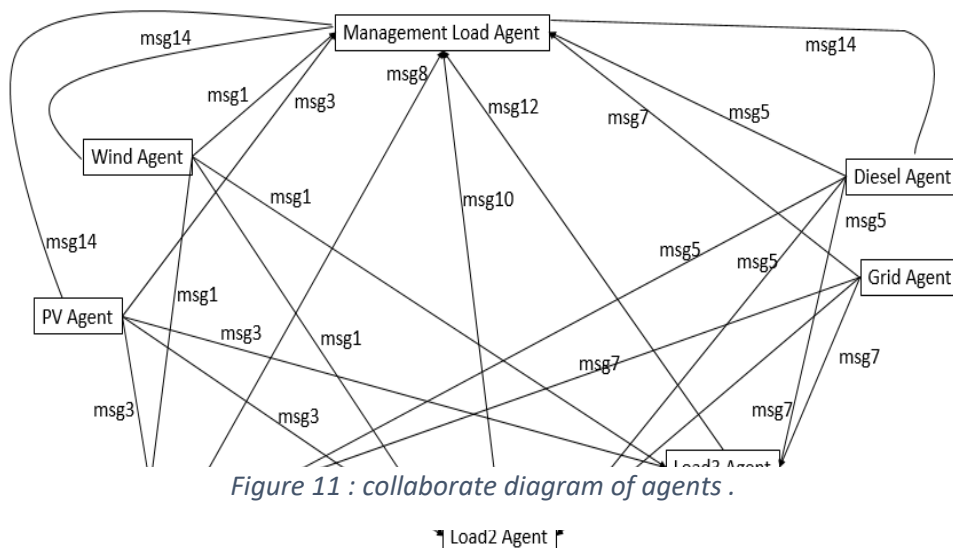


Figure 11 : collaborate diagram of agents .

RESULTS

The system was tested under many conditions according to the weather and failure circumstances. The system was built by using POWER DIGsilent by applying the references signals which are generated by codes in JADE platform.

Scenario 1: The test was carried on according to loads' needs in table (1) and available power in table (2).

Table 1 : Load's needs for scenario 1.

LOADS	P [KW]	Q [KVAR]
LOAD1	400	300
LOAD2	400	300
LOAD3	400	300

Table 2 : Available power in DGs for scenario 1 .

DG	POWER[KVA]
WIND	1000
PV	500
DIESEL	500

Table 3 : The output of agents' algorithms for scenario 1 in KVA.

	Load1	Load2	Load3
Wind DG	500	500	0
PV	0	0	500
Diesel DG	0	0	0
Main grid	0	0	0
The Wind DG output power			=1000
The PV output power			=500
The Diesel DG output power			=0
Power delivered from grid			=0

It is noticeable that the wind DG has fed the first and second loads (which are the closest), whereas PV unit has fed the third load which is the closest to PV unit. That means the renewable units have been relied on to feed the loads without relying on the diesel unit or main grid. The values of busbars for microgrid by using POWER DIGsilent are shown in table (4).

Table 4 : Main values in microgrid for scenario 1.

BUSBAR	P[KW]	Q[KVAR]	V[V]	I[A]
GRID	0	0	20000.0	0
DG1-WIND	800	600	20007.6	28.857
LOAD1	400	300	20003.6	14.431
DG2-DIESIEL	0	0	19997.1	0
LOAD2	400	300	19996.2	14.436
DG3-PV	400	300	20003.4	14.431
LOAD3	400	300	20001.3	14.433

Table 5 :The output of agents' algorithms for scenario 1 when there is an increase in load 1 in KVA.

	Load1	Load2	Load3
Wind DG	1000	0	0
PV	0	0	500
Diesel DG	0	500	0
Main grid	0	0	0
The Wind DG output power		=1000	
The PV output power		=500	
The Diesel DG output power		=500	
Power delivered from grid		=0	

For this case, the load 1 has been increased whereas the other loads have not changed. So, there are changes in priorities of DGs where wind unit feeds load 1 (the closest) with its full power whereas PV unit feeds load3 (the closest one to it) with its full power, so diesel unit covers the need of load2, also there is no need to main grid to feed loads. The values of busbars for microgrid by using POWER DIGsilent are shown in table (6).

Table 6 : Main values in microgrid for scenario 1 when there is an increase in load 1 in KVA.

BUSBAR	P[KW]	Q[KVAR]	V[V]	I[A]
GRID	0	0	20000.0	0
DG1-WIND	800	600	20004.1	28.862
LOAD1	800	600	19999.7	28.868
DG2-DIESIEL	400	300	20002.4	14.434
LOAD2	400	300	20000.3	14.434
DG3-PV	400	300	20002.0	14.432
LOAD3	400	300	19999.8	14.434

Scenario 2: The system was tested under failure circumstances, for example at night PV will not work or wind DG is out of service. Firstly, the system is operated at night. The available power is given in table (7) and loads' needs in table (8).

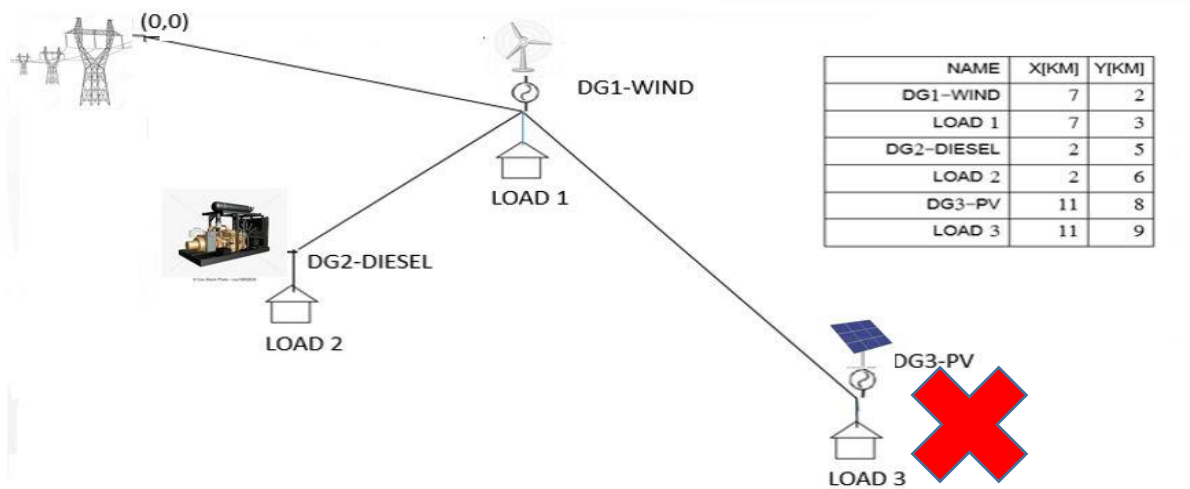


Figure 12 : System is tested when PV is out of service.

Table 7: Available power for DGs for scenario 2.

DG	POWER[KVA]
WIND	1000
PV	0
DIESEL	500

Table 8: Load's needs for scenario

LOADS	P[KWAT]	Q [KVAR]
LOAD1	800	600
LOAD2	400	300
LOAD3	400	300

Table 9 :The output of agents' algorithms for scenario 2 in KVA.

	Load1	Load2	Load3
Wind DG	1000	0	0
PV	0	0	0
Diesel DG	0	500	0
Main grid	0	0	500
The Wind DG output power	=1000		
The PV output power	=0		
The Diesel DG output power	=500		
Power delivered from grid	=500		

It is noticeable that wind DG, with all its power, load 1 needs (the closest) as well as the diesel DG for load 2, but load 3 is fed by the main grid. The values of busbars for microgrid by using POWER DIGsilent are shown in table (10).

Table 10 :Main values in microgrid for scenario 2 when PV is out of service .

BUSBAR	P[KW]	Q[KVAR]	V[V]	I[A]
GRID	400	300	20000.0	14.434
DG1-WIND	800	600	19999.9	28.881
LOAD1	800	600	19988.8	28.887
DG2-DIESEL	400	300	19990.9	14.434
LOAD2	400	300	19988.9	14.442
DG3-PV	0	0	19980.1	0
LOAD3	400	300	19979.0	14.448

Considering the wind DG becomes out of service as well Fig (13), at the same time there are changes in loads' needs, as shown in table (11), the values of busbars for microgrid by using POWER DIGSILENT are shown in table (13).

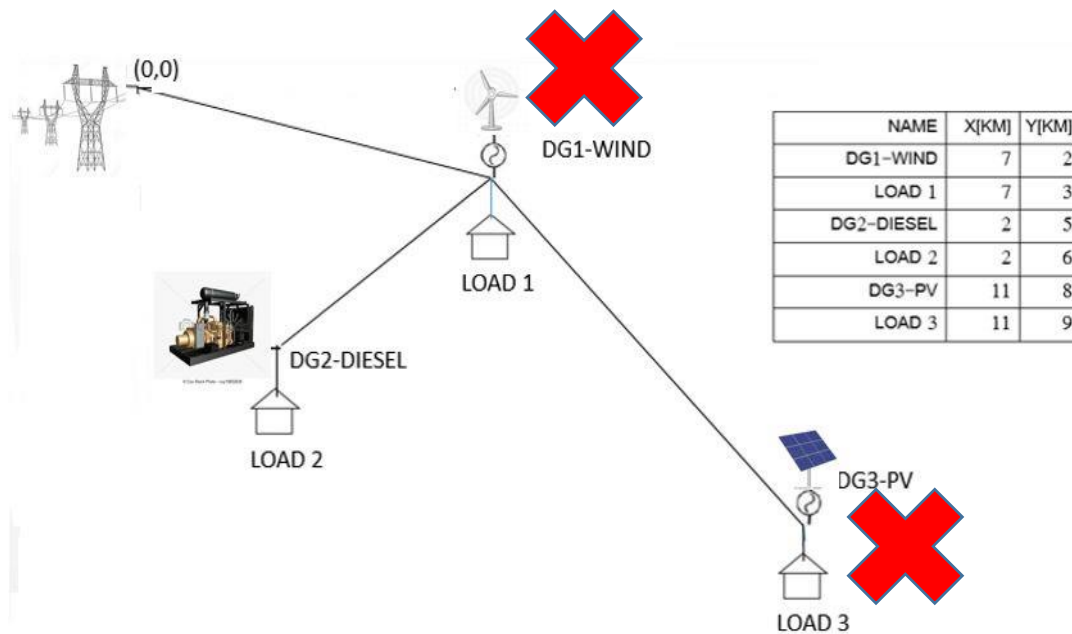


Figure 13 : System is tested when PV and wind DG are out of service .

Table 11 :Changes in loads' need for scenario 2 .

LOADS	P [KW]	Q [KVAR]
LOAD1	800	600
LOAD2	800	600
LOAD3	800	600

Table 12: The output of agents' algorithms for scenario 2 when PV and wind DG are out of service in KVA.

	Load1	Load2	Load3
Wind DG	0	0	0
PV	0	0	0
Diesel DG	500	0	0
Main grid	500	1000	1000
The Wind DG output power			= 0
The PV output power			= 0
The Diesel DG output power			= 500
Power delivered from grid			=2500

Table 13 :Main values in microgrid for scenario 2 when PV and wind DG are out of service .

BUSBAR	P[KW]	Q[KVAR]	V[V]	I[A]
GRID	20007.2	150.5	20000.0	72.434
DG1-	0	0	19929.7	0
LOAD1	800	600	19929.8	28.969
DG2-	400	300	19938.1	14.479
LOAD2	800	600	19936.7	28.959
DG3-PV	0	0	19921.1	0
LOAD3	800	600	19919.6	28.984

CONCLUSION

This paper introduced a model of a control and management system for a small micro grid connected to main grid. This model was built in two level, the first one is classical controllers PI to adjust the amount of the output power for each DG and adapt it while it was working in on-grid system, and the second one was a management algorithm using MAS approach to schedule the priorities of DGs to feed load and achieve the minimum losses during transition the power through the microgrid. The simulation and testing proved the ability algorithms to reduce the dependent on the grid as possible. The priority has always been to transmit the DG's power to the nearest load which will lead to reducing the losses. In addition to that, the system will not be affected by the malfunction of any component in the system. The priorities regulations depend on linear programming, it is better in future work to work with dynamic programming or reinforcement learning algorithms for distributed systems to get optimal solution, in case of huge increasing of loads and DGs. Microgrid and distributed generation with MAS approach is promising solution for electrical power systems due to their abilities to enhance the performance and the reliability of these systems.

REFERENCES

- [1] 2. B. a. 3. A. 1Madan A. Sendhil, Current Status of Research on Hybrid Power Generation Systems, Coimbatore(India): Maxwell Scientific Organization, 2014.
- [2] H. F. a. S. R. M. Pipattanasomporn, "Multi-Agent Systems in a Distributed Smart Grid: Design and Implementation," in *IEEE PES 2009 Power Systems Conference and Exposition*, Washington, USA, 2009.
- [3] J. H. P.-J. L. Jong-Yul Kim, "Coordinated Control Strategy for Microgrid in Grid-Connected and Islanded Operation," *Preprints of the 18th IFAC World Congress*, 2011.
- [4] H. R. P. M. J. H. F. Md Alamgir Hossain, "Evolution of microgrids with converter-interfaced generations: Challenges and opportunities," *International Journal of Electrical Power & Energy Systems*, pp. 160-168, 2019.
- [5] E. A. Setiawan, Concept and Controllability of Virtual Power Plant, Kassel(Germany): Deutsche Nationalbibliothek, April.
- [6] Y. S. ., X. ., J. M. Jiefeng Hu, "A coordinated control of hybrid ac/dc microgrids with PV-wind-battery under variable generation and load conditions," *International Journal of Electrical Power & Energy Systems*, pp. 583-592, 2019.
- [7] M. Tekin and M. Sekkeli, "Active-Reactive Power Control of Grid-Tied Solar Energy Systems, Using Multi-Parameter Band Control for Grid Voltage Regulation," *Acta Polytechnica Hungarica*, vol. 17, no. 3, 2020.
- [8] a. K. L. Wenlei Bai, "Distributed Generation System Control Strategies in Microgrid Operation," *The International Federation of Automatic Control*, 2014.
- [9] N. S. J. a. D. N. Gaonkar², "Modeling and control strategy for grid integrated distributed generation systems with maximum power extraction capability," *International Journal of Engineering, Science and Technology*, pp. 101-110, 2014.
- [10] M. Alotibe, Microgrid: Modelling and Control, Australia: Murdoch University, 2010.
- [11] K. V. D. Tom Rigole, "DISTRIBUTED CONTROL SYSTEMS FOR ELECTRIC POWER APPLICATIONS," K.U.Leuven, Belgium.
- [12] L. E. G. P. W. Abhilash Kantamneni, "Survey of multi-agent systems for microgrid control," *Engineering Applications of Artificial Intelligence*, pp. 192-203, 2015.
- [13] C.-H. S.-J. O. Il-Yop Chung, "Distributed Intelligent Microgrid Control Using Multi Agent Systems," *Scientific Research*, pp. 1-6, 2013.
- [14] T. LOGENTHIRAN, MULTI-AGENT SYSTEM FOR CONTROL AND MANAGEMENT OF DISTRIBUTED POWER SYSTEMS, SINGAPORE, 2012.
- [15] "(JADE)," [Online]. Available: Available: <http://jade.tilab.com/>.
- [16] "FIPA," [Online]. Available: <http://www.fipa.org> .
- [17] J.-W. J. K. Mohammad N. Marwali, "Control of Distributed Generation Systems," *IEEE TRANSACTIONS ON POWER ELECTRONICS*, 2004.

**ASSESSING THE UNDERLYING STRATEGIES FOR EFFECTIVE MANAGEMENT
OF JOB-STRESS IN NIGERIAN CONSTRUCTION PROJECTS**

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1.0 Background of the Study

Stress is neither a simple nervous tension that can result from damage, nor necessarily something to be avoided (Wahab, 2010). From the Health and Safety Executive (HSE, 2007), It is a neurotic human response to psychological, social, job and environmental pressures. This implies that stress is as an adverse reaction people have due to too much pressure or other types of demand placed on them. Some of the causes of stress encountered by professionals in the construction industry are handling of multiple construction projects at a time, poor planning, poor health condition of an individual, poor site condition, large volume of work, ambitious deadline (Leung *et al.*, 2005). Others are workload that employees' cannot cope with, lack of or inadequate consultation by managers with employees regarding their work, communication and negative relationship issues (Leung *et al.*, 2010). It is essential to note that the various causes of stress encountered by professionals in the construction industry can be categorized into physical work environment stressors, organizational related stressors, work demand stressors and job role stressors.

The consequence of stress to employees and organizations across the globe cannot be over emphasized. It could lead to inefficiency, low productivity, abandonment of project, delay in project delivery, depression, anxiety, health related issues such as high blood pressure; headache; body pains; slump or even death of an employee (Leung *et al.*, 2005; Wahab, 2010). The literature exists on stress and its causes in construction project. Also, there are previous studies on the effects of job-stress on employees' and organizations. However, as at when this study was conducted, there seems to be scarce literature on the underlying Strategies for Effective Management of Job-stress in Nigerian Construction Projects

Therefore, this study was conducted to assess the various forms of stress experienced by workers during construction activities. The causes of the various stresses, the impacts of the stress on employees' and organizations as well as the strategies that can be adapted to reduce or overcome the stress were investigated in this study.

2.0 Literature review

2.1 Over view of construction industry

The construction industry is known to be a complex industry in terms of the managerial skills needed and standards to be met, and it is also characterized by numerous elements that differentiate it from other known business sectors of the economy like the manufacturing, banking, oil & gas, services and the likes (Ozaki, 2003). Despite its complexity, the industry contributes about 10% of Gross Domestic Product in a country (Navon, 2005). The technology used in the construction industry has always been known to be flexible due to the fact that construction processes take place at the location of consumption (Tukel & Rom, 2001). Therefore, high demand for labour mobility, low capital intensity and high entrepreneurial risks continue to affect the performance of construction industry across the globe (Vouzaz, 2004). In Nigeria, the construction industry is known by small, medium and large scale local investors (contractors), which in most cases deals with commercial, industrial and residential projects (Dantata, 2008).

2.2 The concept of job-stress

The term stress is used to refer to hardship, strain, adversity or affliction. It was used in the eighteenth and nineteenth centuries to denote force, pressure, strain, or strong efforts relating to an object or person (Somerfield & McCrae 2000). A study by Aitken and Crawford (2007) revealed that the concept of job-stress originated with the research of Selye in 1978. Schuler, (2014) affirmed that stress as a pathological human response to psychological, social, occupational and/or environmental pressures. Melia and Becerril (2007) on the other hand pointed out that stress is an experience expressed in one's feeling of being strained while the Health and Safety Executive (HSE, 2007) defined stress as the adverse reaction people have due to too much pressure or other types of demand placed on them. Put differently, (Lath, 2010) was of the opinion that every person including a child, an adult, employed or unemployed faces stress in his/her everyday life.

2.3 Causes of stress in construction projects

The main cause of stress in construction projects is as a result of factors that negatively arise from the project, and hence makes desired goal unattainable (Kenneth, 2005). Hence, work overloads, working long hours and role ambiguity are known to be leading causes of stress amongst professionals in construction industry (Sutherland & Davidson, 2012). Srivastava,

(2005) asserted that multilevel subcontracting, time pressure; constant worker rotation and unstable work due to temporary contracts can contribute to psychosocial stress among workers. Others are inadequate room for innovation, unsatisfactory remuneration, and ambiguity of job requirement, inadequate knowledge of project objectives, long working hours, tight schedules and unfavourable working conditions (Leiter, 2012; Campbell, 2006).

2.4 Impacts of stress on employees' and organizations

The consequences of stress could be divided into 3 categories: effect on health, effect on personal characteristics, and effect on employees' working efficiency. The most common appearing health problems caused by stress are high blood pressure, elevated cholesterol and blood fats, adult-onset diabetes or high blood sugar, obesity, poor fitness, and inflammatory illness (Buchan *et al.*, 2008). Therefore, it is imperative to prevent any stress at work and by adapting any stress management program or tool rather than to spend money on workers' treatment or replacement (Ben, 2006).

2.5 Stress management strategies in construction projects

Akubue (2000) stated that stress management strategies are referred to as the methods organizations employed to deal with stressful or disturbing situations. These includes the use of advanced project management software's such as primavera, Microsoft project manager among others in projects execution, adequate time management, conducive site office, well ventilated environment, clarity of job role by creating a work schedule, maximization of break time, proper feeding, reduction of work load by employing the different professionals, building interpersonal relationship skills, adequate funding, adoption of appropriate job design practices and education of professionals in stress management. All these strategies will reduce the incidence of stress among professionals in the building industry.

3.0 Research methodology

3.1 Research Design

Research design is the overall design for obtaining answers to the questions being studied and for handling some difficulties encountered during the course of the research (Jeanne, 2011). Field survey research proposed by Griffith (2014) was adopted in this study. Questionnaire was the instrument used for data collection in the survey research design.

3.2 Questionnaire survey

The questionnaire was designed using the information obtained in the literature on the subject matter. It was distributed directly to the study respondents (professionals in construction firms in the study context). The professionals are Architects, Civil engineer, Builder, Quantity Surveyor, Project Manager and Site Supervisor, which were randomly selected from randomly selected firms. The academic qualifications of the professionals range from PhD to Higher National Diploma (HND). The professionals have been working in construction industry for more than 5 years, and have executed different projects ranging from small to large. Before the distribution of questionnaires, a formal approval was obtained from the management of all the selected construction firms in Federal Capital Territory, Abuja. The question in the questionnaire was based on a 5 point likert scale. These enabled respondents express their level of agreement or disagreement with the information in the questionnaire form strongly agrees (5), to strongly disagree (1). A total of 150 questionnaires were distributed out of which only 119 (88%) were returned back and were used for the study. The data obtained through the questionnaire was analysed using descriptive statistics such as mean item score (MIS) and standard deviation (SD) (Digital Bridge Institute, 2018).

4.0 Results and discussion

4.1 Demographical information of the respondents

Table 1 presents the general information on the qualification, years of experience and job position on site of participants of the study. As earlier stated, total of 150 questionnaires were randomly administered to construction professionals in the construction firms in Abuja. Out of the total distributed, 119 responses were obtained, which represents 88.1% of the total distributed.

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Turkish Republic of Northern Cyprus, April 28-30, 2023**

Table 1: Questionnaires administered /returned

Questionnaire	Number	Percentage (%)
Number distributed	150	100
Number received	119	79.3
No response	31	20.7

Table 2: Demographical information of the respondents

Qualification	Frequency	Percentage (%)
PhD	6	5.0
M.Tech / MSc	18	15.1
B.sc	68	57.1
HND	24	20.2
Total	119	100

Experience		
	Frequency	Percentage (%)
1-5 Years	59	49.6
6-10 Years	31	26.1
11- 15 Years	21	17.6
16-20 Years	2	1.7
> 20 years	6	5.0
Total	119	100

Designation		
	Frequency	Percentage (%)
Project managers	31	26.1
Resident builders	28	23.5
Architects	13	10.9
Quantity surveyors	15	12.6
Civil engineers	17	14.3
Contractor	8	6.7
Others	7	5.9
Total	119	100

4.2 Causes of stress in construction projects

Table 3: Main causes of job-stress in construction projects

Causes of stress	SD	MIS	Rank
Bullying by senior colleagues	0.66	1.45	25
Handling more than one project at a time	0.91	1.94	24
Conflict co-worker or labourer	1.03	3.42	19
Ambiguous deadline	0.96	3.21	23
Role ambiguity	1.22	3.25	22
Job complexity	1.15	3.81	2
Poor ventilation in site office	1.03	3.68	9
Too much noise on site	1.04	3.68	9
Poor lighting	1.22	3.76	5
Lack of safety outfit	1.10	3.74	7
Poorly design office space	1.11	3.67	11
Lack of privacy	1.24	3.71	8

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Inadequate machinery and equipment	1.19	3.60	13	In order to ascertain the causes of stress encounter by professionals in construction site, not less than 25 causes
Resources constraint	1.09	3.37	21	
Changes in organization level	1.06	3.76	5	
Poor organizational structure	1.26	3.50	17	
Inadequate staffing	1.01	3.38	20	
Conflict with artesian	4.78	3.52	16	
Poor relationship with superior	1.15	3.56	15	
Lack of communication skill	1.12	3.58	14	
Conflict with co-workers on site	1.16	3.77	3	
Work over load	1.04	3.97	1	
Unfortunate life event	1.07	3.63	12	
Heath condition	1.18	3.43	18	
Personal trait	1.13	3.77	3	

of stress were identified from literature. Respondents were asked to indicate the one mostly encounter during construction activities. The results obtained revealed that work overload with MIS of 3.97 is the most cause of job-stress in construction projects, followed by job complexity. To be precise, with the exception of bullying by senior colleagues and handling more than a project at a time, all other causes of stress identified in the literature were rated to be very significant by the participants of the study. This implies that 23 of the 25 causes of stress identified in the existing literature in the subject matter are the main causes of stress in construction projects. This is similar to findings of Aryal *et al.* (2017), Xing, *et al.* (2020) on the causes of fatigue among employees' during daily activities.

4.3 Impacts of stress in construction projects

In order to evaluate the impacts of stress on construction workers, nine parameters (impacts of stress) were identified from the literature. Respondents were then requested to indicate their agreement on the identified parameters. The outcomes of this section of the questionnaire study are presented in Table 4.

Table 4: Impacts of job-stress on construction workers

Stress impacts	SD	MIS	Rank
Abandonment of project	1.01	3.30	3
Delay in project delivery	0.77	2.68	7
Low productivity of workers	0.87	2.58	8
Negative impact on health of workers	0.96	2.94	6
Building failure due to bad design	0.95	3.39	2
Cost overrun	1.01	3.22	4
Death	1.05	3.42	1
Poor projects performance	0.85	3.02	5

It is obvious from the results presented in Table 4 that the greatest impact of stress on construction workers is death with a mean score of 3.42 followed by building failure due to bad design (MIS=2.39). This is synonymous to the opinion of Okafor and Okafor (2006) on the impact of stress on employees' in construction projects. In a nutshell, the results presented in Table 4 show that virtually all the impacts of stress identified in the literature are highly significant factors. Hence, strategies that can be used to overcome stress in projects need to be continuously investigated by researchers across the globe.

4.4 Strategies for stress minimization in construction projects

Table 5 presents possible organizational strategies for stress minimization in construction projects.

Table 5: Stress minimization strategies

Possible stress minimization strategies	SD	MIS	RANK
Proper project management plans	0.86	2.83	10
Adequate funding	0.79	2.97	9
Encouraging decentralized organizational structure	0.83	2.98	8
Provision of machineries and equipment	0.90	3.02	7
Provision of conducive site office (well ventilated and adequate lighting)	0.90	3.24	5
Effective time management schedule	0.88	3.11	6
Employing enough staff to reduce workload	1.17	3.29	4
Provision of necessary safety gadgets	0.97	3.35	3
Encouraging effective interpersonal relationships / communication between the management and employees	1.18	3.40	1
Providing seminars and workshops for employees to expose them to new technologies in the construction industry	0.94	3.40	1

In order to establish the various organizational strategies that can be adopted to reduce workers stress in construction projects, 10 strategies were identified from the existing literature. Respondents were then requested to indicate the extent of their agreement on each strategy based on their experience. Encouraging effective interpersonal relationships/ communication between the management and employees and providing seminars and workshops for employees to expose them to new technologies in the construction industry were ranked first by the participants of the study, followed by provision of necessary safety gadgets. To be precise, the MIS of all the identified strategies are above 2.5 and can be adopted for stress reduction in construction projects (Digital Bridge Institute, 2018).

5.0 Conclusion and recommendations

Based on the findings of this study, it is clear that construction professionals experience work stress on a daily basis. It can also be concluded that workload, job complexity, and personal trait are the main causes of job-stress in construction projects. Death is the major impact of stress on construction workers. Other organizations impacts are projects delay/poor projects delivery, low productivity of workers, and abandonment of projects. For effective reduction of stress in construction projects, employees need for effective communication between management and workers. Construction firms also need to introduce workplace wellness schemes. Allow flexible

time for workers and encourage effective interpersonal relationships between the management and employees.

Premised on the above conclusion, the study recommends that construction workers should embrace the use of software in project planning and management such as MS project planner, primavera project planner, Orion, and the use of Microsoft spreadsheet. Management should also ensure that workers are not overworked / overloaded with work and their roles in daily activities should be clearly stated. It is also advisable that site offices should be made comfortable and properly ventilated for effective flow of work. The study further recommends that further research should be conducted to determine the level of effectiveness of the identified strategies on stress reduction in construction projects.

References

- Akubue, P. I. (2000). Health checks and health promotion: *Your personal guide to living active life*. Enugu: Snap press limited.
- Aitken, A., and Crawford, L. (2007) coping with stress: Dispositional coping strategies of project managers', *International Journal of Project Management*, 25, 666-673.
- Aryal, A., Ghahramani, A. & Becerik-Gerber, B. (2017) Monitoring fatigue in construction workers using physiological measurements. *Automation in Construction*, 82, 154-165.
- Buchan, J, O'May, F.& Little, L. (2008) Review of models of employment for nursing roles which bridge practice and education. *A report for NHS Education for Scotland Queen Margaret University*.
- Campbell, F. (2006) Occupational Stress in the Construction Industry, Berkshire, UK: Chartered Institute of Building.
- Dantata, S.A., (2008) General Overview of the Nigerian Construction Industry. *Master's Thesis Massachusetts Institute of Technology, USA*.
- Digital Bridge Institute (2018), Data Analysis Using SPSS 23. *Statistical Package for Social Science*, Nigerian Communication Commission, Abuja, Nigeria.
- Griffith, J.(2014) "survey research in military settings" in *routledge handbook of research methods in military studies* edited by Joseph Soeters, Patricia Shields and Seibastaain Reijtens, pp179-193. New York: Routledge.
- Jeanne, Z. (2011) *Research methods in psychology* (9th ed.). New York, NY: McGraw Hill. pp. 161–175.
- Health and Safety Executive (2007) *Tackling Work Related Stress: A Manger's Guide to Improving and Maintaining Employee Health and Well-Being*, Sage Publisher.
- Kenneth, H.R. (2005) *Project Quality Management – Why, What and How*, E-books on-line, J.R. publishing.
- Lath, S.K. (2010) 'A Study of the occupational stress among teachers', *International Journal of Education Administration*, 2 (2), 421-432.
- Leiter, M. P. (2012) 'Coping Patterns as Predictors of Burnout: The Function of Control and Escapist Coping Patterns', *Journal of Organisational Behavior*, 12 (2), 123-144.
- Leung, M. Y., Ng, S. T., Skitmore, M. and Cheung, S. O. (2005) 'Critical stressors influencing construction estimators in Hong Kong', *Construction Management and Economics*, 23, pp. 33-43.
- Leung, M.Y., Chan Y.S. and Yuen K.W. (2010) 'Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong'. *Journal of Construction Engineering and Management, ASCE*, 136 (10), pp. 1093-1103.
- Melia, J.L. and Becerril, M. (2007) 'Psychological sources of stress and burnout in the construction sector: *A structural equation model*', *Psicothema*, 19 (4), 679-686.
- Navon R. (2005) Automated project performance control of construction projects. *Automation in Construction*, 14, pp. 467-476.
- Okafor, J. O., & Okafor, R. U. (2006) *Emotional and mental health*, Nsukka: Ralja publishers.
- Ozaki, R. (2003); Customer-focused Approaches to Innovation in House Building. *Journal of Construction Management and Economics*, pp. 557- 564.
- Schuler., R.S. (2014) "Definition and conceptualization of stress in organizations", *Organizational Behaviour and Human Resource* 24: pp.115-130.
- Srivastava, S. K. (2005) *Organizational Behaviour and Management*, Sarup and Sons, New Delhi, pp.274-276.

- Sutherland, V and Davidson, M. (2012) 'Stress among construction site managers – a preliminary study', *Stress Medicine*, 5, 221-235
- Tukel, O. J & Rom, W. O (2001); An Empirical Investigation of Project Evaluation Criteria, *International Journal of Operations and Production Management*, pp. 400 - 416.
- Vouzas, F. (2004) HR Utilization and Quality Improvement. *The Total Quality Management Magazine*, pp. 125 - 135.
- Wahab, A. B (2010) 'Stress management among artisans in construction industry in Nigeria', *Global Journal of Researches in Engineering*, 10 (1) 93-103.
- Xing, X., Zhong, B., Luo, H., Rose, T., LI, J. & Antwi-afari, M. F. (2020) Effects of physical fatigue on the induction of mental fatigue of construction workers: A pilot study based on a neurophysiological approach. *Automation in Construction*, 120, 103381.

**THE AUTHORITARIAN REGIME AND ITS EFFECTS ON DISAPPEARANCE OF
PERSONS AND THEIR POLITICAL PERSECUTION - THE CASE OF ALBANIA
FROM A HUMAN RIGHTS APPROACH**

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Abstract

Albania is often described by many authors as the former totalitarian country in the Balkans which had the most brutal dictatorial regime for more than forty years. Since the fall of such a regime in the early nineties, challenges remain in restoring justice for many of the victims of that dictatorship, as well as there is much to be done in advancing transitional justice. On the grounds of "the war of classes", a large number of people who were accused of not supporting the communist leaders were later imprisoned, forced to hard labour, and many killed. In this regard, one of the main objectives remains the investigation of human rights violations during the years of the regime. Particular attention will be paid especially to persons who disappeared during communism, in particular women who suffered political prosecution directly or indirectly.

The main aim of the study is to surpass the research of the mere facts, but rather draw conclusions on the role of the political factor and the causes that impeded a full-fledged transitional justice in Albania. The study also analyses several laws that play a crucial role in addressing the issue of victims of enforced disappearance.

In achieving the aim of the study, most materials will be based on archive files on persecuted people, testimonies of representatives of persecuted families, memoirs, online resources, and other secondary sources. The methodological framework of this paper mainly consists of qualitative research on the field of transitional justice.

Key words: transitional justice, disappearance of persons, human rights.

A. Introduction

Historical and life experience has shown that public opinion in all post-dictatorship societies has had to deal with important challenges about the past regime and its stand to it. In the case of Albania, after the fall of the regime, its people did not caution to abide by the applicable laws back then, entirely disregarding them as laws established through violence, demagoguery, and voting processes devoid of freedom of choice for the people. Seen in this light, those laws (such as that on punishing anti-communist agitation and propaganda) could not serve as the basis of just and irrefutable punishments, but only as a means of defending that regime. Some of the violations of those laws that demonstrated opposition to the communist policy can be regarded as the beginning of the popular revolution that would later overthrow the communist regime.

Therefore, even the question “Can a democratic society be built without doing justice on the old communist regime?” implies a negative answer. Albania has not fully done justice on the old communist regime and, as a result, its transition is lingering longer than in other former communist countries. The political discourse between the left wing and the right wing is very fierce and many people feel frustrated by democracy, especially the former politically persecuted.

In Albania, as in all former communist countries, the first attempts to pave the legal way for transitional justice began immediately after the establishment of democracy. Following these democratic changes in Albania in the early 1990s, the Albanian parliament passed three important laws. In 1991, it passed the Law “On the Innocence, Amnesty and Rehabilitation of Former Politically Convicted and Persecuted”. In 1995, two other important laws were passed, called the “Law on Genocide and crimes against humanity committed in Albania during the communist regime for political, ideological and religious reasons” and the “Law on the vetting of officials and other persons related to the protection of democratic state” (the so-called Law on Verifications).

The “Law on Lustration”, adopted in 2008 provided that all people of the old communist regime were banned from public office, but it was repealed by the Constitutional Court in 2010. This decision created problems to the implementation of transitional justice in Albania. Equally important was the law “On the Compensation of Former Politically Convicted by the Communist Regime”, adopted in 2007, amended and improved several times afterwards. Particularly important for the persons disappeared during the communist regime was the amendment introduced to Article 74 of the Criminal Code (2013), which defines enforced disappearance among the crimes against humanity and serves as a basis for the searching of disappeared persons during the communist era.

Shortly afterwards, in 2010, the Institute of the Former Politically Persecuted was established. Scholar Sokol Lleshi says: “The establishment of the Institute was officially supported by the Democratic Party, a centre-right political party. It was hoped that that Institute would have, legally and practically, all the symbolic power of a state institute with unlimited access to the archives of the communist secret police. From the point of view of official institutional features and symbolic power, the Institute would have the same achievements as the other similar institutions. Founded in 2010 and housed in the same building that had housed the representative of Fascist Italy in Tirana, the Institute focused on gathering evidence of the politically persecuted, presenting graphic reconstructions of concentration camps, and publishing a database on victims”.¹

However, there is still much to be done for transitional justice in Albania. As scholar Altin Gjeta puts it, “Transitional justice has been largely overlooked in post-communist Albania, partly due to a lack of human resources, funding, and research interest in the issue. Most research has been done by foreign scholars. [...] There is a general agreement among scholars that the Albanian authorities have failed to address human rights violations by the communist state.”²

Human rights violations in communist Albania and disappearing persons during the regime

The scale of communist crimes in Albania is very painful. There are at least four facts that make those crimes extreme compared to other former communist countries: the targeting of the intellectual elite, the brutality of persecution and crime against women, the seizure of private property and assets, and the considerable number of disappeared persons.

Written documents and accounts of the relatives of the former persecuted show a large number of disappeared persons during the regime. A Study Report conducted by the ICMP experts and supported by the EU in 2018-2020 states that: “It is estimated that around 6,000 persons went missing under the communist regime in Albania in the period between 1944 and 1991. According to official data, 5,501 persons convicted for political reasons were executed during this period. Their bodies were never returned to their families. Official data also indicates that an additional

¹ Lleshi, Sokol, *European Politics and Society*, ISSN: 2374-5118 (Print) 2374-5126 (Online) Journal homepage: <https://www.tandfonline.com/loi/rpep21>

² Gjeta, Altin, “Transition without justice in post-communist Albania: Its implications to collective memory building and democracy promotion”, OSCE, *Justice and Transformation in Albania*, 2020, pg. 6

987 political prisoners died from various causes in prisons and detention centres in Albania. The whereabouts of their mortal remains are unknown to surviving relatives”³.

As author Fatbardha Saraçi states in her book “The ordeals of women in communist prisons”, “[...] around 10% of those executed by firing squad in Albania by the communist dictatorship were women [457]. Out of 308 persons who lost their mental balance, some were girls and women. 7,367 girls and women were politically convicted and 10,792 were interned.”⁴

The tragic fate of lawyer Erifili Bezhani⁵ is an example of how the dictatorial regime persecuted many intellectuals to extinction. An excellent law graduate in France, Bezhani returned to Albania in 1943. After the war, she told her relatives about the communist terror that “it is a scary reprisal, far from the example of European countries, so it has to be stopped”. She was arrested for her political opinions and sentenced to 20 years in prison. After her release in 1958, she was condemned to working as a street sweeper in Tirana, doing only night shifts. After this humiliating job, she fell ill and died during a hospital surgery in February 1959.

There is also the painful story of Marie Tuci⁶, the only woman among the 38 martyrs of the Catholic Church, who was killed by barbaric physical and psychological torture in October 1950. She was arrested and suffered her tragic fate at the age of 22, when she was a teacher in Mirdita, only because she spoke out against the humiliation of the Catholic Church by the communists.

Several thousand other women who refused to divorce their husbands to make ends meet for themselves and their families experienced savage suffering along with their families in internment camps. As the author Saraçi puts it again in her book about those women, “They became heroines, being chased for years, traveling in cold or hot weather, on foot or on trucks loaded with wood, sleeping on the streets, because the house-doors of the residents near the prisons and labour camps were not opened for them, from fear of the State Security”⁷.

Moreover, the blatant and inhuman human rights violations in Albania included property plunder through the seizure of assets, houses, money or other valuable items. A significant case is that of the intellectual and patriotic teacher Edip Tërshana who openly stood against the dictator’s policy. In a letter found in his pocket before being executed on 18 January 1948, he wrote to Enver Hoxha,

³ ICMP Report, Press Release, 2 March 2021

⁴ Saraçi (Mulleti), Fatbardha, “Kalvari i grave në burgjet e komunizmit”, pg. 10

⁵ <https://kujto.al/fati-tragjik-i-erifili-bezhanit-avokatja-e-pare-shqiptare-ge-vuajti-burgun-e-burrelit-dhe-perfundoi-si-fshesaxhije/>

⁶ <https://kujto.al/mesuesja-ge-vdiq-nga-torturat-si-e-percmoi-kryehetuesin-e-tmerrshem/>

⁷ Saraçi (Mulleti), Fatbardha, “Kalvari i grave në burgjet e komunizmit”, pg. 191

accusing him of betraying Albania and Kosovo*⁸ in collusion with the Yugoslavs. In that letter he says, “I am against the executions of people with or without trials... This is treason ... I am against this power, because it is speculative and robs the people by law, and sells the goods seized from traders at a higher price than theirs, throwing on the street many families of traders labelled as speculators. I am against the call ‘We are the children of Stalin’... I am against it, because there is no freedom of speech and free press. There is only terror...”⁹.

Even the religious communities in Albania did not escape the savage persecution by the communist dictatorship. The Catholic Clergy, in particular, endured brutal reprisals. A short extract from Father Zef Pllumi’s book would suffice to comprehend the dimensions of the tragedy inflicted on Albanians by the communist dictatorship: “The titanic so-called proletariat violence exerted day and night, restlessly and everywhere, with no distinction between villages and cities, associated with the parrot-like shouted slogans and inhuman tortures, lies and fabrications by servile or paid persons: after all those bloody executions, imprisonments and violent mass displacements, they managed to subdue the free people of Albania and thus partisan violence managed to form the government”¹⁰.

Reasons of delays in searching and locating missing persons

In their article about the practical experience of transitional justice in Albania, Robert C. Austin and Jonathan Ellison state that “Having experienced possibly the harshest form of communism in Europe, one would think that Albania had the most compelling reasons to undergo sustained transitional justice. One need not look much past the biographies of Albania’s transition leaders to confirm that Albania did little vis-à-vis with the past. What Albania offered is simply political vengeance.

Albania’s post-communist justice is about the selective destruction of the past, not an attempt to deal with it... From 1991 to 1997, when a few attempts were made, the process was disorganized, politicized and unsuccessful... There were huge purges of the public administration in the aftermath of the victory of the anti-communist Democratic Party in March 1992 and there were

* All references to Kosovo, whether to the territory, institutions or population, should be understood in full compliance with United Nations Security Council Resolution 1244.

⁹ "Rajoni" magazine, <https://gazetarajoni.com/shqipshqiptari-i-vetëm-ne-planet-qe-guxoi-dhe-i-tha-te-verteten-e-nver-h-oxhes-po-vr-et-popullin-po-i-kthen-ne-skill-ever/>, 28 October 2021

¹⁰ Pllumi, At Zef, “Rrno vetëm për me tregue”, Printing House "55", 2006 edition, pg. 35

again huge purges of the public sector after the Socialist Party (former communists) won the elections in 1997. This cannot be considered lustration as it is entirely consistent with Albania's twentieth century political culture, which has always left open the door to be a hero one day and a traitor the next. This process was heavily influenced by political vengeance"¹¹.

From another perspective, Gjergj and Mirela Sinani state that "Even 30 years after Albania embraced the democratic system, our state institutions, which claim to be democratic, continue to display a serious lack of attention, consideration or support for scientific research in truth-seeking about the communist crime against the Albanian people. We note that as soon as facts about the communist crimes resurface and once an ordinary discourse is raised to understand a certain situation, a whole propaganda army is mobilized against it under the disguise of objective criticism. Indeed, this is a traditional method used during the dictatorship to discourage dignified research-driven scholars and this is one of the reasons why very few researchers stick to this field of research... We note a meagre state interest in listening to and understanding the discovered facts, let alone making them available to the public opinion"¹².

The authors Austin and Ellison make accurate and interesting reasoning on this mentality trend of the new post-communist political elite in Albania. They write: "In the first place, Albania had no dissident movement. Albania was only developing a dissident movement when collapse finally came. The anti-communist leaders and reformist-minded communists that emerged in 1990 and 1991 all had relatively solid communist credentials. Like in Romania, we see elite reproduction, not elite replacement. That said, very few were willing to dig too deeply into the past and even fewer had any reason to call for a complete opening of the police files. However, they all had to work extra hard to prove their anti-communist credentials. The result was a highly politicized quest for justice"¹³.

For this reason, the Albanian post-communist left-wing parties either kept silent about the communist crimes, or tried to bypass or reduce such crimes using phrases like "that was the time and law back then", etc. In holding these views, they were probably influenced by a not-so-open pragmatism that implied that the complicated issues of the former politically persecuted were temporary and would naturally wane off together with the persecuted generation during human

¹¹ Robert C. Austin and Jonathan Ellison, "Transitional Justice in Eastern Europe and the For-mer Soviet Union", ed. Lavinia Stan, Routledge, 2009, pg. 176

¹² AIDSSH, "Profile të 'Armikut të popullit' në diktaturë, ["Profiles of the 'enemy of the people' under the dictatorship"], pg. 156-157

¹³ Robert C. Austin and Jonathan Ellison, "Transitional Justice in Eastern Europe and the For-mer Soviet Union", ed. Lavinia Stan, Routledge, 2009, pg. 180

life and forgetfulness. The left-wing stand also relied on its interest in power that made it unwilling to lose votes from traditional supporters. For this reason, once in power by late 1990, the left-wing granted several amnesties to those few old communist elite leaders who received light sentences from transitional justice.

The post-communist right-wing displayed its lacking political will in another form. Perhaps for lack of experience and knowledge in the transitional justice area, it initially expressed its public idea that all Albanians were “jointly perpetrators and victims” of the past communist regime, which caused disappointment among the politically persecuted and their families. In later years, the right-wing government adopted the above-mentioned laws related to the transitional justice and initiated the rehabilitation and compensation for the politically persecuted, but the process moved very sluggishly and was marred by clientelist interests of the politics. There was even no attempt to condemn the politically driven genocide of the communist dictatorship, while trials against the old communist leaders held them accountable under economic charges only.

It was precisely these general circumstances related to the insufficient process of establishing transitional justice in Albania that have strongly influenced as a major cause in keeping this serious issue unresolved, both in terms of justice and human redemption for the politically persecuted people who disappeared during the communist regime. It continues to be a very troubling problem even today, after thirty years of a pluralist democratic society, manifesting itself in a slowdown in the search, finding and identification of the victims of the genocide of the communist dictatorship. Consequently, “Albania’s incapacity to implement comprehensive transitional justice measures has maintained, if not amplified, the polarization of Albanian society over the totalitarian past”¹⁴.

Major future challenges

Recently, Frédérique Hanotier, Human Rights Officer at the EU Delegation to Albania, commended the ICMP report on missing persons under the communist era in Albania saying, “The EU is strongly committed to supporting transitional justice in Albania, and in particular the Authority [AIDSSH, author’s note, T. Starova] through ICMP. Raising public awareness about reconciliation and addressing the issue of persons missing from the communist era is of the utmost importance.”¹⁵

¹⁴ Gjeta, Altin, “Transition without justice in post-communist Albania: Its implications to collective memory building and democracy promotion”, OSCE, Justice and Transformation in Albania, 2020 edition, pg. 17

¹⁵ ICMP Report, Press Release, 2 March, 2021

Based on this research and the extensive literature and documents reviewed, we believe that Albania probably needs to finally address some major challenges in the field of transitional justice:

- Condemn by law all the communist crimes and their perpetrators, through the adoption of a law by extensive cross-party consensus.
- Set up an inter-institutional co-ordination structure to follow up on the resolution of all the transitional justice issues.
- Review and improve the law on access to former State Security files to eliminate any impediments or untruths related to them.
- Promote and support scholars to engage in research on the former State Security files and shed light on the untold truths about violations committed and plotted by the communist regime.¹⁶
- Launch a significant undertaking to revise the history textbooks so that younger generations comprehend and do not forget the tragic truth of the communist dictatorship.
- Provide state support to historians in shedding light on important historical events and figures in the Albanian history that have been overlooked or misjudged or hindered by the communist dictatorship.
- Build an important monument dedicated to the victims of the communist dictatorship to serve as a meaningful act of historical collective memory for the Albanian people and, especially, for the younger generations.

BIBLIOGRAPHY

AIDSSH, “Profile të ‘Armikut të Popullit’ në diktaturë”, Tiranë, 2021.

AIDSSH, “Udhërrëfyes” Për të drejtat e familjarëve të personave të zhdukur gjatë periudhës së komunizmit, bot. 2021.

AIDSSH, “Sigurimi dhe shkencëtarët”, Sh. Botuese Onufri, 2021. AIDSSH, “E vërteta e inxhinierëve të kënetës së Maliqit”, 2019,

Ed. Olivera Simiç, “An Introduction to Transitional Justice”, Routledge, 2017.

Almanak [Almanac] (Volume 1), 2014 Tiranë: Author. Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit,

Bernhard, M., & Kubik, J. (Eds.). (2014). Twenty years after communism: The politics of memory and commemoration. New York, NY: Oxford University Press.

Butka, U. (1993, January 20). Ligji i pafajësisë: Një fitore tjetër e demokracisë [Innocence law: Another victory of democracy].

¹⁶ Authority for Information on Former State Security Files [AIDSSH], “Kërkimi shkencor”, [“Research”], brochure, 2019 edition

- Kopeček, M. (2011). The rise and fall of Czech post-dissident liberalism after 1989, *East European Politics and Societies: and Cultures*, 25(2), 244–271.
- Mink, G. (2017). Is there a new institutional response to the crimes of communism? National memory agencies in post-communist countries: The Polish case (1998– 2014), with references to East Germany. *Nationalities Papers*, 45(6), 1013–1027.
- OSCE, “Justice and transformation in Albania”, bot. 2020.
- Pervizi, L. (2014). Në rrathët e ferrit: Album [In the circles of inferno: Album of drawings]. Tiranë: Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit.
- Pllumi, At Zef, “Rrno vetëm për me tregue”, Sh. Botuese 55, bot. 2006.
- “Profile të ‘Armikut të Popullit’ në diktaturë”, Konferencë ndërkombëtare e organizuar nga AIDSSH, Sh. Botuese Onufri, 2021.
- Saraçi, F. (2017). Kalvari i grave në burgjet e komunizmit [The suffering of women in communist prisons]. Tiranë: Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit.
- “Transitional Justice in Eastern Europe and the Former Soviet Union”, ed. Lavinia Stan, Routledge, 2009.
- Zërat e Kujtesës [Voices of Memory] (Volume 1). Tiranë: Author. Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit. (2015, January 31). Spaç
- Zërat e Kujtesës [Voices of Memory] (Volume 2). Tiranë: Author. Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit. (2016).
- Zërat e Kujtesës [Voices of Memory] (Volume 3). Tiranë: Author. Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit. (2017).
- Zërat e Kujtesës [Voices of Memory] (Volume 4). Tiranë: Author. Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit. (2019, February 27). Virtual museum: Tepelena Camp
- Xhomaqi, E. (2017). Përtej harrimit [Beyond oblivion]. Tiranë: Instituti i Studimeve për Krimet dhe Pasojat e Komunizmit

PHYSIOLOGICAL STUDY FOR EFFECTING OF RADON GAS ON ESTROGEN
LEVEL OF FEMALE RATS

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Abstract

In this work, the physiological effect of radon gas (radon-222) on change in estrogen level in females' rats at different time period of exposure. Time periods were 4-day, 8-day, 12 day, and 16 days. The work was done on 25 animals of aged (8-12) weeks and the weight of (132-208) gm. Rats were divided into five groups which it is first group (control group), second group (exposure for 4 days), third group (exposure for 8 days), fourth group (exposure for 12 day), and five group (exposure for 16 day). The results show that there is significant decrease ($p>0.05$) in radiation groups and control groups for estrogen levels (Pg/mL) in five groups 0.92 ± 0.08 , 0.97 ± 0.19 , 0.99 ± 0.19 , 0.98 ± 0.17 , and 1.31 ± 0.09 , respectively. So, it may be concluded the radon gas at different time exposure was affected on estrogen levels in female rats.

Keyword: physiological parameters, estrogen, female rats and radon gas.

1. Introduction

Radon gas is a radioactive gas that is inert, colorless, tasteless, and odourless. It is also known as the "invisible or silent killer". Radon contains three isotopes ^{222}Rn , ^{220}Rn , and ^{219}Rn (Rühle et al., 2017). Radon in itself does not pose a health hazard because it penetrates into a non-reactive gas, however, when radon and its short-lived decay products are inhaled, the alpha particles released by the deposited decay products account for the majority of the radiation dosage to lung tissue, can harm sensitive lung cells, especially those attached to small aerosols, or are in unattached form, raising the risk of cancer. what part of the radon progeny will enter the blood into the lungs and radiate the whole human body (Gaisberger et al., 2021). Indoor radon exposure accounts for the largest proportion of the radiation dose received by the general public (Maier et al., 2021). Therefore, one of the most important and dangerous dangers of ionizing radiation is continuous and prolonged exposure to radon gas, whether in homes or workplaces. Radon acts mainly as the source of its decay outcome, which actually delivers the dosage to the lungs; however, as a convenient abbreviation, the health effects of radon decay products are often referred to as the health effects of radon (Abojassim *et al.*, 2021). Numerous types of non-ionizing and ionizing radiations and both have recognized causative influences on infertility. Other health effects have been studied but there is no conclusive evidence at present concerning radon-induced health effects other than lung cancer (Abojassim et al., 2021). Estrogen, one of the first hormone substances identified, was thought to have only female-selective activities important in female reproduction. We now know, however, that estrogen is also involved in male reproduction and in numerous other systems including the neuroendocrine, vascular, skeletal, and immune systems of both males and females. Estrogen influences many physiological processes, as it is also implicated in many different diseases including obesity, metabolic disorder, a variety of cancers, osteoporosis, lupus, endometriosis, and uterine fibroids (Burns and Korach, 2012). Estrogen works through several possible cellular mechanisms to mediate its biological responses. Therefore, the aim of this research is to study the effect of four period time exposure (4, 8, 12, and 16 day) of radon gas on the estrogen levels for female Albino rats.

2. Materials and methods:

2.1. Preparing laboratory animals

The study included (25) female albino Swiss Rat belonging to the (Bulb/C) breed, whose ages ranged between (8-12) weeks, and their average weight was between (132-208) grams. Animals were used after confirming their fertility for the purpose of conducting fertility testing and the

animals were obtained from the animal house in the Faculty of Science / University of Kufa. The animals were introduced into the animal house at the Faculty of Science / University of Kufa and placed in plastic cages with their own mesh covers and the floor of the cages were furnished with sawdust and were changed weekly and the animals were placed under appropriate laboratory conditions where the temperature ranged between (21 - 30) C and at a fixed lighting system at the rate of (13) hours of light and (11) hours of darkness. The animals were constantly given water and food in blackberry form and according to need, and were obtained from specialized agricultural shops in Kufa.

2.2. Irradiation Source and Radon detector

Radium-226 has been used for samples irradiation of the female rates samples. Radium-226 source was produced in 2009 and has activity 6600 Bq. This source consists of a container containing a rod, where the radioactive nucleus releases the radon gases.

One of the more sensitive polymeric plastics, the CR-39 nuclear track detector sheets is the most commonly used in radionuclides measurement that producing α -particles such as radon gases, and has a small size, simplicity, and durability (Hamzah *et al.*, 2022). The CR-39 abbreviation for the Columbia Resin No. 39 detector. Chemical structure for CR-39 is C₁₂ H₁₈ O₇. Each detector was assigned a unique code in order to differentiate them. TASTRAK Analysis System, Ltd., UK: TASTRACK sold the detector CR-39. A CR-39 detector sheet had dimensions of 2.5cm×2.5cm, a thickness of 1mm, and a code for each sheet that suited the TASL image system. The sheet has a density of almost 1.32 grams per cubic meter.

2.3. Measurements of Estrogen

This ELISA group used the ELISA competitive principle. The small ELISA panel available in this kit is pre-coated with E2. During the reaction, E2 in the samples or standard competes with a fixed amount of E2 on the solid phase supporter for sites on the biotinylated. Detection antibody specific for E2. Excess conjugate and unbound sample or standard were washed from the plate, Avidin conjugated to Horseradish peroxidase (HRP) are added successfully to each micro plate well and incubated. Then TMB substrate solution is added to each well. The enzyme substrate reaction is terminated by the addition of the stop solution and the color change is measured. The optical density (OD) is measured spectrophotometrically at a wavelength of 450 nm +- 2 nm. The concentration of E2 in the samples is then determined by comparing the OD of the samples to the standard curve.

2.4. Calculations

1. The standard curve is used to determine the amount of specimen.

2. Average the duplicate readings for each standard control and sample.
3. As an alternative, . Build a standard curve by scanning the average absorption of each criterion on the y-axis versus focusing on the x-axis and draw a best-fitting curve through the points on the graph
4. The data can be linear by plotting the E2 concentration record against the OD record and the best fit line can be determined by regression analysis. This action will result in sufficient but less accurate fit of the data. If the samples are diluted, the concentration read from the standard curve should be multiplied by the dilution factor.
5. This standard curve is provided for demonstration only. A standard curve should be generated for each set of samples assayed.

2.5. Experimental Design

The rats kept in animal house for acclimation to laboratory condition for two weeks before they were used for the experiment. Then, animals were placed in plastic cages that it is contains of irradiation source (by radon gas) as seen in Figure (1). Each group was formed 5 ats and the Rats exposed by radon gas (^{222}Rn) at different doses which depend on the variable period time. The values of dose exposure of radon gas in control groups, group 1(4 day), group 2(8day), group 3(12 day), and group 4(16 day) were 0 Bq/m^3 , 588.51 Bq/m^3 , 714.62 Bq/m^3 , 756.66 Bq/m^3 , and 840.73 Bq/m^3 , respectively.

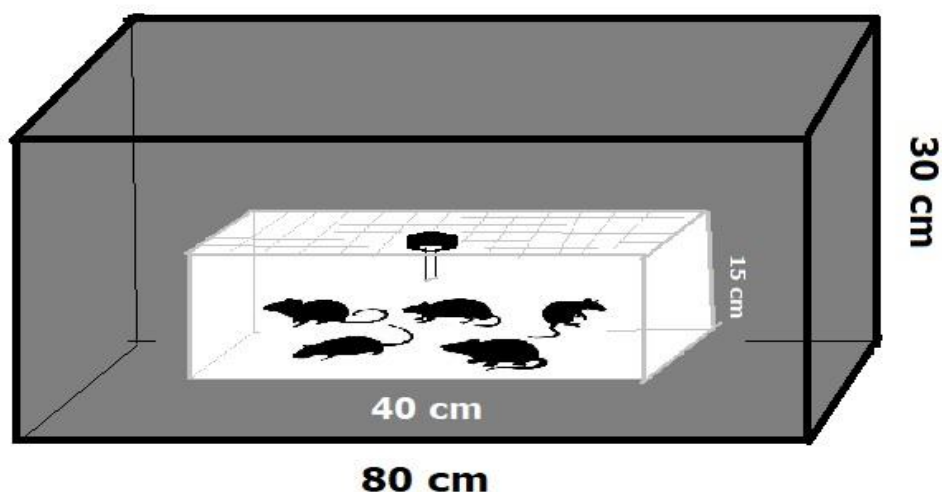


Figure (1): Diagram of house of Irradiation for animals in the present study using radon source.

3. Result

The results of Table (1) indicate that there is significant decrease ($p>0.05$) in radiation groups and control groups for estrogen levels (0.92 ± 0.08 , 0.97 ± 0.19 , 0.99 ± 0.19 , 0.98 ± 0.17 , 1.31 ± 0.09 , 1.31 ± 0.09 , 1.31 ± 0.09 , 1.31 ± 0.09) respectively.

Table (1): Demographic of estrogen in control groups, radiation groups.

	Estrogen (Pg/mL)	
	Control	RAD
4 days	1.31 ± 0.09	0.92 ± 0.08
8 days	1.31 ± 0.09	0.97 ± 0.19
12 days	1.31 ± 0.09	0.99 ± 0.19
16 days	1.31 ± 0.09	0.98 ± 0.17
LSD	0.17	0.308
p-value	1.000	0.963

Discussion

Estrogen one of the essential ovarian hormones and controls numerous phases of female reproduction, for example, estrus behavior, the increase in serum gonadotropin concentrations, ovulation, uterine propagation, and endometrial gland secretion (E. Tokunaga *et al.*, 2014, K. J. Hamilton *et al.*, 2014).

As shown in Table (1). RAD administration caused a down estrogen level in blood as compared with control groups. The high effect of radon gas was with 588.51 Bq/m^3 of 4 days. These study agreement with previous studies such as Mahmoud *et al.*, 2020. Study showed that radiation cause down estrogen level. The current had reports about the effect of EMR exposure on female reproductive tract in human (Nazıroğlu *et al.*, 2013) and animals (Kismali *et al.*, 2012).

Conclusion

Radon gas cause effected in estrogen level in female rats, it is found estrogen level decreased with increasing of radon concentrations. Very high levels of radon gas exposure can affect on estrogen level change in female rats for many years or permanently. So, it is clear from this study the exposure to high levels of radon gas affect fertility and may be causing infertility.

References

- Abojassim, A. A. (2021). Radiological risk assessment of radon gas in bricks samples in Iraq. *Journal of Nuclear Engineering and Radiation Science*, 7(3).
- Burns KA, Korach KS, 2012. Estrogen receptors and human disease: an update. *Archives of toxicology* 86, 1491–1504.
- Dehghan T, Mozdarani H, Khoradmehr A, Kalantar SM.(2016) Effects of gamma radiation on fetal development in mice. *Int J Reprod Biomed (Yazd)*.14(4):247–54.
- Gaisberger, M.; Fuchs, J.; Riedl, M.; Edtinger, S.; Reischl, R.; Grasmann, G.; Hölzl, B.; Landauer, F.; Dobias, H.; Eckstein, F.; et al.(2021). Endogenous anandamide and self-reported pain are significantly reduced after a 2-week multimodal treatment with and without radon therapy in patients with knee osteoarthritis: A pilot study. *Int. J. Biometeorol.*, 65, 1151–1160.
- Hamilton, K. J., Arao, Y., & Korach, K. S. (2014). Estrogen hormone physiology: reproductive findings from estrogen receptor mutant mice. *Reproductive biology*, 14(1), 3-8.
- Hamzah, Z. S., Hashim, A. K., & Abojassim, A. A. (2022). Assessment of Annual Effective Dose and Excess Lifetime Cancer Risk in Grain Samples Collected from Kerbala Governorate, Iraq. *Iranian Journal of Science and Technology, Transactions A: Science*, 1-10..
- Kismali, G., Ozgur, E., Guler, G., Akcay, A., Sel, T., & Seyhan, N. (2012). The influence of 1800 MHz GSM-like signals on blood chemistry and oxidative stress in non-pregnant and pregnant rabbits. *International Journal of Radiation Biology*, 88(5), 414-419.
- Mahajan N.(2015). Fertility preservation in female cancer patients: an overview. *J Hum Reprod Sci.*;8(1):3–13.
- Mahmoud, E., Diab, A., Ibrahim, M., & Bedeer, S. (2020). Effect of Exposure to Electromagnetic Radiation on Sex Steroids and Systemic & Local Uterine Redox Status during Early and Late Pregnancy in Rats. *Zagazig University Medical Journal*, 26(1), 186-195.
- Maier, A.; Wiedemann, J.; Rapp, F.; Papenfuß, F.; Rödel, F.; Hehlhans, S.; Gaipf, U.S.; Kraft, G.; Fournier, C.; Frey, B.(2021). Radon Exposure—Therapeutic Effect and Cancer Risk. *Int. J. Mol. Sci.* 2021, 22, 316.
- Marci R, Mallozzi M, Di Benedetto L, Schimberni M, Mossa S, Soave I, et al.(2018). Radiations and female fertility. *Reprod Biol Endocrinol.*; 16(1): 112.
- Milgrom SA, Vargas HA, Sala E, Kelvin JF, Hricak H, Goodman KA.(2013). Acute effects of pelvic irradiation on the adult uterus revealed by dynamic contrast-enhanced MRI. *Br J Radiol.*;86:20130334.
- Nazıroğlu, M., Yüksel, M., Köse, S. A., & Özkaya, M. O. (2013). Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. *The Journal of membrane biology*, 246, 869-875.
- Rodriguez-Wallberg KA, Oktay K.(2014). Fertility preservation during cancer treatment: clinical guidelines. *Cancer Manag Res.*;6:105–17.
- Rühle, P.F.; Wunderlich, R.; Deloch, L.; Fournier, C.; Maier, A.; Klein, G.; Fietkau, R.; Gaipf, U.S.; Frey, B.(2017). Modulation of the peripheral immune system after low-dose radon spa therapy: Detailed longitudinal immune monitoring of patients within the RAD-ON01 study. *Autoimmunity*, 50, 133–140.
- Tang M, Webber K.(2018). Fertility and pregnancy in cancer survivors. *Obstet Med.*;11:110–15.
- Teh WT, Stern C, Chander S, Hickey M.(2014). The impact of uterine radiation on subsequent fertility and pregnancy outcomes. *Biomed Res Int.*;2014:482968.

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Turkish Republic of Northern Cyprus, April 28-30, 2023

- Tokunaga, E., Hisamatsu, Y., Tanaka, K., Yamashita, N., Saeki, H., Oki, E., ... & Maehara, Y. (2014). Molecular mechanisms regulating the hormone sensitivity of breast cancer. *Cancer science*, 105(11), 1377-1383.
- Xuexian Pei, Qijun Gu, Dongdong Ye, Yang Wang, Xu Zou, Lianping He, Yuelong Jin and Yingshui Yao (2015). Effect of computer radiation on weight and oxidant-antioxidant status of mice, *Original / Investigación animal, Nutr Hosp.*31(3):1183-1186.

SYNTHESIS AND CHARACTERIZATION OF MG-NI NANOSIZED SPINAL FERRITE

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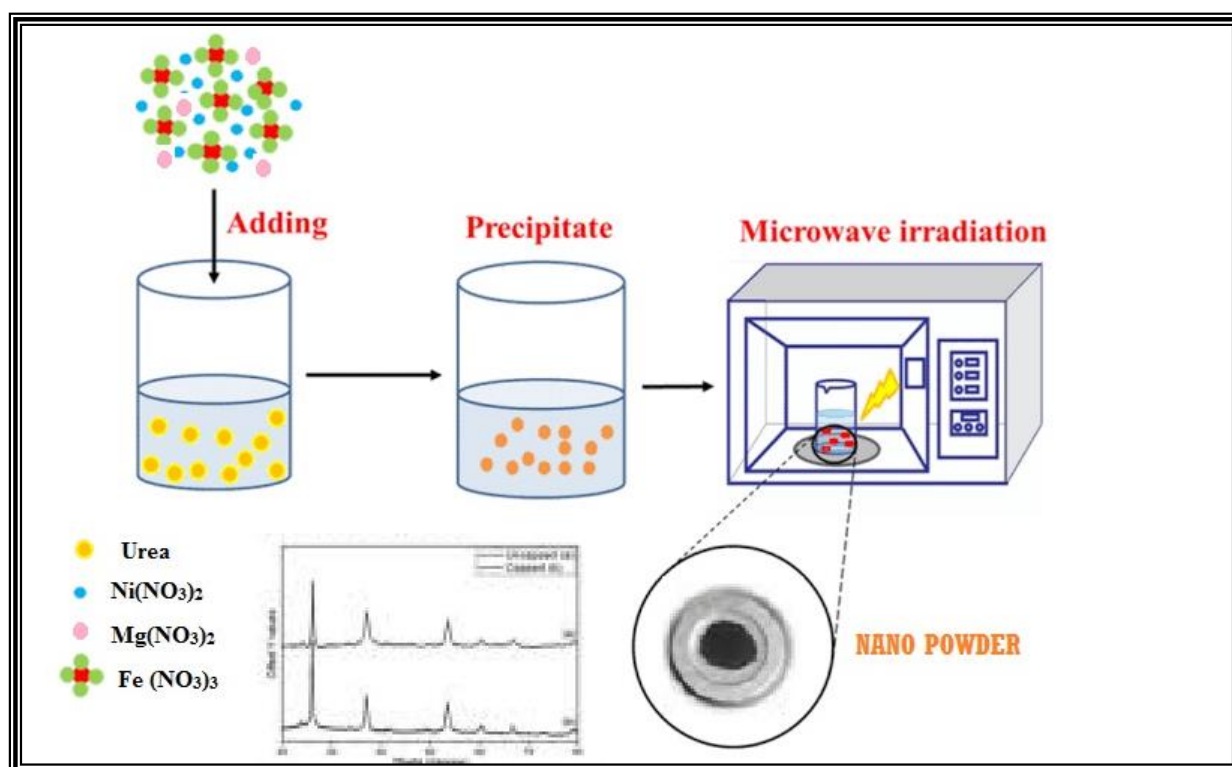
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Abstract: - In this current work, the numerous goals are to urge prepared NiFe₂O₄ and Mg NiFe₂O₄ mineral primary solid solution nanoparticles through a basic, practical, and greener methodology and to boot do a nitty-gritty characterization of NiFe₂O₄ and MgNiFe₂O₄ mineral primary solid solution nanoparticles. Along these lines, NiFe₂O₄ and Mg NiFe₂O₄ nanoparticles were prepared by an organic compound interceded sol-gel ignition strategy.



Keywords: - Nanoparticles, Characterization, Nanocomposites

Introduction

The nanoparticles embody the particles having size between one and one hundred nm. These particles have totally different properties at their atomic level because of their size. This modification in properties of nanoparticles is helpful in several fields [1, 2]. Engineering is one amongst the foremost fascinating fields for researchers since the last century. Numbers of developments are created since then within the field of engineering. Nanoparticles will be classified as metal nanoparticles, non-metal ceramic nanoparticles and semiconductor nanoparticles [3]. Nanoparticles have those chemical and physical properties that make them terribly totally different from that of the corresponding bulk materials because of their tiny size and enormous surface to volume quantitative relation. They attract abundant attention as a result of their potential applications in several fields together with optics, electronics, magnetism, ceramics, and chemical change [4].

Spinel solid solution nanoparticles have received an excellent potential within the wide selection of applications like data storage, electronic devices to medical specialty, drug delivery, super capacitors, anode materials for lithium-ion batteries, and microwave- and radar-absorbing material. [4-5] Nickel solid solution (NiFe_2O_4) is one amongst the vital candidates among the mineral solid solution family as a result of its application in microwave, electronic, magnetic, and chemistry devices. [6] It exhibits an occasional coercivity, eddy and physical phenomenon loss; so, it's helpful for electronic devices like telecommunications and high-frequency devices. [7] Nickel and metallic element solid solution is extensively used in variety of electronic devices because of their high porousness at high frequency, exceptional high electrical electric resistance, mechanical hardness, chemical stability and affordable cost [8]. NiFe_2O_4 may be a documented inverse mineral with Ni^{2+} at octahedral [B-site] and Fe^{3+} ions distributed equally in tetrahedral (A-site) and octahedral sites [B-site] [9]. Metallic element solid solution (MgFe_2O_4) is one amongst the foremost vital ferrites. It has a spinel structure of traditional spinel-type and may be a soft magnetic n-type conductor, that finds variety of applications in heterogeneous chemical change, adsorption, sensors, and in magnetic technologies [10]. Recently, nanostructures of magnetic materials have received a lot of and a lot of attention because of their novel material properties that are unit considerably totally different from those of their bulk counterparts [11-15]. It's been additionally detected that the electromagnetic radiation absorption capability of mineral solid solution nanoparticles depends on its structural characteristics like crystallinity, particle size, ion distribution, morphology, dopant ions, etc. [16] consequently, goodish efforts are dedicated to prepare mineral solid solution nanoparticles by numerous chemical synthesis

techniques like co-precipitation, hydrothermal/ solvothermal methodology, microwave-assisted synthesis, microemulsion methodology, sonochemical synthesis, sol-gel combustion methodology, etc. [17-19]

Among numerous chemical synthesis approaches, the sol-gel combustion methodology has numerous blessings like a speedy synthesis approach, formation of high-purity product, unvaried composition and stabilization of stability phases, low energy consumption, and an easy, economic, and ascendible synthesis methodology. [20-21]

In this gift work, the foremost objective is to arrange MgNiFe₂O₄ mineral solid solution nanoparticles via an easy, efficient and greener approach and to additional perform a close investigation on the impact of size of MgNiFe₂O₄ mineral solid solution nanoparticles. Therefore, MgNiFe₂O₄ nanoparticles were ready by organic compound from the microwave mediate combustion methodology. To the simplest of the authors' data, this can be the primary report on the synthesis of MgNiFe₂O₄ nanoparticles by urea from the microwave mediate combustion methodology.

Experimental

(i) Synthesis of Magnesium doped nickel ferrite

Magnesium doped nickel ferrite were synthesized by sol-gel microwave auto-combustion technique using urea as fuel. Magnesium nitrate, Nickel Nitrate, Iron nitrate and urea were weighed and mixed in double distilled water and mixed together. The solution was stirred continuously and heated on magnetic stirrer at 80⁰C till a gel is obtained. The gel was then fired in a microwave oven so that a floppy ash was obtained which then ground in a mortar pestle for four hours to get fine powder. This powder was then calcined at 800⁰C.

(ii) Synthesis of nickel ferrite

Nickel ferrite was synthesized by sol-gel microwave auto-combustion technique using urea as fuel. Nickel Nitrate, Iron nitrate and urea were weighed and mixed in double distilled water and mixed together. The solution was stirred continuously and heated on magnetic stirrer at 80⁰C till a gel is obtained. The gel was then fired in a microwave oven so that a floppy ash was obtained which then ground in a mortar pestle for four hours to get fine powder. This powder was then calcined at 800⁰C.

Results and Discussion

1. XRD Analysis

X-ray diffraction patterns of $\text{MgNiFe}_2\text{O}_4$ and NiFe_2O_4 one spinel ferrite nano- particles are shown in Figure 1 and 2.

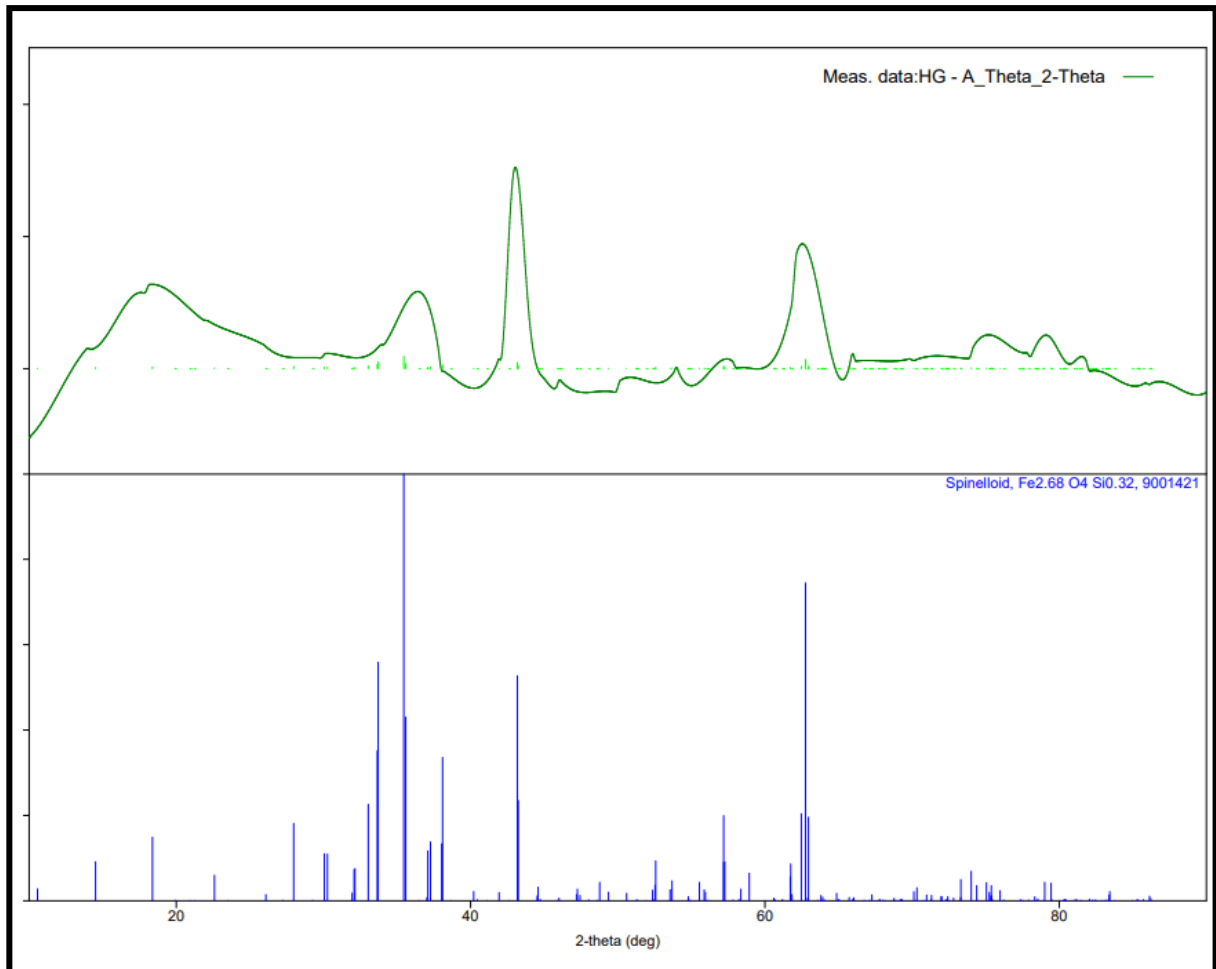


Figure 1: X-ray diffraction pattern of $\text{MgNiFe}_2\text{O}_4$

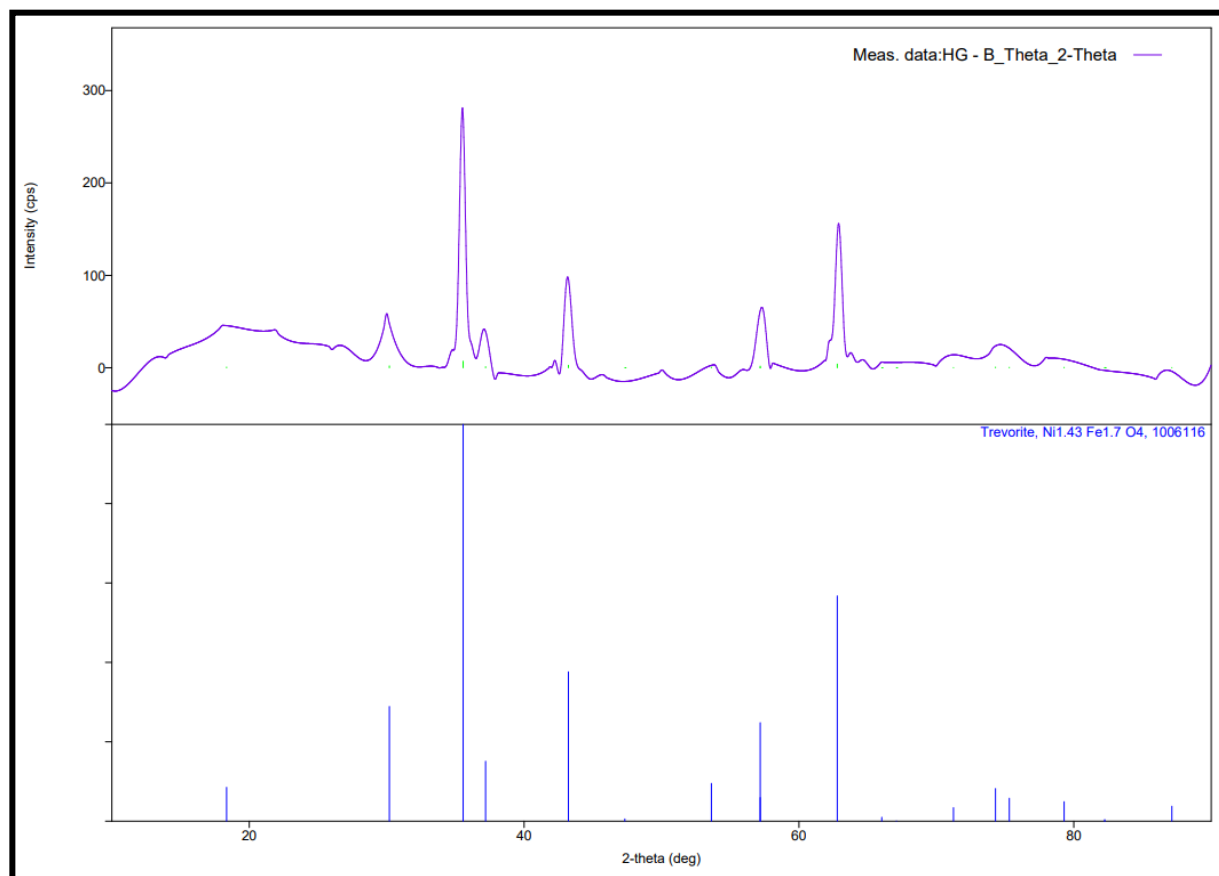


Figure 2: X-ray diffraction pattern of NiFe₂O₄

The XRD patterns well match all the characteristic reflections of cubic spinel structure without any extra peaks therefore the structure is single phase. From the survey of literature, we found that the goodness values of our Rietveld refined sample have the good agreement with the reported values in previous literature. Figure 1 and 2 shows the typical Rietveld refined of X-ray pattern for sample $x = 1$, and one respectively.

FTIR analysis

Fourier transform infrared (FTIR) spectra of the samples were recorded in the frequency range 400–4000 cm^{-1} at room temperature and are shown in the Figure 3. Two absorption frequency bands ν_1 and ν_2 are the characteristic bands of the spinel ferrites corresponding to stretching vibration of metal cation (Me) – oxygen anion (O_2^-) bond in tetrahedral and octahedral sites. The stretching vibrations of higher frequency band, ν_1 corresponds to tetrahedral site and stretching vibrations of lower frequency band ν_2 corresponds to octahedral site. Broad absorption peak around 3435.22 ($\text{MgNiFe}_2\text{O}_4$), 3493.03 (NiFe_2O_4) cm^{-1} and somewhat less broad absorption peak around 1450.43 ($\text{MgNiFe}_2\text{O}_4$), 1514.12 (NiFe_2O_4) cm^{-1} in all the samples corresponds to stretching and bending vibration of O-H interacting via H-bond expected due to absorbed water molecules on the surface [22].

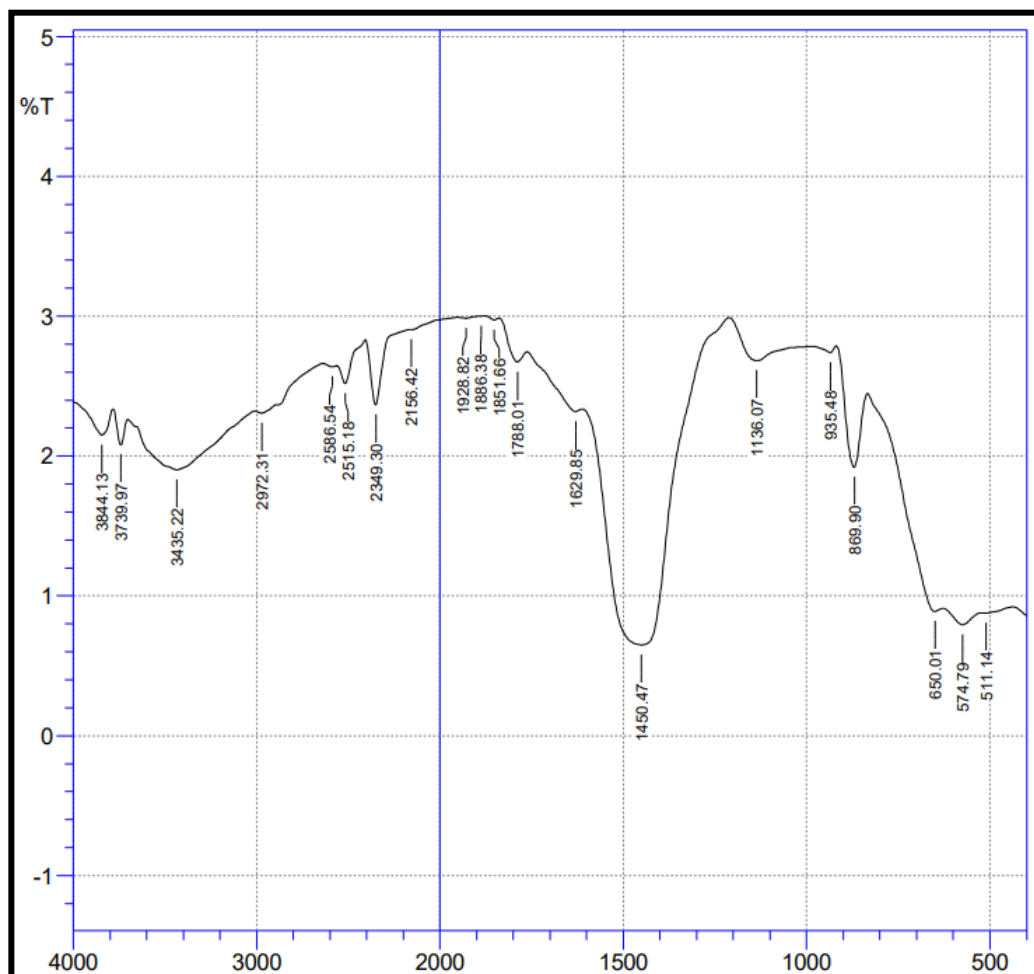


Figure 3: FTIR pattern of MgNiFe₂O₄

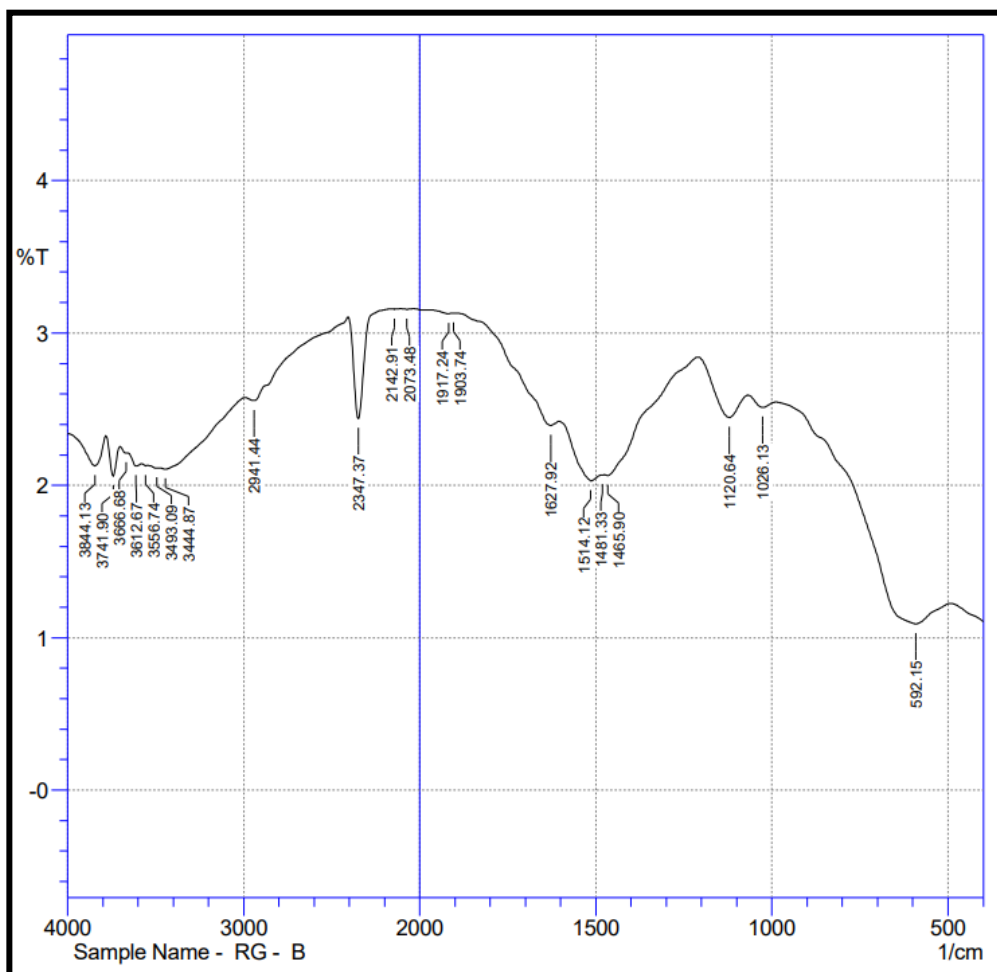


Figure 4: FTIR pattern of NiFe₂O₄

Conclusions

Magnesium substituted Nickel Ferrite, MgNiFe₂O₄ and MgNiFe₂O₄ were synthesized by sol-gel auto-combustion technique with microwaves using urea as fuel. The superparamagnetic nanoparticles of size 11–23 nm was synthesized successfully by solgel microwave assisted auto combustion method. The small coercivity and squareness ratio and non-saturation of the samples at even at high applied magnetic fields indicates that the most of the nanoparticles even if not all, are superparamagnetic in nature. The various properties of these nanoparticles studied indicates that they can be of potential applications use in many applied fields like MRI contrast agent, magnetic drug delivery and magnetic hyperthermia, data storage, sensors and catalysts.

References

- [1] Yang C, Li W, Yang Z, Gu L, Yu Y. Nanoconfined antimony in sulfur and nitrogen co-doped three-dimensionally (3D) interconnected macroporous carbon for high performance sodium-ion batteries. *Nano Energy*. 2015; **18**:12-19.
- [2] Pan D, Wang S, Zhao B, Wu M, Zhang H, Wang Y, et al. Li storage properties of disordered graphene nanosheets. *Chemistry of Materials*. 2009; **21**:3136-3142.
- [3] Shao Y, Xiao J, Wang W, Engelhard M, Chen X, Nie Z, et al. Sodium ion insertion in hollow carbon nanowires for battery applications. *Nano Letters*. 2013; **13**:3909-3914.
- [4] Kaskhedikar NA, Maier J. Lithium storage in carbon nanostructures. *Advanced Materials*. 2010; **21**:2664-2680.
- [5] Zhang, J.; Zhang, Y.; Wu, X.; Ma, Y.; Chien, S.-Y.; Guan, R.; Zhang, D.; Yang, B.; Yan, B.; Yang, J. Correlation between Structural Changes and Electrical Transport Properties of Spinel ZnFe₂O₄ Nanoparticles under High Pressure. *ACS Appl. Mater. Interfaces* 2018, 10, 42856–42864.
- [6] Shirsath, S. E.; Liu, X.; Assadi, M. H. N.; Younis, A.; Yasukawa, Y.; Karan, S. K.; Zhang, J.; Kim, J.; Wang, D.; Morisako, A.; Yamauchi, Y.; Li, S. Au quantum dots engineered room temperature crystallization and magnetic anisotropy in CoFe₂O₄ thin films. *Nanoscale Horiz.* 2019, 4, 434–444.
- [7] Manikandan, V.; Mirzaei, A.; Vigneselvan, S.; Kavita, S.; Mane, R. S.; Kim, S. S.; Chandrasekaran, J. Role of Ruthenium in the Dielectric, Magnetic Properties of Nickel Ferrite (Ru–NiFe₂O₄) Nanoparticles and Their Application in Hydrogen Sensors. *ACS Omega* 2019, 4, 12919–12926.
- [8] Ishino K & Narumiya Y, *Ceram Bull* 66(1987)1469.
- [9] Zhou Z H ,Xue J M,Wang J, Chan H S O,Yu T & Shen Z X,*J Appl Phys*,91 (2002) 6015.
- [10] R.J. Willey, P. Noirclerc, G. Busca, *Chem. Eng. Commun.* 123, 1 (1993). doi:10.1080/00986449308936161.
- [11] S. Choi, M.H. Chung, *Semin. Integr. Med.* 1, 53 (2003) .
- [12] Z. Lai, G. Xu, Y. Zheng, *Nanoscale Res. Lett.* 2, 40 (2007). doi:10.1007/s11671 006-9027-3
- [13] S.A. Corr, Y.P. Rakovich, Y.K. Gun'ko, *Nanoscale Res. Lett.* 3,87 (2008). doi:10.1007/s11671-008-9122-8
- [14] S. Wang, Y. Zhou, W. Guan, B. Ding, *Nanoscale Res. Lett.* 3,289 (2008). doi:10.1007/s11671-008-9151-3
- [15] W. Wu, Q. He, C. Jiang, *Nanoscale Res. Lett.* 3, 397 (2008). doi:10.1007/s11671-008-9174-9.
- [16] Shirsath, S. E.; Jadhav, S. S.; Patange, S. M.; Jadhav, K. M.; Toksha, B. G. Influence of Ce⁴⁺ Ions on the Structural and Magnetic Properties of NiFe₂O₄. *J. Appl. Phys.* 2011, 110, No. 013914. Yang, Y.; Li, M.; Wu, Y.; Zong, B.; Ding, J. Size-dependent microwave absorption properties of Fe₃O₄ nanodiscs. *RSC Adv.* 2016, 6, 25444–25448.
- [17] Yan, A.; Liu, X.; Yi, R.; Shi, R.; Zhang, N.; Qiu, G. Selective Synthesis and Properties of Monodisperse Zn Ferrite Hollow Nanospheres and Nanosheets. *J. Phys. Chem. C* 2008, 112, 8558-8563.
- [18] Ayyappan, S.; Philip, J.; Raj, B. Effect of Digestion Time on Size and Magnetic Properties of Spinel CoFe₂O₄ Nanoparticles. *J. Phys. Chem. C* 2009, 113, 590–596.
- [19] Winiarska, K.; Szczygieł, I.; Klimkiewicz, R. Manganese–Zinc Ferrite Synthesis by the Sol–Gel Autocombustion Method. Effect of the Precursor on the Ferrite's Catalytic Properties. *Ind. Eng. Chem. Res.* 2013, 52, 353–361.
- [20] Liu, C.; Zou, B.; Rondinone, A. J.; Zhang, Z. J. Reverse Micelle Synthesis and Characterization of Superparamagnetic MnFe₂O₄ Spinel Ferrite Nanocrystallites. *J. Phys. Chem. B* 2000, 104, 1141-1145.

- [21] Toksha, B. G.; Shirsath, S. E.; Mane, M. L.; Patange, S. M.; Jadhav, S. S.; Jadhav, K. M. Autocombustion High-Temperature Synthesis, Structural, and Magnetic Properties of $\text{CoCr}_x\text{Fe}_{2-x}\text{O}_4$ ($0 \leq x \leq 1.0$). *J. Phys. Chem. C* 2011, 115, 20905–20912.
- [22] C. Venkata Reddy et al., Investigation of structural, thermal and magnetic properties of cadmium substituted cobalt ferrite nanoparticles, *Superlattices Microstruct.* 82 (2015), 165 (2015). DOI: 10.1016/j.spmi.2015.02.014.

DEVELOPMENT OF PHONOLOGICAL ABILITIES AT THE PRESCHOOL AGE

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Abstract

Numerous studies indicate that phonological abilities are one of the most important factors in children's reading adoption, so it is important to encourage them. The paper presents action research in Preschool institution "Plavi Chuperak" in Serbia, an initial research aimed at determining the development of phonological abilities in preparatory preschool groups. The sample was 100 children tested individually with a test of phonological abilities - FONT 2.1. (51% boys) average age of 6.5 years. The results indicate that almost all children have a developed ability to segment syllables, over 70% and to rhyme and identify the initial phoneme, while 45% of children successfully identifying the final phoneme. In half of the children, the ability of voice analysis was developed, the ability of phonemic substitution developed less than 40% of children, and the elimination of the initial phoneme less than 20% of children. The results confirm that non-phonemic abilities develop earlier, and that phonemic analysis, which are directly related to the adoption of reading in the largest number of children, develop in the year before starting school. It is important to work in a partnership with parents and the school on encouraging phonemic segmentation, initial phoneme elimination, and phoneme substitution so that children are ready to acquire initial reading.

Keywords: phonological abilities, reading adoption, prompting, partnership, transition

INTRODUCTION

Opinions in the literature indicate that the acquisition of literacy is a developmental path that begins early in a child's life and is characterized by the gradual development and acquisition of different aspects of literacy (Nikolić, Cvijetić, Milenković, 2018). A number of authors point out that phonological ability determines initial reading and writing (Fletcher, Snowling & Scanlon, 2004; Gillon 2002; Hulme, Snowling, Caravolas & Carroll, 2005; Koutsoftas, Harmon & Gray, 2009; Reid, 2009; Richardson, Thomson, Scott & Goswami, 2004; Schuele & Boudreau, 2008; Snowling, 2000; Vellutino, Siok & Fletcher, 2001), so it can be considered a crucial component of reading acquisition. In numerous studies of this metalinguistic ability, the question of which skill at the level of phonological abilities is more predictive of success in acquiring reading and writing has been discussed. Some authors emphasized that the most predictive is the ability to recognize rhyme (Bradley & Bryant, 1983; Bryant, Bradley, MacLean & Crossland, 1989; Bryant, MacLean & Bradley, 1990), while others emphasized the ability to segment words into phonemes, and within its omission of the first phoneme (Mutter, Hulme, Snowling & Stevenson, 2004). When assessing this ability, numerous tasks were used in the world: recognizing rhyme, counting syllables, separating syllables, listing words that have the same initial sound, making out the initial sound, counting sounds in words, voice analysis and synthesis, manipulating sounds in terms of omitting, moving, replacing etc. (Yopp & Yopp, 2000, according to: Lazarević, 2014:426). It has been established that the development of phonological abilities begins at a younger preschool age, with the ability to notice rhyme. Between the ages of five and six, children begin to divide words into syllables, then into phonemes, pronounce the initial phonemes of words, and are able to count the phonemes in small words, and between the ages of six and seven they can count the phonemes in longer words, pronounce words with omitting a phoneme that is at the beginning or end of a word and connecting the phonemes into a word (Snow, Burns & Griffi, 1998, according to: Lazarević, 2014:426).

In our environment, in the Republic of Serbia, research into the development of phonological abilities as a predictor for the acquisition of reading and writing began in the 80s of the last century (Göncz and Kodžopeljić, 1991a, Kodžopeljić, 1996b, 1997, Ognjenović and Morača Stojnov, 1982, 1983; according to: Kodžopeljić, 2008). When assessing phonological ability, tasks of phonemic or syllabic word segmentation were mainly represented, the so-called. "tapping" procedure, which was a modified version of the research strategy of Lieberman et al. (Lieberman et al., 1973), while other types of tasks were almost not represented (according to: Lazarević, 2014:427).

Analyzing in detail the incoherence in defining the concept of phonological/phonemic awareness as well as research procedures, Subotić (2011) approached the construction and psychometric evaluation of a test for testing phonological awareness in the Serbian language, on a sample of 96 children aged 5-8 years. He previously points out, relying on the views (Rathvon, 2004:66) that phonological awareness is a broader construct than the more refined phonemic awareness, as it refers to the general awareness of the sound structure of spoken language, while phonemic awareness concerns the understanding that spoken words are composed of individual sounds, which can be analyzed and manipulated. He also states that according to Rathvon (2004), all types of phonological awareness tasks can be classified into two categories: non-phonemic tasks that measure global aspects of phonological awareness, such as rhyme and syllable sensitivity, and phonemic awareness tasks that measure the ability to direct attention to individual phonemes. and to manipulate them.

The phonological awareness test - FONT 2.1, which, in the current version, includes eight types of tasks, with six items each (more about the instrument in the research method) is highly reliable (Cronbach's $d = .96$), with an approximately normally distributed corrected item- total correlations, acceptable range and average value ($Sk = -0.38$, $Ku = -0.88$; $Min = .34$, $Max = .80$, $M = .60$, 95% CI [.56, .64], $SD = .13$), which suggests good internal agreement and discrimination in the included age interval (Subotić, 2011:132).

In the last decade, the FONT 2.1 test. was used in several studies in our speaking area, in the Republic of Serbia and Croatia. In one of the studies conducted on a sample of 22 respondents (16 girls and 6 boys) aged 4.8 to 5.6 years, 6 tasks from the test (Lazić, 2014) were applied (the tasks of combining syllables and segmenting syllables were omitted). The results showed that all examined children aged 5 years (100%) were successful in rhyme tasks, 95.5% were successful in identifying the initial phoneme, and 54.6% in the task of identifying the final phoneme. 18.2% of the children succeeded in the phoneme segmentation tasks, 22.1% in the elimination of the initial phoneme, while only 9% of the examined children succeeded in the phoneme substitution tasks. Children of mothers who have completed higher and higher education are significantly more successful in rhyming than children of mothers with completed SSS, and children of fathers with completed higher and higher education are more successful at the initial phoneme elimination task than children of fathers with SSS.

Similar results were obtained in the research on a sample of 60 children, of both sexes (51.6% boys and 48.4% girls), aged six (33.3%), seven (38.3%) and eight (28.3%) years, which was conducted by group of authors (Golubović, Ječmenica, Subotić, Kobac, 2019) with the aim of

determining the level of development of the elements of phonological awareness and the mutual relationship of these elements in children with typical development. The results showed a generally high achievement of children on all types of phonological awareness assessment tasks (ranging from 73.3% to 90.8% success). Relatively easier tasks (joining syllables, recognizing rhyme, syllabic segmentation and identifying the initial phoneme) were differentiated from relatively difficult tasks (identifying the final phoneme, phonemic segmentation, phonemic substitution of the initial phoneme and elimination of the initial phoneme). The results showed that phonological abilities develop and are acquired by the age of seven. Gender, as well as the interaction of gender and age, did not represent a significant source of differences in children's achievement on phonological awareness tasks.

Given that the results of previous research implicitly indicate that the critical period for the development of phonological abilities measured by phonemic tasks is in the year before children start school, the goal of the research presented in this paper was to confirm the development of all aspects of phonological abilities precisely at this age, including a significantly larger number of children compared to the aforementioned research. It was assumed that the largest number of children have developed abilities of syllabic segmentation, rhyming and identification of the initial phoneme, and that a smaller number of children have developed phonemic segmentation, identification of the last phoneme, elimination and substitution. It was also expected that gender and education of fathers and mothers would significantly differentiate children's performance on phonemic tasks. The goal of this part of the research was to determine the level of development of certain aspects of phonological abilities for each child in order to create a support plan at the level of educational groups and individually in the next phase of the research (this part of the research will be presented elsewhere).¹⁷

RESEARCH AND FINDINGS

Method

Research sample and procedure

The research was carried out in Preschool institution "Plavi Chuperak" in Titel, on a sample of 100 children (51 boys and 49 girls), with an average age of 6.5 months, who attended the preparatory preschool program. In our sample, about 70% of mothers and fathers have completed secondary education, 8% of mothers and 5% of fathers have higher or higher education, and about 20% of parents (both fathers and mothers) have lower vocational education. The

¹⁷ The support plan at the level of educational groups and individually, due to limited space, will be presented in another paper

examination was carried out individually, with each child, with the assistance of the institution's psychologist. The average examination time for one child was 25 minutes.

The examiners reported the following about the course of the examination itself:

The children were very happy to participate in the examination, they rejoiced, they simply raced. Since the testing was done individually, in cooperation with the preschool psychologist, the children who had not yet reached their turn could hardly wait to be invited. One teacher reported that some children even came to kindergarten early to "take a seat" for testing. After completing the testing, the children had fun with the test material by giving each other exercises, analogous to the tasks they did in the test (for example: What will you be called if you swallow the first syllable of your name?). Very quickly, parents became interested in the testing and the results. They asked the teacher what exactly the children were doing. Some of the parents wanted more detailed instructions and expressed their desire that they and their children do similar tasks at home.

Instruments used

Test FONT 2.1 (Subotić, 2011): in the current version, it includes eight types of tasks, with six items each (with attached instructions for assignment): 1) combining syllables 2) syllabic segmentation 3) identifying the initial phoneme, 4) recognizing rhyme, 5) identifying the final phoneme, 6) phonemic segmentation, 7) elimination of the initial phoneme and 8) phonemic substitution (initial phoneme).

All assignments are formatted exclusively for oral assignments. The test did not include tasks that would tend to produce "non-words" in the Serbian language (eg manipulation of central phonemes), or would result in a change of word type, gender, or case (eg elimination or substitution of the final phoneme).

Each task contains six items, which are scored according to the true-false principle. The largest number of items are monosyllabic or two-syllable nouns. In the tasks of recognizing the rhyme and identifying the initial and final phonemes, the respondents answer with yes-no, therefore these tasks have two control items each, which serve to detect mechanical affirmative responding (the correct answer to all control items is "no"). In cases of affirmative from \neg speaking on both control items on one task, a score of zero was calculated for the entire task, as well as in the case of correct answers only on the control items, which suggests mechanical giving of the answer "no".

Data analysis

For the purposes of the research, three groups of responses were first defined by cluster analysis for each child and classified into the following categories: 1) child with underdeveloped phonological awareness; 2) phonological awareness is partially developed and 3) phonological awareness is developed. Descriptive statistics (frequencies and percentages) were used to determine the number (percentage) of children with/without developed phonological abilities, while the correlation between gender, mother's and father's education and success on phonological ability tasks was determined by the Chi-square test.

Results

Table 1 shows the children's achievements in each aspect of phonological abilities. More precisely, the number and percentage of children who have developed, partially developed or not developed each of the examined phonological abilities was determined.

Table 1. Percentage of children who have/have not developed phonological abilities

Phonological ability	Level of development - % of children		
	Not developed	Partially developed	Fully developed
1. Joining syllables	-	1	99
2. Syllable segmentation	1	3	96
3. Identifying the initial phoneme	8	22	70
4. Rima	1	21	76
5. Phonemic segmentation	33	16	51
6. Identifying the final phoneme	31	24	45
7. Elimination of the initial phoneme	65	17	18
8. Phonemic substitution	44	22	38

Analyzing the results in table 1, it can be seen that almost all children from the sample are completely successful in the tasks of syllabic merging and syllabic segmentation (96-99%). Therefore, almost all children of preschool age can break down a word into syllables, or synthesize a word based on syllables. About 70% of preschool children are successful in identifying the initial phoneme and rhyming, while only about 50% of preschool children develop the ability to analyze sounds, as well as identify the final phoneme. The most difficult tasks for

children of this age are elimination of the initial phoneme and phoneme substitution. 38% of children can successfully replace one phoneme with another, and only 18% of children have the ability to pronounce a word without the initial phoneme. The first hypothesis was confirmed because it was determined that a smaller number of children of preschool age have developed the ability of phonemic segmentation, elimination of the initial phoneme and phonemic substitution, while the majority of children have mastered the so-called non-phonemic tasks (syllabic segmentation and rhyming), as well as identification of the initial phoneme. Identification of the final phoneme is, obviously, a more difficult task for children, because it involves keeping pairs of words in working memory, and then comparing them.

The Relationship Between Phonological Abilities And Children's Gender And Parents' Education

Based on the value of the Chi-square test, no differences were found in the development of phonological abilities in children in relation to gender and father's education (all values are $p > 0.05$), so in this part we reject the hypothesis. In relation to the mother's education, statistically significant differences were found in the following phonological abilities: phonemic segmentation (Chi square= 9.924, $df=4$, $p=0.042$), final phoneme identification (Chi square=10.924, $df=4$, $p=0.027$), elimination phoneme (Chi-square=14.550, $df=4$, $p=0.006$) and phoneme substitution (Chi-square=9.937, $df=4$, $p=0.041$). Children of mothers with higher and higher education have better developed mentioned aspects of phonological ability, and in that part the hypothesis is rejected.

Discussion of results

As earlier researches in the world and in our country have established, the ability of syllabic segmentation appears at earlier ages, so, developmentally, all children of preschool age have mastered this ability. 70% of children are successful in recognizing rhyme and identifying the initial phoneme, which indicates that at preschool age 1/3 of children still have more or less difficulty in these aspects of phonological abilities, but that, nevertheless, these tasks represent easier language material for children in relation to phonemic tasks, which is in accordance with the results of the research of Golubović et al. (2019). What is particularly important for further steps is the finding that 50% of children have developed the ability of phonemic segmentation, which, according to the results of a large number of studies, is a crucial component of reading acquisition. This indicates that at the preschool age, it is necessary to work on encouraging the development of phonemic abilities in children with the aim that as many children as possible will be ready to learn reading by entering the first grade. Increasing awareness of the

importance of the development of phonemic abilities to success in acquiring reading and writing skills and introducing strategies to increase these aspects of phonological awareness at preschool age significantly contribute to the development of literacy in children (Tafa, 2008).

The analysis of individual results indicated how developmentally ready each child is for learning to read and in which segments the child's development should be encouraged. Children who need more intensive support in this area, as well as children who need to be referred to a speech therapist (without already being included in the treatment) have been identified. The analysis at the level of the educational group gave clear guidelines to educators in defining a plan for further support.

Also significant is the finding that certain aspects of phonological abilities are associated with maternal education. This indicates that the family context, more precisely the interaction with mothers who probably spend more time with children and are more verbally open, can be a significant supportive factor in the development of phonological abilities. If we add to that the fact that the parents in the pre-school institution where the research was conducted already at this stage showed interest in the test material and motivation to do similar tasks with their children at home, there is no doubt that developing a partnership with parents in this area should be part of the plan further support.

It is especially important to note that the children, participants in the research, showed an exceptional interest in the test material, that the tasks were fun, stimulating, and that they encouraged learning in the social interaction of their peers.

The data collected in this phase of the research are also valuable for establishing cooperation with the school and realizing the transition in the area of literacy development.

Conclusion

Research on the development of phonological abilities at preschool age was the initial step in creating a support plan in preparing children for the acquisition of reading and writing in the Preschool institution "Plavi Chuperak" in Titel. The test material (FONT 2.1, Subotić, 2011) turned out to have great research and practical potential, and it would be useful to train as many professional associates and educators in preschool institutions as possible to give and analyze this test. Determining the development of non-phonemic and phonemic aspects of phonological abilities confirmed earlier findings in a research sense, and in a practical sense opened up more directions for the introduction and implementation of a support plan in this area, with the active participation of parents and school representatives. It is particularly important that testing can identify children who need additional support for the development of phonemic abilities, who are suspected of dyslexia (and dysgraphia), and determine timely intervention.

LITERATURE

- Bradley, L. & Bryant, P. (1983). Categorising sounds and learning to read. A causal connection. *Nature*, 301, 419–521.
- Bryant, P., MacLean M. & Bradley, L. (1990). Rhyme, language, and children's reading. *Applied Psycholinguistics*, Vol. 11, 237–252.
- Fletcher, J., Snowling, M. & Scanlon, D. (2004). Specific reading disability (dyslexia): What have we learned in the past four decades? *Journal of Child Psychology and Psychiatry*, 45(1), 2-40.
- Gillon, G. T. (2002). Follow-up study investigating benefits of phonological intervention for children with spoken language impairment. *International Journal of Language and Communication Disorders*, Vol. 37, No. 4, 381–400.
- Golubović, S., Ječmenica, N., Subotić, S., Kobac, D. (2019). Razvoj fonološke svesnosti kod dece uzrasta 6-8 godina. *Primenjena psihologija*, 12(2), 157-182.
- Göncz, L., Kodžopeljić, J. (1991a). Exposure to two languages in the preschool period: metalinguistic development and the acquisition of reading. Clevedon, England: *Journal of Multilingual and Multicultural Development*, Vol. 12:13, 137-163.
- Hulme, C., Snowling, M., Caravolas, M. & Carroll, J. (2005). Phonological skills are (probably) one cause of success in learning to read: A comment on castles and coltheart. *Scientific Studies of Reading*, Vol. 9, No. 4, 351–365.
- Kodžopeljić, J., & Genc, L. (1996). Fonemska svest kao faktor usvajanja čitanja. U M. Franceško, i M. Zotović (Ur.), *Ličnost u višekulturnom društvu*, 3 (str. 45–54). Novi Sad: Odsek za psihologiju.
- Kodžopeljić, J. (2008). *Metajezikički aspekti zrelosti za polazak u školu*. Novi Sad: Savez pedagoških društava Vojvodine.
- Koutsotas, A. D., Harmon, M., T., & Gray, S. (2009). The effect of tier 2 intervention for phonemic awareness in a response-to-intervention model in low-income preschool classrooms. *Language, Speech, and Hearing Services in Schools*, 40, 116–130.
- Lazarević, E. (2014). Razvijenost fonološke sposobnosti dece predškolskog uzrasta, *Zbornik instituta za pedagoška istraživanja*, 46 (2), 425-450.
- Lazić, P. (2014). Razvoj fonološke svesti kod dece uzrasta 5-6 godina, *neobjavljen završni rad*, Sremska Mitrovica: Visoka škola strukovnih studija za vaspitače i poslovne informatičare - Sirmijum.
- Lieberman, I. Y., Shankweiler, D., Fisher, W., & Carter, B. (1973). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology*, 18, 201–212.
- Muter, V., Hulme, C., Snowling, M. J., & Stevenson, J. (2004). Phonemes, rimes and language skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology*, 40(5), 665–681.
- Nikolić, M., Cvijetić, M., Milenković, S. (2018). Podsticanje razvoja fonološke svesti u pripremi dece za usvajanje čitanja: efekti programa stručnog usavršavanja U: Panić, T., Mijailović, G., Dedaj, M. (ur.) (153-162). *Zbornik radova, Inicijalno obrazovanje i stručno usavršavanje vaspitača - stanja i perspektive*, Sremska Mitrovica: Visoka škola strukovnih studija za vaspitače i poslovne informatičare – Sirmium.
- Rathvon, N. (2004). *Early reading assessment: A practitioner's handbook*. New York: The Guilford Press.
- Reid, G. (2009). *Dyslexia and inclusion: Classroom approaches for assessment, teaching and learning*. New York: Routledge.
- Richardson, U., Thomson, J. M., Scott, S. K. & Goswami, U. (2004). Auditory Processing Skills and Phonological Representation in Dyslexic Children. *Dyslexia*, Vol. 10, No. 3, 215–233.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- Subotić, S. (2011). Konstrukcija testa fonološke svijesti na Srpskom jeziku. *Primenjena psihologija*, Br. 2, 127–149.
- Schuele, C. M., & Boudreau, D. (2008). Phonological awareness intervention: Beyond the basics. *Language, Speech, and Hearing Services in Schools*, 39, 3–20.
- Snowling, M. (2000). *Dyslexia* (second edition). Blackwell: Oxford.
- Tafa, E. (2008). Kindergarten reading and writing curricula in the European Union. *Literacy*, Vol. 42, No. 3, 162–170.
- Vellutino, F. R., Fletcher, J., Snowling, M. J. & Scanlon, D. M. (2004). Specific reading disability (dyslexia): What have we learnt in the past four decades? *Journal of Child Psychology and Psychiatry*, Vol. 45, No. 1, 2–40.

OER REPOSITORIES OF OPEN UNIVERSITIES IN INDIA: A STUDY

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Abstract

A key component of the current information-driven era is information and communication technology (ICT). The conventional methods of disseminating information have changed as a result of the Internet and modern IT, of technological research and development.

Increasing need of information in electronic format, the concept of simple access to electronic or digital information is gaining worldwide momentum. Information is now more easily accessible because of open access. Open accessible educational resources, to the students of all strata of the society is one of the blessings of this era of open movement.

Open Educational Resources (OER) have gained popularity and are therefore particularly useful for e-learning and other distance learning methods. In India, a number of OER efforts have been considerably aiding to distance learning, enabling students to access knowledge sources. There are fifteen open universities in India at present. Some of these universities have implemented OER for the benefit of the students successfully. E-Gyankosh, of Indira Gandhi National Open University, a celebrated Central University, and maintains a high-end OER in the country among others. The OER's offer a variety of knowledge transmission methods and courses through the platform of multimedia (audio, video and, textual lectures), aiding in the interactive nature of teaching and learning. Different OERs have different material uploaded with varying structure and policies.

The present study dealt with the basic concept of OER, through observation method of study, and gives a detailed finding in this regard, of the OERs of Open Universities in India. The motivation of this study is to find out the national ability to conceive, conserve and disseminate the open education for the future development of every education system based on research and development.

Keywords: Open Educational Resources (OER), Open Access, ICT, Information, Open Universities, India.

1. Introduction

Open Educational Resources (OER) have become an increasingly popular topic in education in recent years. OER refers to educational materials that are openly licensed and available for use and repurposing, often for free. The purpose of this literature review is to explore the benefits and challenges of OER, as well as the impact of OER on student learning outcomes.

The creation of Open Educational Resources (OERs) is currently taking place on a global scale, and members of the Open Ware Consortium come from every continent. Students and teachers are using open educational resources (OER) more frequently, which helps spread the idea of OER and expand the number of resources available. OERs are seen as a way to improve quality, cut prices, and increase access to educational materials as well as a way to address the various problems that developing nations' educational institutions face.

The usage of open educational resources is permitted by professors, institutions, and students alike and is made available for free online. Simulations, experiments, and demonstrations, as well as curricula and teacher resources, can all be found in open educational resources (OERs) (UNESCO 2002). It is the outcome of global efforts to make educational resources accessible everyone (Bissell, 2009). OER's, innovative approach to information sharing, which can result in economic success for both individuals and entire nations, is the biggest advantage for developing countries (McDowell, 2010).

2. OER Components, Benefits and Challenges

The Commonwealth of Learning (COL) defines Open Educational Resources (OER) as ‘materials offered freely and openly to use and adapt for teaching, learning, development and research’ (Open Educational Resources Policy - Commonwealth of Learning, 2021).

Open Educational Resources (OER) consist of several components that work together to create a complete educational resource. These components include:

- **Content:** This refers to the educational material itself, such as textbooks, videos, lesson plans, and quizzes. OER content is typically created with an open license that allows others to use, adapt, and share the material freely.
- **Licenses:** OER licenses are legal tools that allow content creators to specify how others can use and share their work. Creative Commons license are the most common types of licenses used for OER.
- **Metadata:** Metadata is information about the educational material, such as the author, subject, and date of creation. Metadata helps users find, evaluate, and use OER more effectively.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- Tools: OER tools include software and platforms that facilitate the creation, use, and sharing of educational resources. For example, there are authoring tools that allow educators to create OER content, and repositories that allow users to find and share OER.
- Communities: OER communities include educators, students, and other stakeholders who collaborate to create and use OER. These communities provide support, feedback, and resources to help improve the quality and accessibility of OER.

These components work together to create a comprehensive and effective open educational resource that is accessible to all. Benefits of using OERs include:

- Expanded learning access is one benefit of using OERs.
- OERs are freely available to use at any time by students all around the world, many times.
- OERs are inexpensive or free to share broadly.
- The addition of new course content. Where there are glaring information gaps in textbooks and lectures, OERs can be used as a supplement.
- Improvement to the normal course material. For instance, multimedia content like videos can be used in conjunction with text. Information presented in a variety of formats could make it easier for pupils to understand what is being taught.
- When compared to information published in textbooks or journals, which may take months or even years to become accessible, information can be disseminated quickly. The timely and/or relevant nature of the information may rise with the rapid availability of

There are various challenges also when it comes to utilizing OER effectively. Some of these are

- Because there isn't a single repository for OER, this is a problem. They can be found all over the internet.
- Creative Commons open licenses and what they allow are not widely known.
- The practitioner needs practice editing and remixing resources in addition to fundamental ICT abilities in order to modify and repurpose OER.
- Many instructors choose to guard rather than share their own materials because they feel awkward or that it is improper to use other people's work.
- For OER access and adaptation, reliable internet connectivity and easy access to ICT are necessary.
- Due to competing objectives, many educators spend relatively little time creating their course materials because universities rarely offer incentives for course creation.

3. Background

India has several open universities that provide distance education. At present there are fifteen (15) open universities in India, namely: **2273**

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Table 1 List of Open Universities in India

Open University (Establishment Year)	Type	Website
Indira Gandhi National Open University, Delhi, India (IGNOU) (1985)	Central	www.ignou.ac.in
Dr. B.R. Ambedkar Open University (BRAOU), Hyderabad, India (1982)	State	https://braou.ac.in/
Vardhman Mahaveer Open University (VMOU), Kota, Rajasthan, India (1987)	State	http://www.vmou.ac.in
Nalanda Open University (NOU). Patna, Bihar, India (1987)	State	http://www.nou.ac.in/
Yashwantrao Chavan Maharashtra Open University (YCMOU), Nashik, Maharashtra, India (1989)	State	https://www.ycmou.ac.in/
Madhya Pradesh Bhoj Open University (MPBOU), Bhopal, M.P. India (1991)	State	http://mpbou.edu.in/
Dr. Babasaheb Ambedkar Open University (BAOU), Ahmedabad, Gujarat, India (1994)	State	https://baou.edu.in/
Karnataka State Open University (KSOU), Mysore, Karnataka, India (1996)	State	https://ksoumysuru.ac.in/
Netaji Subhas Open University (NSOU), Kolkata, W.B. India (1997)	State	www.wbnsou.ac.in
U.P. Rajarshi Tandon Open University (UPRTOU), Allahabad, U.P. India (1998)	State	http://www.uprtou.ac.in/
Tamil Nadu Open University (TNOU), Chennai, Tamil Nadu, India (2002)	State	http://www.tnou.ac.in
Pt. Sunderlal Sharma Open University (PSSOU), Bilaspur, Chhattisgarh, India (2005)	State	http://www.pssou.ac.in
Uttarakhand Open University, Haldwani, Distt. Nainital, Uttarakhand, India (UOU) (2005)	State	http://uou.ac.in
Krishna Kanta Handique State Open University, Guwahati, Assam, India (KKHSOU) (2006)	State	http://www.kkhsou.in/web_new/index.php
Odisha State Open University (OSOU) (2015)	State	https://www.osou.ac.in

These open universities offer a wide range of courses, including undergraduate, postgraduate, diploma, and certificate programs.

Open universities in India are regulated by the University Grants Commission (UGC) and can be found in various forms, including a network of national and state institutions and online learning portals (Edu, 2023). These universities offer distance education programs and are particularly useful to people who cannot attend traditional universities due to various reasons such as financial constraints, location, or job commitments (Vaishak, 2020).

India has been working towards becoming an open knowledge society and has been exploring Open Educational Resources (OER) as a medium of education, research, and training (Padhi, 2018). OER are defined as teaching, learning, and research resources that are in the public domain or have been released under an intellectual property license that permits their free use or repurposing by others (Kumar, 2009). OER can be found in India through various sources such as Digital Library of India, National Digital Library, Shodhganga, NPTEL, Project OSCAR, NCERT, NIOS, and Agropedia (Vaishak, 2020).

Open Educational Resources (OER) provided by Open Universities in India have a significant impact on the education system. Governmental and private organisations in India have launched a number of programmes to provide free educational materials. There are several blogs, YouTube videos, and other content pieces created by people and groups that appear to contain valuable instructional resources.

Some of the Open Universities in India have already launch their OERs successfully and some are yet to take the initiatives on the same. Table 2 decited the list of Open Universities with the link to their Webportal for OER or OPEN Self Learning Materials

Table 2 List of Open Universities with the link to their Webportal for OER or OPEN Self Learning Materials

Open University	OER Repository/ Open-SLM Weblinks
IGNOU	https://egyankosh.ac.in/
BRAOU	http://vidyagani.braou.ac.in/
VMOU	https://www.vmou.ac.in/slm
NOU	http://www.nou.ac.in/econtent-slm.html https://nalandaopenuniversity.cloudhostdns.net/econtent-management
YCMOU	https://ycmou.ac.in/self_learning_material https://ycmou.ac.in/pages/index/185
MPBOU	http://mpbou.edu.in/newslm/slmonline.html http://mpbou.edu.in/Bhojvani.html
BAOU	https://baou.edu.in/open-educational-resources-oer-repository
KSOU	https://ksoumysuru.ac.in/oer.php
NSOU	http://nsouoer.krc.net.in/
UPRTOU	http://gyansangam.uprtou.ac.in
TNOU	https://www.tnou.ac.in/OER.php
PSSOU	https://pssou.ac.in/index?page=ebook https://pssou.ac.in/index?page=about&about_id=VIDEO_LECTURE https://pssou.ac.in/index?page=element&id=AL_EDUCATION
UOU	https://elearning.uou.ac.in/course/index.php?categoryid=6
KKHSOU	http://dlkkhsou.inflibnet.ac.in/handle/123456789/214
OSOU	http://egyanagar.osou.ac.in/

4. Related Literature

The Open Educational Resources (OER) movement has gained significant attention in recent years, with numerous studies analyzing the opportunities and challenges associated with it. Here's a brief literature review on OER:

Another study on the usage of OER compared the performance of groups of students who were taught using a blended learning method utilizing OERs to groups of students who were taught using a standard book in a face-to-face class. There were 605 students using the blended learning strategy as opposed to 2439 in the face-to-face class. There was no significant difference in the scores of the two groups, however students who used the blended learning technique and OERs scored somewhat higher than those who were taught using the traditional way (Bowen et al., 2014).

A study by Butcher et al. found that OER can help bridge the digital divide and provide access to education to marginalized populations. The study also highlighted the need for quality assurance mechanisms to ensure the credibility and relevance of OER (Butcher et al., 2015).

In a systematic review of 20 studies, Jhangiani et al. found that OER can have a positive impact on student learning outcomes, especially in terms of academic achievement and engagement. The review also highlighted the importance of faculty buy-in and institutional support for OER implementation (Jhangiani et al., 2016).

Another study by Hilton et al. found that OER had a positive impact on student retention rates and student success in courses (Hilton et al., 2016).

A study by Wiley and Hilton found that OER adoption can significantly reduce the cost of textbooks for students, while also improving their academic performance. The study also highlighted the need for faculty training and support to encourage OER adoption (Wiley and Hilton, 2018).

In a study it was found that OER can help improve the quality of education, especially in developing countries with limited resources. The study also highlighted the need for open licenses and sustainable funding models to ensure the long-term viability of OER (Mishra et al., 2018).

In a study Shukla opined that though the projects are still in their infancy, the time will come when it makes a difference and the entire population is educated and benefits from it. The Government of India had recognized the potential of OER and had therefore developed several large-scale projects (Shukla, 2020).

The, eGyanKosh, OER of IGNOU, provides a personal learning space, in which free digital learning resources are integrated with a high-end learning management system, suitable for anyone who wants to learn, regardless of their educational needs and experience. eGyanKosh, initially surfaced as a digital repository to archive digital learning content, evolved as a major platform for e-learning (Chakraborty & Chakraborty, 2021).

A study published in Springer found that converting entire degree programs to OER requires colleges to intentionally integrate OER work into their organizational strategies, policies, and practices, requiring coordinated efforts (Griffiths et al., 2022).

Bose and Vijayvargiya concluded in a study that majority of the users in the higher educational institutions have awareness about open access resources and their uses to fulfil their academic needs. More awareness and training programmes would definitely help to enhance their familiarity in use of open access resources effectively (Bose and Vijayvargiya, 2023).

Overall, the literature suggests that OER have the potential to improve access to education, reduce costs, and enhance learning outcomes. However, there are also challenges associated with OER adoption, including the need for faculty training and support, quality assurance mechanisms, and sustainable funding models.

5. Scope of the study

At present there are fifteen (15) Open Universities in India. Fourteen (14) State Open Universities and One (1) Central Open University. These fifteen Open Universities has been chosen for the present study.

6. Objective of the study

The main objectives of the study are

- i. exploring OER initiatives in the Open Universities in India
- ii. examining the open access full text availability of resources of the OERs
- iii. types of digital materials used in the OERs
- iv. Language of the resources in the OER
- v. software used to develop OER
- vi. facilities provided to the users by the OERs
- vii. study the policies of the OERs

7. Methodology

The information pertaining to the OER of the fifteen Open Universities in India gathered from their websites till May 01, 2023. From each website, information about the dedicated web portal for OER, repository software used for OER, accessibility, resource types, file formats, facility of e-SLM (self-learning materials), Language of the resources, searching facilities, OER Policies were retrieved and collected. The analysis has been performed using Microsoft Excel 2010.

8. Findings

The websites of the 15 Open Universities and their available OER has been accessed and the following observations were analyzed.

8.1 OER Web-portal status and Open Universities

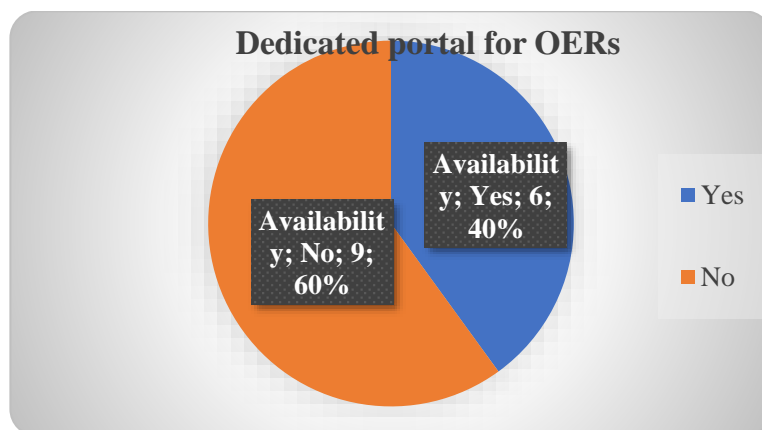


Figure 1 Availability of dedicated web portal for OERs

8.2 Use of Repository software for OERs and Open Universities

Table 3 Type of Software used of OER

Open University	Repository Software used for OER	Open University	Repository Software used for OER
IGNOU	DSpace	KSOU	Proprietary
BRAOU	Proprietary	NSOU	DSpace
VMOU	Proprietary	TNOU	Proprietary
NOU	Proprietary	PSSOU	Proprietary
YCMOU	Proprietary	UOU	Proprietary
MPBOU	Proprietary	KKHSOU	DSpace
BAOU	Proprietary (Google Drive)	OSOU	Proprietary
		UPRTOU	Data Not Available

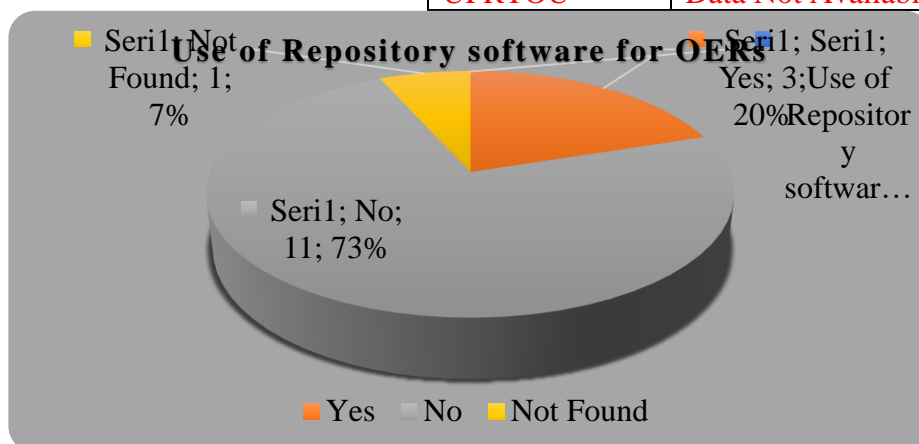


Figure 2 Use of Repository software for OERs

8.3 Open Access OERs/ Open e-SLM and Open Universities

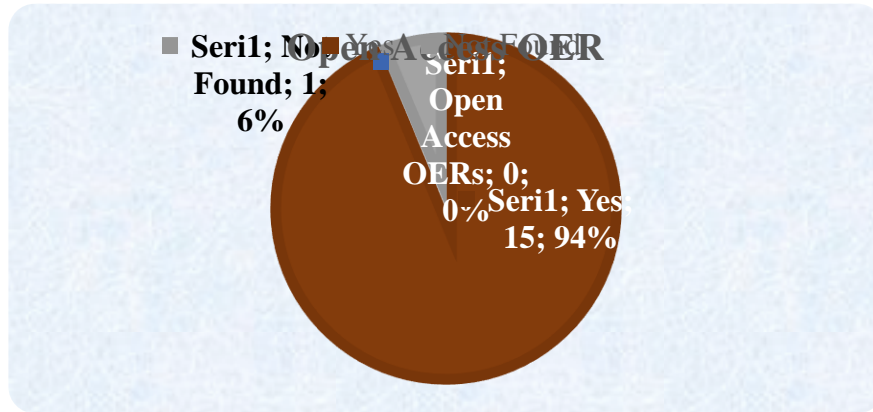


Figure 3 Availability of Open Access OER or Open e-SLM

8.4 Type of Resources in Open Universities OERs

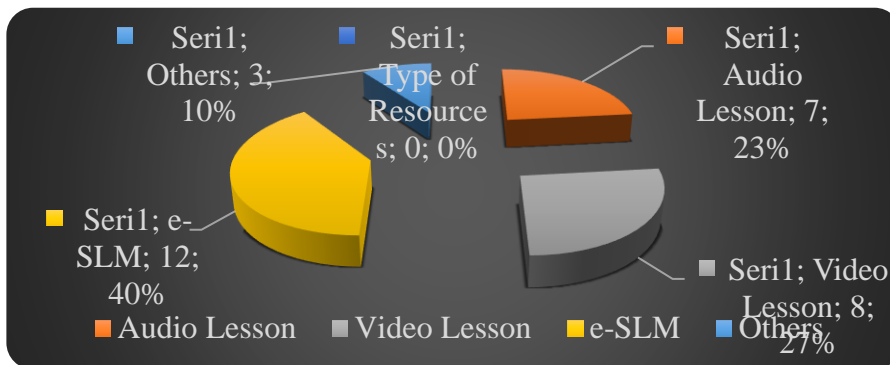


Figure 4 Type of resources in the OERs

8.5 Type of File formats in Open Universities' OERs

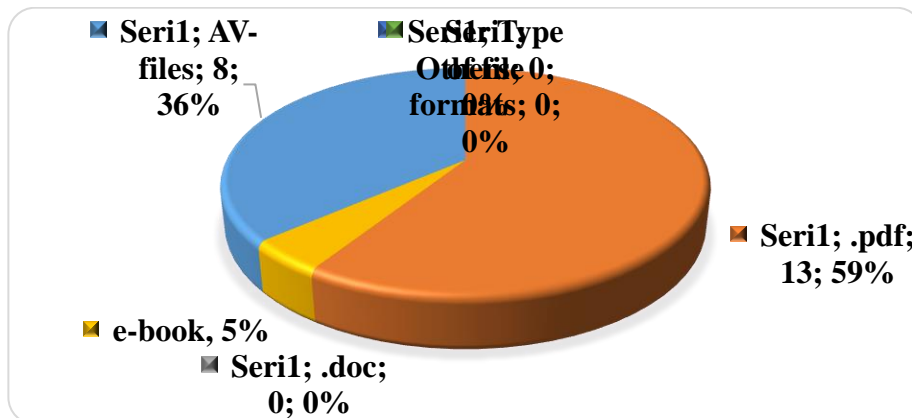


Figure 5 Various file formats in OERs

8.6 e-SLM (Self-Learning Materials) in the OERs and the Open Universities



Figure 6 Availability of e-SLM under OERs

8.7 No. of Open Universities providing resources in Vernacular Languages through the OER

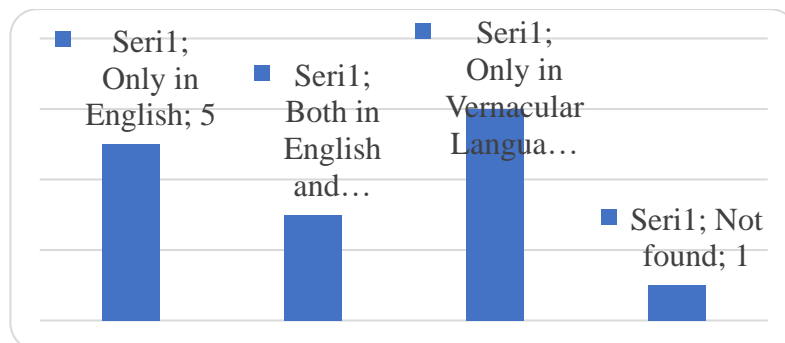


Figure 7. Resources in vernacular languages in OERs

8.8 Availability of Open e-SLM of the Open Universities

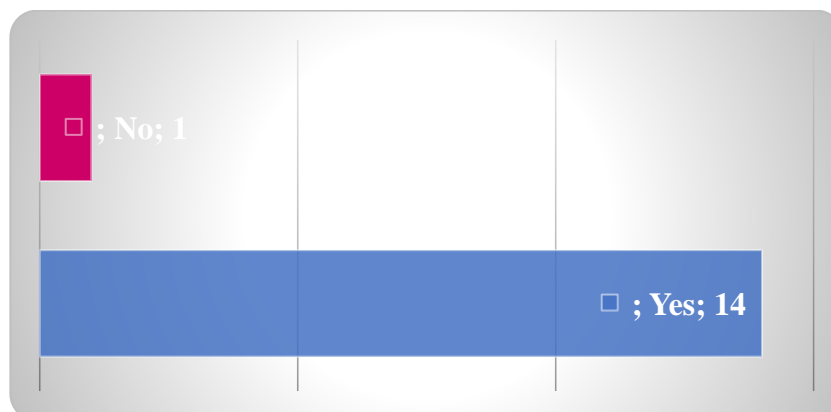


Figure 8 Availability of Open e-SLM

8.9 Searching Facility on the OER Repository/ Open e-SLM Web portals

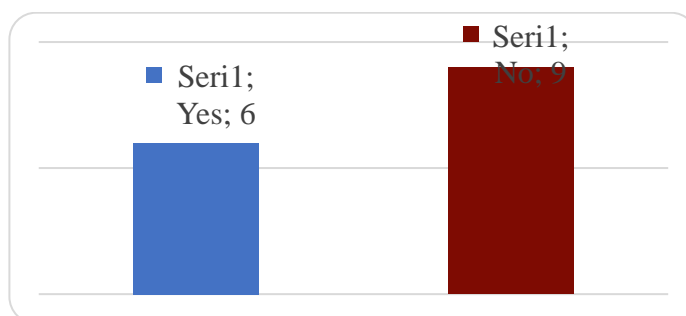


Figure 9 Facility available for searching in the OERs

8.10 Defined OER Policy and Open Universities

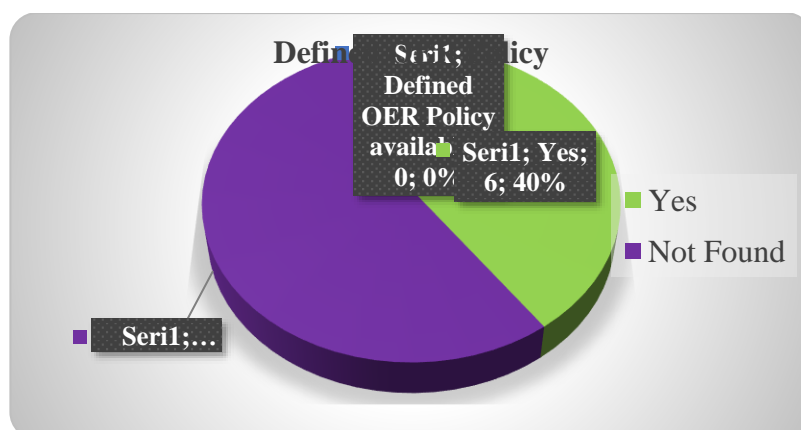


Figure 10 Availability of OER policies in the Open Universities

9.Data Analysis

From the above observations, it has been found that:

- As Figure 1 revealed that out of 15 Open Universities, only 40% (6) have initiated their OER Repository for their students and they have dedicated URL for the OERs
- Figure 2 and Table 3 showed that majority of the Open Universities are not using specialized software like DSpace, ePrint etc. Specialised OER software has been used only by 20% of the Open Universities
- 94% Open Universities have been providing Open Access to their OERs or Open e-SLM (Figure 3)

- From Figure 4, it has been clear that the majority of the content is e-SLM in all the cases. Some of the OERs also contained Video lectures, Presentations etc.
- As Figure 5 is showing that .pdf file format is preferred for uploading resources along with AV (Audio-Visual files) file formats.
- Only in 47% cases the Self-Learning Materials are kept under the OER Web portal (Figure 6). Others have kept the link of the e-SLM in their University websites. Therefore, this can not be taken as a specialized and dedicated OER.
- As depicted in Figure 8, all the Open Universities are providing open access eSLM except one that is B.R.Ambedkar Open University (BRAOU) of Andhra Pradesh. In case of BRAOU, one need to have the login credentials.
- Only 6 Universities are providing searching facilities on the OER Repository/ Open e-SLM Weblinks (Figure 9)
- 40% of the total 15 Open Universities are providing resources in Vernacular Languages and 20% in both English and in Vernacular Languages (Figure 7).
- Only 6 Universities have defined OER Policies out of 15. Others either are in process or are yet to form a policy regarding the same (Figure 10).

All the available OER of Open Universities are using Open License system for providing educational resources freely.

It has also been observed during the study that E-Gyankosh of IGNOU is the most feature enriched and resourceful OER among the other OERs of Open Universities. IGNOU's OER includes course material, question papers, and e-books for students to access free of cost. The university also collaborates with other institutions to create OERs.

OER of Dr. B.R. Ambedkar Open University includes e-books, course material, and question banks. The university also has a YouTube channel where it uploads video lectures and other educational content.

Dr. Babasaheb Ambedkar Open University has a mobile app that allows students to access OER on their phones.

To summarise, the some of the Open Universities in India offer OER that includes e-books, course material, and video lectures. Some universities also have mobile apps that allow students to access OER on their phones. Almost all these universities have their YouTube channels where they upload video lectures and other educational content. However, the extent and quality of OER may vary by university.

10. Conclusion

Several studies have investigated the academic impact of Open Educational Resources (OER). According to a study published in PLOS One, it is necessary for researchers to consider textbook access rates prior to implementation of OER when measuring their impact on an entire sample of students (Grimaldi et al., 2019).

Initiation of OER Repository in the Open Universities in India are in a very budding stage though OER is an excellent tool for providing free access to the resources. Use of proper Repository software is an essential criterion for implementing OERs as this kind of software provide better facilities and workflow. Dedicated staff for maintaining the OERs is also an important factor. Any successful implementation requires a team with expertise. The Digital Divide, barrier of technology, infrastructure, access and non-familiarity with the system can be a threat to the use of OERs. OERs in local/ vernacular languages are also an important factor to popularize and to achieve maximum utilization of OERs. This would also be helpful to disseminate resources in local languages to all the strata of the society.

OER have the potential to improve access to education, reduce costs, and enhance learning outcomes. However, there are also challenges associated with OER adoption, including the need for faculty training and support, quality assurance mechanisms, and sustainable funding models. Proper policy implementation and technical expertise are required for a successful implementation of OER in all the cases.

References

- Arunava Bose, Dr. Divya Vijayvargiya (2021) *Evaluation of Open Education Resources with Special Reference to Educational System In West Bengal, India. Elementary Education Online*, 20 (6), 4095-4105. doi:10.17051/ilkonline.2021.06.389
- Atkins, D. E., Brown, J. S., & Hammond, A. L. (2007). A Review of the Open Educational Resources (OER) Movement: Achievements, Challenges, and New Opportunities. The William and Flora Hewlett Foundation
- Bissell, A. N. (2009). Permission granted: open licensing for educational resources. *Open Learning*, 29(1), 97-106.
- Bliss, T. J., Hilton III, J., Wiley, D., & Thanos, K. (2013). The cost and quality of online open textbooks: Perceptions of community college faculty and students. *First Monday*, 18(1).
- Burnett, N., D'Antoni, S., Johnstone, S., Margulies, A., Baraniuk, R., Thille, C., ... & Joyce, A. (2009). Open educational resources: Conversations in cyberspace. Unesco.
- Chakraborty, S. B., & Chakraborty, S. (2021). National Conference on eLearning Experiences: Apps & Tools. In *eLearning Experiences: Apps & Tools*. Kolkata, West Bengal; Barrackpore Rastraguru Surendranath College.
- Commonwealth of Learning (2021) *Open educational resources policy, Commonwealth of Learning*. Available at: <https://www.col.org/about/values/cols-policy-open-educational-resources/> (Accessed: April 28, 2023).
- Dhanarajan, G., & Porter, D. (2013). Open Educational Resources: An Asian Perspective. Published by Commonwealth of Learning and OER Asia, Vancouver. Available online: <http://www.col.org/resources/publications/Pages/detail.aspx>
- Downes, S. (2007). Models for sustainable open educational resources. *Interdisciplinary Journal of E-Learning and Learning Objects*, 3(1), 29-44.
- Edu, L. (2023, April 13). *Open University In India: All You Need To Know - Leverage Edu*. Leverage Edu; Leverage Edu. <https://leverageedu.com/blog/open-university-in-india/>
- Edvnce. (2021, September 26). *Open Universities in India | Complete List with Courses | Edvnce*. Edvnce. <https://edvnce.com/open-universities-india/>
- Emergence of open educational resources (OER) in India and its impact on lifelong learning | Emerald Insight. (2013). *Library Hi Tech News*, 28(5), 10–15. <https://doi.org/10.1108/lhtn>
- Griffiths, R., Mislevy, J., & Wang, S. (2022). Encouraging impacts of an Open Education Resource Degree Initiative on college students' progress to degree. *Higher Education*, 84(5), 1089–1106. <https://doi.org/10.1007/s10734-022-00817-9>
- Grimaldi, P. J., Basu Mallick, D., Waters, A. E., & Baraniuk, R. G. (2019). Do open educational resources improve student learning? Implications of the access hypothesis. *PLOS ONE*, 14(3), e0212508. <https://doi.org/10.1371/journal.pone.0212508>
- Harsasi, M. (2015). The Use of Open Educational Resources in Online Learning: A Study of Students' Perception. *Turkish Online Journal of Distance Education*, v16 n3 p74-87
- Hilton, J. (2019). Open educational resources, student efficacy, and user perceptions: a synthesis of research published between 2015 and 2018. *Educational Technology Research and Development*, 68(3), 853–876. <https://doi.org/10.1007/s11423-019-09700-4>
- Hylén, J. (2020). Open educational resources: Opportunities and challenges.
- Jhangiani, R. S., Pitt, R., Hendricks, C., Key, J., & Lalonde, C. (2016). Exploring faculty use of open educational resources at British Columbia post-secondary institutions.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- M.S. Vijay Kumar(2019). *Open Educational Resources in India's national development*. Open Learning: The Journal of Open, Distance and E-Learning. <https://www.tandfonline.com/doi/full/10.1080/02680510802627860>
- McDowell. E.A (2010) using Open Educational Resources to help Learners understand the sub-prime lending crisis. *Journal of Business Education*, 3 (11) 85-92
- Mishra, S. (2017). Open educational resources: Removing barriers from within. *Distance education*, 38(3), 369-380.
- NIC, Laxminarayan Prajapati. (2023). *Major Initiatives | Government of India, Ministry of Education*. Education.gov.in. <https://www.education.gov.in/>
- Nusbaum, A. T., Cuttler, C., & Swindell, S. (2020). Open Educational Resources as a Tool for Educational Equity: Evidence From an Introductory Psychology Class. *Frontiers in Education*, 4. <https://doi.org/10.3389/educ.2019.00152>
- Open Educational Resources in India*. (2020, December 30). Learn to Teach Online. <https://blog.learnyst.com/open-educational-resources-in-india/>
- Open Educational Resources in India's national development*. (2019). Open Learning: The Journal of Open, Distance and E-Learning. <https://www.tandfonline.com/doi/full/10.1080/02680510802627860>
- Padhi, N. (2018). Acceptance and Usability of OER in India: An Investigation Using UTAUT Model. *Open Praxis*, 10(1), 55. <https://doi.org/10.5944/openpraxis.10.1.623>
- Research Guides: OER - Open Educational Resources: Research*. (2019). Pcc.edu. <https://guides.pcc.edu/oer/research>
- Shukla, P. (2020). *Open Educational Resources: Initiatives in India*. DigitalCommons@University of Nebraska - Lincoln. Retrieved May 1, 2023, from <https://digitalcommons.unl.edu/libphilprac/3876/>
- targetstudy.com. (2023). *Open Universities in India, List of Open universities in India, Distance Universities*. Targetstudy.com. <https://targetstudy.com/university/open-universities/>
- UNESCO (no date) *Open Educational Resources*. UNESCO. Available at: <https://www.unesco.org/en/open-educational-resources> (Accessed: April 28, 2023).
- Vaishak, S (2020). *Open Educational Resources in India*. Learn to Teach Online. <https://blog.learnyst.com/open-educational-resources-in-india/>
- Wikipedia Contributors. (2020, July 17). *Category:Open universities in India*. Wikipedia; Wikimedia Foundation. https://en.wikipedia.org/wiki/Category:Open_universities_in_India
- Wiley, D., Bliss, T. J., & McEwen, M. (2014). Open educational resources: A review of the literature. *Handbook of research on educational communications and technology*, 781-789.
- Yuan, L., MacNeill, S., & Kraan, W. G. (2008). Open Educational Resources-Opportunities and challenges for higher education.

CANNABIS LEGALIZATION

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ABSTRACT

I'm attempting to find out both the advantages and disadvantages of marijuana usage, as well as how it might lead to bad economic outcomes in a society. Cannabis offers a lot of advantages. Scientists are on the hunt for some that have yet to be discovered. Cannabis is a green mixture of dried sativa flowers, weeds, herbs, pots, grass buds, and a few other things. It's utilised for both recreational and therapeutic uses in granular form. Cannabis is the world's most misunderstood substance, yet it's perfectly safe because it's legal in some nations. Cannabis has been used by humans since the Paleolithic era, and it is profoundly interwoven in the traditions of the world's first civilizations. It is tied to religious beliefs and practises in India, dating back to the period when the Supreme was controlled by gods and goddesses. Since the illicit distribution and enforcement of marijuana seizures under the Narcotic Drugs and Psychotropic Substances Act, 1985, legalisation of marijuana has been a contentious issue in India. Even after it was employed in the medical business, no useful steps were done. After two American municipalities opted to legalise marijuana for recreational use, there has been a storm of liberal thinking in the United States. The goal of this research is to look at the use of marijuana in depth.

INTRODUCTION

“Every form of addiction is bad, no matter whether the narcotic be alcohol,
morphine or idealism.”¹⁸— Carl Gustav Jung

“Cannabis is listed as one of the "five kingdoms of plants that relieve us from concern" in the Atharvaveda, the Vedas' fourth book, and its uses are outlined in the Sushruta Samhita and the Bhava Prakasha. According to a passage in Panini's Ashtadhyayi, cannabis was known to Indians as early as 2,300 years ago. In the 10th century CE, it was nicknamed "lunch of the gods." Astringency, heat, inspiration, and the capacity to release wind and phlegm were among its features 500 years later. Dhurtasamagama, a Sanskrit comedy from the 16th century, depicts two vagabonds discussing in front of a corrupt judge. Before making a decision, the judge asks for money for his decree, which is swiftly delivered in the form of bhang. It was then connected with amrit, the elixir of life, according to the Rajvallabh, a 17th-century text.

After all, India's alcohol taxes brought in Rs 1.75 lakh crore in 2019-20. Tobacco goods bring in approximately Rs 53,000 crore to the Indian government each year. We have no restrictions on the sale of those items. Customers can't afford them because we make them expensive.

According to UNODC data, marijuana is the most widely manufactured narcotic in the world, and governments that legalise it for non-medical use risk catastrophic consequences. Marijuana is the most extensively produced drug in the world, according to UNODC data, and countries that legalise it for non-medical use risk market infection and diversification.

The Narcotics Drugs and Psychotropic Substances (NDPS) Act of 1985 now governs India's cannabis laws. Cannabis resin and flowers are unlawful to sell or eat, while seeds, stems, and leaves are permitted. In practise, bhang is lawful, but ganja and charas remain illegal. Do you think that's the case, though? After all, beer, wine, vodka, and whiskey all have different levels of alcohol. Beer has 5% alcohol, whereas wine includes 12 percent, vodka carries 45 percent, and whiskey contains 45 percent alcohol. Because of their potency, do we make one lawful and the other illegal?”

AIMS/OBJECTIVE:

- ❖ To examine the orthodox mentality regarding Weed.
- ❖ Analyse, and discuss the effects of Weed.

RESEARCH QUESTIONS:

- ❖ Why don't we legalise cannabis and tax it like alcohol and tobacco?
- ❖ Why cannabis should/should not be legalized?

- ❖ Pros and cons of usage of cannabis
- ❖ How it can affect once body?
- ❖ How does the legalization of weed affect the number of cannabis users?

HYPOTHESIS

- ❖ The usage of cannabis is very high.
- ❖ The laws regarding the usage & plantation of cannabis should be re-viewed.
- ❖ More you legalize the less the society will become corrupt.

STATEMENT OF PURPOSE:

- ❖ “First and foremost, the extremely significant concerns about marijuana legalisation must be thoroughly investigated and evaluated. The first is that legalising marijuana encourages both direct and indirect marijuana usage among current and future generations. Cannabis prohibition, on the other hand, has had little impact on the market. The right logical chain is the one that proceeds in the other way. The current craving for marijuana is fueled by its accessibility, and the most civilised atmosphere in which it may be obtained is most likely restricted. As a result, the structure's producers are the only ones who receive a true incentive. They will be compensated more if their losses mount. The right logical chain is the one that proceeds in the other way. The existing marijuana supply and control over the highly civilised environment are due to the current monkey-tight condition. As a result, the manufacturers who gain from the incentive system are those who are really moving. They will be charged greater premiums if their losses escalate. The likelihood of future criminals participating in this market will increase. As a result, the ban's actual effects may differ slightly from its stated goals.
- ❖ The second thing to keep in mind is that drug usage, particularly marijuana use, leads to strict drug use. According to research, those who take milder drugs have a larger proportion of illegal drug users than those who do not. However, this does not imply that using soft drugs leads to more strict drug approval. When exposed to both illicit soft and harsh drugs, some people choose to take hard drugs immediately away. People cannot be influenced in their lifestyle and consumption patterns, even if the concept of adopting stronger drugs later is permitted for a cause. Some politicians are unable to give up individual liberty because they do not share the interests of certain segments of society.
- ❖ Marijuana usage is hazardous not only to the user, but also to the community in which they live. In practise, it may result in a rise in crime and medical expenditures. This assumption, however, is frequently wrong for a variety of reasons. To begin with, someone cannot be punished only for committing a crime. Only the genuine nature of the

offence or provocation may be investigated. Otherwise, both city-zones will be sanctioned and will be allowed to commit future offences (theoretically). This logic's ramifications are manifestly incompatible with ostensibly democratic norms. Those who require more therapy should pay for it themselves, with no additional funding allocated to them.

- ❖ The fourth concern is that marijuana, since it is addictive, has a negative impact on people's capacity to think sensibly. This assertion is somewhat true since cannabis users' mental ability may be harmed. The consumer's selection is justified, however, when he or she uses marijuana for the first time, that is, when he or she picks the best option based on personal preferences. Other individuals have the right to express their thoughts and opinions if they so want. They cannot, however, order the user to quit using marijuana if he or she so desires.
- ❖ Last but not least, the government will not take any action that has a detrimental impact on the well-being of its population. The administration appears to be obsessed with ensuring that inhabitants are safe from both local and international threats. Despite the fact that marijuana usage might lead to addiction, the government should not make it illegal due to its negative consequences. People should be allowed to make their own decisions about their own health and well-being, with the government assisting but not interfering.”

REVIEW OF LITERATURE:

“According to an essay by 'Mrinalini Krishna' titled "The Economic Benefits of Legalizing Weed," despite several public campaigns in the United States to legalise marijuana for drug and recreational use, several states have previously taken similar moves. Marijuana's commercial supply is tightly controlled, providing a financial incentive for its legalisation. Increasing tax income, creating jobs, and increasing investment opportunities are all compelling reasons to pursue legal incentives.

According to Tathagata Satpathy's 2017 article in *The Hindu*, 5% of India's population uses cannabis for recreational purposes, while 95% uses it for therapeutic ones. It discusses the benefits of marijuana usage. Nipton, a tiny town in California, was recently bought by American Green with the purpose of turn it into a "smart marijuana" community where individuals may obtain drugs. Clothes and marijuana that has been smoked are prohibited. Odisha has legalised marijuana, and every Monday evening, a Puja Trinath Mela is hosted (where they sit under a big tree and pray for the three supreme beings and smoke marijuana). The law is founded on a way of life that must not be damaged.

According to Charles "cully" Stimson's paper "Why We Shouldn't Legalize Marijuana," cannabis is an addictive gateway drug (2012). Proponents of marijuana legalisation have ignored or downplayed the well-documented negative aspects of cannabis trafficking and consumption. Supporters of marijuana have had some success arguing that it is a "soft" drug similar to alcohol, and that it is fundamentally different from "hard" narcotics like cocaine or heroin. Finally, it states that marijuana is illegal under federal law, regardless of state law, and that inhabitants of the state do not have the right to authorise abortions. If a state could legalise marijuana, it would serve a function other than alleviating the drug issue.

The study looked at individuals between the ages of 13 and 20 who were determined to be connected to marijuana based on clinical indicators or a positive urine test on ED/UC visits from 2005 to 2015, according to Elizabeth Mechcatie's article "The Impact of Legalization of Medical and Recreational Marijuana." (2018). The number of marijuana-related ED/UC visits climbed from 161 in 2005 to 777 in 2015, with the number of such visits, which included mental health screens, increasing from 84 to 500 during the same time period. Sixty-two percent of the 4,202 instances involved cannabis use, abuse, or neglect. Seizures and bipolar disorder are diagnosed in 71 percent of instances, with depression (39 percent) and mood disorders (39 percent of total visits) following closely behind (22 percent).

"Should Marijuana Be Legal?" is a question that many people ask. Michael Gonchar is the author of this piece. Eighteen states, according to the *New York Times*, have legalised

marijuana for therapeutic use. Should it be permitted in all 50 states to use for therapeutic purposes? Should customers over the age of 21 be allowed to use it recreationally, as Washington and Colorado have done? Is the existing federal marijuana prohibition, in general, a good idea? Why? Randall c. Archibold addresses the Organization of American States' reference to nations legalising marijuana as "juice-how-to-drug-war" in "For a Debate on the Legitimacy of Cannabis in the American Alliance." "It adds to the discourse," said Ethan Nadelmann, executive director of the Drug Policy Alliance, a pro-loitering group.

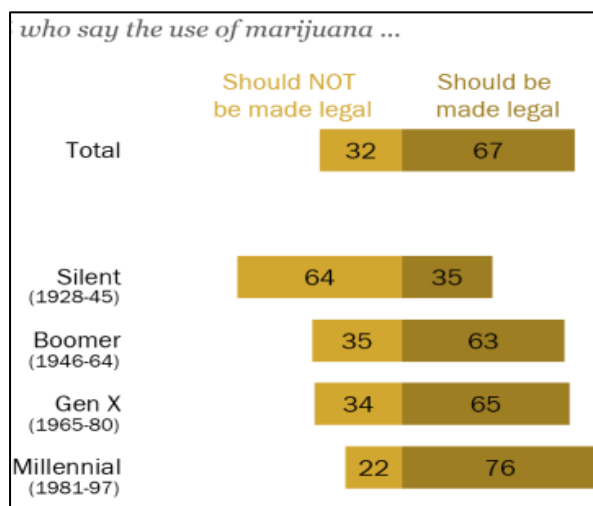
According to many publications and UNODC data on marijuana, India's entire cannabis consumption is just 3,91,275 kg and 4298 tonnes. Afghanistan, Morocco, and the United States are the top three marijuana producers. In clinical trials, it has been found to increase lung capacity, combat cancer, aid in the treatment of glaucoma, lessen the adverse effects of hepato-arthritis, and improve therapeutic efficacy, among other things.”

ANALYSIS

The benefits of Marijuana are:

- * Helps to lose weight
- * Regulates and prevent diabetes
- * Fight's cancer
- * Can help children suffering from autism?
- * Mend bones
- * Treatment of Glaucoma
- * Helps with tremors associate with Parkinson's disease
- * Bring in tax revenue

“Millennials (born 1919–1997), Jean Gers (born 1965–1980), and Baby Boomers (born 1965–1980) all favoured marijuana legalisation, according to one server. It needs to be reaffirmed decades ago. Marijuana legalisation was opposed by the silent generation (born between 1928 and 1945). Consider how legal marijuana would be if there was a high demand for it after it was declared illegal. Can you image



how legal marijuana would be if there was a big demand in the market after it was deemed illegal? With 100,000 tonnes of marijuana produced annually throughout the world, can you imagine how legal it would be if there was a high demand in the market after it was made illegal? Legalizing marijuana is the most effective way to stabilise the economy of impoverished countries like Niger, Liberia, and Ethiopia.”

“In one study, a woman with glaucoma was given both a typical glaucoma pre-ejaculation medicine and marijuana. The eyes of the lady are subjected to significantly less dangerous stress. This does not, however, imply that a person should avoid heights at all costs to avoid eye problems. A person's tolerance to toxins builds up to the point that the patient feels relieved, even though he or she is not overweight, according to Paul Paulberg. Marijuana has also been demonstrated to aid in the prevention and treatment of neurological conditions. Marijuana should be made legal in general, and the current policy should be changed immediately. It's better not to give up on this plan. Many individuals are in favour of the change in policy, and the government should follow suit. Another reason for policy change now is the amount of money marijuana

brings in to the government's coffers and the legal system. It is hazardous even if purchased. Cannabis smoke has 50 to 70 percent more carcinogens than cigarette smoke. According to a huge study, smoking a single marijuana joint causes more lung damage than smoking five regular cigarettes one after the other. Bronchitis, a lung infection, is usually brought on by continuous joint smoking. Cannabis is one of the few drugs that has been shown to cause abnormal cell division, which can lead to serious genetic diseases. A pregnant woman who regularly smokes marijuana or hashish will have a premature kid with a low birth weight. In the last 10 years, many children of cannabis users have been born with poor aspirations and low abilities to focus and follow life goals. According to the study, prenatal (prenatal) medicines may increase the risk of birth abnormalities, mental impairments, and leukaemia (bone marrow cancer) in children. True, everything has both positive and negative aspects. This is also true with marijuana, which has both good and harmful social implications.”

While researching I came across some facts that why Marijuana should be legalized. Those facts are listed below:

1. It will eliminate illegal trade & associate crimes:

Legalization (or decriminalisation) of cannabis would add an over-the-counter market to the illegal market's production and sale. There will be regulations and limits in place, but the state, fishermen, businessmen, and retailers, rather than criminals or drug traffickers, will dominate commerce.

2. Marijuana addiction is rare:

According to the findings of the observational study, only 9% of those who use marijuana become chronically reliant on it. The 'similar concentrations' of cigarettes, alcohol, and cocaine were 32 percent, 20 percent, and 15 percent, respectively.

3. Taxing Marijuana will increase governments revenue:

By legalising and selling marijuana, the government would be able to make enormous profits that would otherwise go to Italian and Israeli criminal gangs. Around 500 economists signed an official declaration to US President George W. Bush urging for marijuana to be "legal but controlled and managed as other commodities," headed by Nobel winner Milton Friedman.

4. It will create job opportunities:

The legalisation of cannabis for recreational and medicinal uses in Colorado has resulted in the creation of 10,000 new jobs. The cannabis industry can provide a variety of solutions for lowering India's unemployment rate.

5. Marijuana use has medical benefits:

According to research, weed offers a wide range of medicinal benefits. Glaucoma can be addressed, cancer can't spread to other areas of the body, anxiety can be lessened, Alzheimer's disease can be sped up, digestion can be improved, and brain originality can be encouraged.

6. It will help the locals:

In locations like Himachal Pradesh and Tamil Nadu, where marijuana plants are grown, marijuana appears to be the only source of revenue for many communities. Individuals are encouraged to sell it to drug traffickers at a low price since it is a controlled substance, and they suffer further harassment from officials who are paid to destroy cannabis grows. The 'war on drugs,' which is being conducted against our own people, would come to an end if marijuana is legalised.

7. Marijuana has limited withdrawal symptoms & its use can't be fatal:

"I heard you have to smoke roughly 15,000 joints in 20 minutes to get a lethal dose of delta-9 tetrahydrocannabinol," says Dr. Paul Hornby, a biochemist and human pathologist. "I'm going to delegate it to someone." Not only is it practically difficult to overdose on marijuana, but it also causes little withdrawal symptoms in users.

8. Alcohol is more harmful than Marijuana:

Marijuana smoking, unlike the use of alcohol, has never been regarded a morally repulsive conduct. Keeping it lawful was considered as a "enlightened perspective" in reality. Marijuana has now been proven to be less dangerous than alcohol in medical studies. Unlike drinkers, stoners should avoid dangerous driving and violent fighting. They seem pale and kind while under the influence of cannabis."

CONCLUSION

"As a result, there is a compelling need to control the use of marijuana. Beginning in elementary school, governments should launch campaigns to create awareness among teenagers and youth by teaching them about the hazards of consuming drugs through literature and digital media. Countries should strictly limit the use of marijuana for medicinal purposes, with the goal of making medical marijuana only available to those who have gotten a doctor's prescription. The authorities should keep an eye on the amount of THC in marijuana since it is THC that causes cannabis addiction."

"Since the objective of commercialization is to produce money, marijuana should not be sold if it is legalised. Businesses are also aware that focusing on the youth assures that they will have long-term customers. Ice cream, candy, and even soft beverages containing cannabis are becoming more commonly available. Allowing unlimited access to Marijuana production,

distribution, and use poses a serious threat to the country and its citizens, which must be tackled methodically. Marijuana, drugs, cigarettes, and other chemical addictions have a terrible influence on daily life, but they may be overcome with the right counselling and commitment.”

“After 25 years of fighting Western pressure, India finally caved in to Western demands in 1986, clubbing but criminalising marijuana and other hazardous substances. On the other side, making it illegal has raised additional issues. Marijuana should certainly be kept out of the reach of youngsters, but it presents no risk to adults when used safely.”

“Why should our government go to the difficulty of apprehending marijuana traffickers and torching marijuana plantations instead of legalising a culturally acceptable commodity that may aid the country's socioeconomic development?

Due to the corrupt and unregulated system which contributes majorly to controlling the abuse,

1. Supports the unselfish use of marijuana and assists developing nations in attaining this aim, owing to the crooked and uncontrolled system that plays a big role in limiting its misuse;

2. Authorizing nations must employ the following techniques to guarantee that marijuana does not wind up in the hands of criminals or on the illegal market across the world:

Only government-approved (government regulating committee) companies should be able to cultivate or manufacture marijuana if it is legalised.

When maintaining marijuana for therapeutic purposes, special invoices must be issued.

Recommends that marijuana be made more freely available, that campaigns to encourage its use in medicinal settings be held, and that a worldwide drug-abuse law be enacted, taking into account the appropriate age range for each country. Strongly opposes the legalisation of marijuana for recreational use in any form.”

For concluding my research, I would like to quote the golden lines given by late Bob Marley:

“I do smoke, but I don't go through all this trouble just because I want to make my drug of choice legal. It's about personal freedom. We should have the right in this country to do what we want, if we don't hurt anybody.”¹⁹

¹⁹ Marco Medic et al., 41 FAMOUS MARIJUANA QUOTES FROM THE MOST SUCCESSFUL PEOPLE IN HISTORY
GREENCAMP (2020)

**International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

Reference

- MD Peter Grinspoon, MEDICAL MARIJUANA HARVARD HEALTH BLOG (2020),
Should Marijuana Be Legalized in India? LEGAL SERVICE INDIA - LAW, LAWYERS AND LEGAL
RESOURCES
- Namrata Reddy Sirupa, WHY CANNABIS SHOULD BE LEGALISED IN INDIA BW BUSINESSWORLD
- Michael Gonchar, SHOULD MARIJUANA BE LEGAL? THE NEW YORK TIMES (2013)
- Elizabeth Mechcatie, THE IMPACT OF LEGALIZATION OF MEDICAL AND RECREATIONAL...AJN
THE AMERICAN JOURNAL OF NURSING LWW
- Deborah White, PROS AND CONS OF LEGALIZING MARIJUANA IN THE U.S THOUGHTCo (2019)
- Vikram Patel, INDIA MUST JOIN OTHER COUNTRIES IN DECRIMINALIZING MARIJUANA THE INDIAN
EXPRESS (2020)
- Sameeruddin Shaik, LEGALIZATION OF CANNABIS IN INDIA READERS BLOG (2020),
TATHAGATA SATPATHY, SHOULD MARIJUANA BE LEGALISED? THE HINDU (2017),
Mrinalini Krishna, THE ECONOMIC BENEFITS OF LEGALIZING WEED INVESTOPEDIA (2020),
Cannabis, WORLD HEALTH ORGANIZATION
- Marco Medic et al., 41 FAMOUS MARIJUANA QUOTES FROM THE MOST SUCCESSFUL
PEOPLE IN HISTORY GREENCAMP (2020)
- Carl Jung: Quotes, ENCYCLOPÆDIA BRITANNICA

CUTANEOUS FIBROSARCOMA IN A PERSIAN CAT

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ABSTRACT

Fibrosarcoma is a mesenchymal tumor of malignant fibroblasts in a collagen background. It was reported in all species, but most commonly in older dogs and cats. This tumor often occurs on the head and limbs, but may also occur anywhere on the body. A 6-year-old male Persian cat (3/5 kg) with a raised mass on the right anterior limb was referred to the veterinary hospital. Based on owner information, within the previous 2-month period, the mass had become evident and grew larger. Finally, complete surgical removal was selected. On gross examination, the mass was approximately 8×10×12 mm in size. Macroscopically, the mass was well circumscribed, ulcerated, firm and white to yellow. Tissue samples of the mass were fixed in 10% neutral buffered formalin and routinely processed, dehydrated, embedded in paraffin wax, sectioned at 5µm in thickness and stained with Hematoxylin and Eosin and Masson's trichrome. Immunohistochemical studies of the mass sections were performed using Vimentin, SMA and Desmin. Microscopically, the mass was encapsulated and the dermis and subcutaneous area were expanded by spindle-shaped to polygonal neoplastic cells in the interwoven pattern and contained a single ovoid to polygonal nucleus and a moderate amount of eosinophilic cytoplasm. Nucleoli were often prominent. Mitotic figures were infrequent. The sections were positive for Masson's trichrome and Vimentin and negative for Desmin and SMA. Based on histopathological features, a well differentiated fibrosarcoma was diagnosed. No new growth of the mass was observed six months following the surgical procedures. The incidence of fibrosarcoma in cats has been rising in the last 20 years, most likely associated with vaccination. Similar to this case, surgical excision is the treatment of choice in this tumor.

Keyword: Cat, Cutaneous, Fibrosarcoma, Pathology

INTRODUCTION

Fibrosarcoma is a mesenchymal tumor of malignant fibroblasts in a collagen background with immature proliferating fibroblasts or undifferentiated anaplastic spindle-shaped cells arranged in distinct interwoven patterns (Hendrick, 2017). These tumors occur commonly in all domestic animal species (Hendrick, 2017; Modiano & Breen, 2007) and have been reported in cats (Strong et al., 2016), dogs (de Paula et al., 2021) and horses (Bass et al., 2017). This paper is about the macroscopic, surgical, and histopathological findings of a well differentiated cutaneous fibrosarcoma in a Persian cat.

CASE DESCRIPTION

In December 2022, a 6-year-old male Persian cat (3.5 Kg) with a raised mass on the lateral side of its right hind limb was referred to the hospital. Based on owner information, within the previous 2-month period the mass had become evident and grew larger. On physical examination vital signs such as pulse rate and respiratory rate were normal. Further clinical examination revealed no other physical abnormalities and complete surgical removal of the mass was chosen. The cat was anaesthetized with intravenous injections of ketamine and diazepam and maintained with 1%-2% isoflurane in oxygen. Analgesia was provided by subcutaneous injection of ketoprofen (for 3 days). On gross examination, the mass was approximately 8×10×12 mm in size. It was well circumscribed, ulcerated, firm and white to yellow. Tissue samples of the mass were fixed in 10% neutral buffered formalin, routinely processed, dehydrated, embedded in paraffin wax blocks, sectioned at 5µm thicknesses (Rotary Microtome RM2 145; Leica, Wetzlar, Germany) and stained with Hematoxylin & Eosin and Masson's Trichrome (Luna, 1968). Immunohistochemical studies of the mass were performed using Vimentin (V9, mouse monoclonal, dilution: 1/50, Dako, Denmark) (Luna, 1968), SMA (1A4, mouse monoclonal, dilution: 1/50, Dako, Denmark), and Desmin (D33, mouse monoclonal, dilution: 1/50, Dako, Denmark) (Vascellari et al., 2006). Sections were examined using a light microscope (E600; Nikon, Tokyo, Japan) and representative images were taken. Hemorrhage, necrosis and peripheral aggregates of lymphocytes were observed in the histopathological sections. Microscopically, the mass was encapsulated and the dermis were expanded by spindle-shaped to polygonal neoplastic cells. These cells were arranged in an interwoven pattern and contained a single ovoid to polygonal nucleus. Nucleoli were often prominent. Mitotic figures were infrequent. Some neoplastic cells had cellular and nuclear pleomorphism (Fig 1). Masson's trichrome demonstrated the positive and blue staining of collagen. Immunohistochemically, the sections were uniformly positive for Vimentin and negative for Desmin and SMA. Based on

histopathological, histochemical and immunohistochemical features, a well differentiated fibrosarcoma was diagnosed.

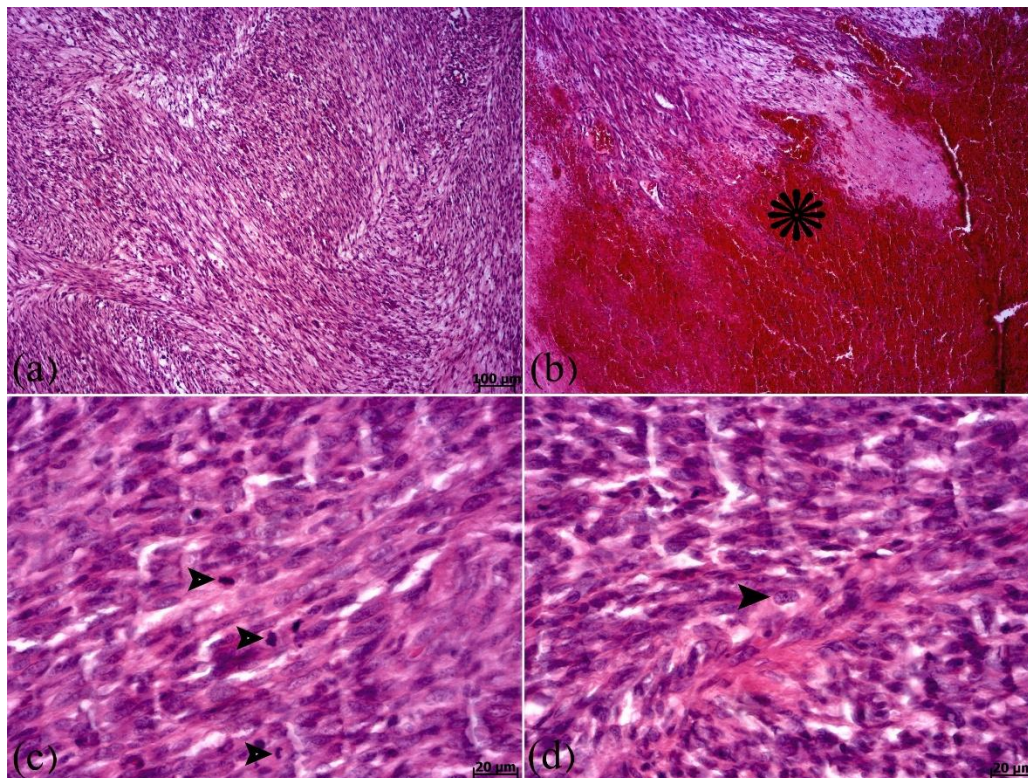


Figure 1: Well differentiated fibrosarcoma in a Persian cat. (a): spindle-shaped to polygonal neoplastic cells in an interwoven pattern. (b): Severe Hemorrhage (*). (c): Mitotic figures (arrowheads). (d): bizarre cell (arrowhead), H&E.

DISCUSSION

fibrosarcomas occur in all domestic animal species, but most commonly occur in adult and aged cats and dogs and can appear anywhere on the body (Hendrick, 2017). These tumors can range from well differentiated to more aggressive, but metastasis is uncommon (Hendrick, 2017). A well differentiated fibrosarcoma is composed of spindle cells, collagen and rare mitotic figures in the herringbone pattern (Hendrick, 2017; Van den Top et al, 2008). FeSV can also induce a rare and aggressive fibrosarcoma in cats. FeSV-induced tumors are multicentric and are found most frequently in young cats (Hartmann, 2011). These tumors are characterised by rapid growth. Metastasis to the lungs or other organs occurs with approximately 30% of virally induced fibrosarcomas in cats. However, only 2% of fibrosarcomas in cats are virally induced (Vail et al. (2020). Fibrosarcoma is the most common tumor of the cat. Its incidence has increased over the past 20 years, most probably due to its association with vaccination. There is significant overlap between fibrosarcomas and leiomyosarcomas in histopathological findings, thus making the use of special stains and immunohistochemical identification, essential for the final diagnosis.

Microscopically, leiomyosarcomas, unlike fibrosarcomas, have elongated nuclei, with blunt rounded ends and eosinophilic cytoplasm. Spindle cells with red cytoplasmic stain were not found among the blue collagen bundles on Masson's trichrome staining. The mass also stained negative for Desmin and SMA and positive for Vimentin. These results prove that this tumor could not have originated from muscle cells and it is a well differentiated fibrosarcoma. (Hendrick, 2017; Roccabianca et al, 2020). Similar this case, surgical excision is the treatment of choice for well differentiated fibrosarcoma (Hendrick, 2017).

CONCLUSION

Surgical excision remains the treatment of choice for fibrosarcomas in cats with radiation therapy as secondary treatment, particularly if surgical removal is difficult.

REFERENCES

1. Bass, K., Mochal-King, C. A., Cooley, A. J., & Brinkman, E. (2017). Equine mandibular fibrosarcoma in two horses: clinical, diagnostic, and therapeutic considerations. *Journal of Equine Veterinary Science*, 48, 31-38.
2. de Paula, L. V., do Amaral, A. V. C., Saturnino, K. C., & de Souza Ramos, D. G. (2021). Canine primary corneal fibrosarcoma—case report. *Topics in Companion Animal Medicine*, 42, 100494.
3. Hartmann, K. (2011). Clinical aspects of feline immunodeficiency and feline leukemia virus infection. *Veterinary immunology and immunopathology*, 143(3-4), 190-201.
4. Hendrick, M. J. (2017). Mesenchymal tumors of the skin and soft tissues. *Tumors in domestic animals*, 5, 142-175.
5. Luna, L.G., 1968. Manual of histologic staining methods of the Armed Forces Institute of Pathology.
6. Modiano, J., & Breen, M. (2007). The etiology of cancer. *Withrow and MacEwen's Small Animal Clinical Oncology*.
7. Roccabianca, P., Schulman, Y., Avallone, G., Foster, R., Scruggs, J., Dittmer, K. & Kiupel, M. (2020). *Surgical Pathology of Tumors of Domestic Animals. 3: Tumors of Soft Tissue*.
8. Strong, T. D., Tangeman, S., Ben-Shlomo, G., Haynes, J., & Allbaugh, R. A. (2016). Corneal fibrosarcoma in a cat. *Veterinary Ophthalmology*, 19, 131-135.
9. Van den Top, J. G. B., De Heer, N., Klein, W. R., & Ensink, J. M. (2008). Penile and preputial tumours in the horse: a retrospective study of 114 affected horses. *Equine Veterinary Journal*, 40(6), 528-532.
10. Vail, D. M., Thamm, D. H., & Liptak, J. (2019). *Withrow and MacEwen's Small Animal Clinical Oncology-E-Book*. Elsevier Health Sciences.
11. Vascellari, M., Melchiotti, E & Mutinelli, F. (2006). Fibrosarcoma with typical features of post injection sarcoma at site of microchip implant in a dog: histologic and immunohistochemical study. *Veterinary Pathology*, 43, 545-448.

TARIM SEKTÖRÜNDE KOOPERATİFLEŞMENİN ÖNEMİ

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ÖZET

Ülkelerin ekonomik gelişimlerini sürdürebilmeleri için düzenli olarak üretim kapasitelerini artırmaları gerekmektedir. Bu gaye ile yöneticiler teknoloji, sermaye ve emek unsurlarını son derecede verimli kullanılmaya çalışmaktadırlar. Bu prensip ile kooperatifçilik terimi birçok sektörde iş birliğini esas almakta ve günümüzde farklı ekonomi politikaları içerisinde yer almaktadır. Teknolojik, ekonomik, sosyal ve politik unsurların durumuna bağlı olmakla birlikte birçok ülkede ve çeşitli sektörlerde kooperatifleşmeler görülmektedir. Tarım sektöründe yer alan kooperatifler, çiftçi ürünlerinin üretim aşamasından pazarlamaya kadar olan süreçte çok önemli roller üstlenmektedir. Kooperatifler genellikle bilgi açığını ve piyasa belirsizliklerini azaltarak çiftçilere çeşitli ekonomik avantajlar sağlamaktadır. Küçük tarım üreticilerinin kooperatifleşirmeyi benimseme ölçeği ne olursa olsun, kooperatif planlamalarının sosyal, pratik, kişisel ve psikolojik avantajları bulunmaktadır. Bu derlemede tarımda kooperatifleşmenin önemi ve avantajları hakkında bilgilere yer verilmiştir.

Anahtar Kelimeler: Tarım kooperatifleri, İş Birliği, Ekonomi

**THE IMPORTANCE OF COOPERATIVIZATION IN THE AGRICULTURAL
SECTOR**

ABSTRACT

To continue their economic development, countries must regularly increase their production capacity. For this purpose, managers use technology, capital, and labor elements exceptionally efficiently. With this principle, the term cooperative is based on cooperation in many sectors and is included in different economic policies today. Depending on technological, economic, social, and political factors, cooperatives are seen in many countries and sectors. Cooperatives in the agricultural sector play very important roles in the process from the production stage of farmer products to marketing. Cooperatives generally provide various economic advantages to farmers by reducing the information gap and market uncertainties. Regardless of the scale at which small agricultural producers adopt cooperatives, cooperative planning has social, practical, personal, and psychological advantages. This review gives information about the importance and advantages of cooperatives in agriculture.

Keywords: Agricultural cooperatives, Cooperation, Economy

1. GİRİŞ

Toplum ve dünya arasındaki ilişki, modern çağda azalan kaynaklar, artan nüfus ve buna ek olarak çevrede uygulanan baskı, toplumun değişen beklentileri, yeni teknolojiler ve ayrıca büyüyen iklim değişikliğinin etkileri ile tarımın geleceğinin ve üreticiden tüketiciye gıda zinciri organizasyonlarının büyük ölçüde değişmesi beklenmektedir (Kalogiannidis, 2020). Ekonomik olarak sürdürülebilir tarımın sağlanabilmesi tarımsal yönetim ve üretim paradigmalarının değiştirilmesine bağlıdır (Yılmaz ve ark., 2021). Diğer taraftan gıda dışı tarım konuları da giderek fazla önem kazanmaktadır. Bu nedenle çiftçiler, daha akıllı ve daha sürdürülebilir üretim sistemleri geliştirip yönetebilmek için modern bilgi becerilerine ve yenilikçi fikirlere ihtiyaç duymaktadır (Kalogiannidis, 2020). Gelecekte artan tüketici duyarlılıkları ve daha sürdürülebilir olan tarımsal ürünlerin arzının artması beklenmektedir. Bu bağlamda, çiftçilerin sürdürülebilirlik için ekonomik, çevresel ve sosyal tüm boyutları uzlaştırarak sürdürülebilir üretim yapmaları gerekmektedir (Candemir ve ark., 2021).

Tarım sektöründe iş birliği ve ayrıca kooperatiflerin ve kooperatif şirketlerinin kurulması, küçük çiftçilerin artan rekabet koşullarında hayatta kalma çabalarını etkilemektedir. Çiftçiler, ekonominin diğer sektörlerindeki meslektaşlarına kıyasla genellikle "küçük" girişimciler olarak kabul edilir. Bu nedenle, hayatta kalma ihtiyacı, çiftçilerin çoğunu pazarlık gücü elde etmek için birleşmeye yönlendirmektedir (Kalogiannidis, 2020). Çiftliklerin sürdürülebilirliğine ve sürdürülebilirliğe dair faktörlere ilişkin değerlendirmelere birçok deneysel literatürde yer verilmiştir. Bu faktörler, çiftçilerin sosyodemografik özellikleri (ör. yaş, eğitim), çiftlik özellikleri (ör. organizasyon yapısı, büyüklük, borçluluk, ana üretim), tedarik zinciri türü, piyasa fiyatları ve devlet müdahaleleri gibi dış unsurlar ile ilgilidir. Bununla birlikte, tedarik zinciri organizasyonlarının rolü, özellikle çevresel ve sosyal sürdürülebilirlik açısından şimdiye kadar yeterince araştırılmamıştır (Candemir ve ark., 2021).

2. KOOPERATİFLEŞME

Kooperatif; kendi kendine yardım etme, beraberlik, birlik, ortakların menfaatini koruma, ortak hareket etme, dayanışma, bir araya gelme gibi anlamlar taşımaktadır. Ortakların ekonomik menfaatleri ve özellikle geçim ve meslekleri veya ihtiyaçlarını parasal ve işgücü katkılarıyla dayanışma, yardım ve kefalet suretiyle sağlayıp korumak amacıyla tüzel ve gerçek kişiler ile kurulan değişir sermayeli ve değişir ortaklı birlikteliklere kooperatif denmektedir (Aydın, 2021). Kooperatifçilik hareketi, 1800'lü yıllarda Avrupa ülkeleri tarafında ortaya atılmış ve sonrasında tüm Dünya'da yaygınlaşmıştır. Kooperatifçilik ortak hedeflere erişmek isteyen kişiler ile

oluşturulan ekonomik iş birliği çerçevesinde yürütülen örgütlenme modelidir. Mal ve hizmet sunumu ve üretiminde, piyasa yapısı ve işleyişini düzenlemede, ortakların pazarlık gücünü arttırmada kooperatifler; önemli roller üstlenen dayanışma ve yardımlaşmayı arttırmak ve yoksulluğu azaltmak amacıyla özellikle küçük üreticilerin birleşerek oluşturduğu örgütlenmelerdir. Kooperatiflerde asıl amaç, ekonomik sıkıntıları yaşamak istemeyen kişilerin geçim ve mesleklerine yönelik ihtiyaçlarını karşılıklı kefalet ile rasyonel olarak temin etmektir (Çelik ve ark., 2021). Kooperatifleşme ile üretim yapan üreticiler emeklerinin karşılığını tam anlamıyla alabilecekleri konusunda fikir birliğine varırlar. Buna rağmen üreticilerin kooperatiflere karşı ön yargıları da bulunmaktadır. Bazı üreticiler emeklerinin kooperatifçilik ile zayi olacağını düşünmekte ve karamsarlığa kapılmaktadırlar. Türkiye’de son zamanlarda yürütülen başarılı kooperatif uygulamaları bu yanılığın önüne geçilmesine neden olmuştur (Özyücel, 2021).

3. TARIMDA KOOPERATİFLEŞME

Tarım teknolojilerinin penetrasyonu, farklı bölgeler ve tarım sistemleri arasında önemli ölçüde farklılık göstermektedir. Birçok Afrika ve Asya ülkesindeki küçük çiftçiler, tarımsal üretim ve geçim kaynaklarının iyileştirilmesinden yararlanmalarını kısıtlayan, tarım teknolojilerini nispeten düşük benimseme oranlarına sahiptir. Tipik olarak, teknolojinin benimsenme oranlarının düşük olduğu bölgelerde tarımın gelişimi, teknik ve ekonomik potansiyellerden yararlanmada geride kalmaktadır. Bu da gıda güvenliğini tehdit etmekte ve tarım genellikle yerel ekonomilerin temel direği olduğu için yoksulluğun azaltılmasını engelleyememektedir (Zhang ve ark., 2020). Küresel yoksulların yaklaşık %80'i kırsal alanlarda yaşamaktadır. Bu durum yoksulluğun azaltılmasını, uluslararası düzeyde kırsal hanelerin savunmasızlığını azaltmak için önemli bir kalkınma hedefi haline getirmektedir (Gava ve ark., 2021).

Tarım sektöründe bilgi paylaşımı, öğrenme ve yenilikçiliğe yönelik yaklaşımlar hızla gelişmektedir. Eğitim, öğretim, araştırma, danışmanlık ve tarım sektörlerindeki tüm katılımcılar, bu değişen çerçeveye uyum sağlamada kaçınılmaz olarak belirli zorluklarla karşılaşmaktadır. Geçmişte, araştırmacılar tarafından çözümlerin geliştirilmesi ve ardından çiftçiye iletilmesi muhtemelen tatmin edici görünmekteydi. 21. yüzyılda ise tarım ve gıda üretiminin rekabet edebilirliğini ve kırsal alanların canlılığını sürdürmek için bilgi ve deneyim alışverişinin daha iyi uygulamaları, inovasyon modellerini, şirketleri, danışmanları, bilim adamlarını ve çiftçiler tarafından yürütülen çeşitli çalışmaları tanımamıza yardımcı olmaktadır (Kalogiannidis, 2020). Tarımda yaşanan sıkıntıların ortak çözümleri için etkili bir örgüt yapılanmasının oluşturulması gerekmektedir. Tarım örgütleri incelendiğinde, örgütlerin ortakları, sahipleri ya da üyeleri

üreticilerdir. Bu örgütlerin gelişmesinde ve etkin olmasında ise asıl önemli olan unsur üreticilerin kooperatifçilik bilinçleridir (Değer ve ark., 2020). Kooperatif kuruluşları tarımsal üretimi ve pazarlamayı geliştirmeyi amaçlasa da bazı ülkelerde, tüm üyeler ürünlerini tarımsal kooperatifler aracılığıyla satmamaktadır. Kooperatiflerin risk tutumu; çiftlik büyüklüğü, makine sahipliği, satış yeteneği ve demonstrasyon seviyesinin üyelerin tarımsal kooperatifleri bir pazarlama kanalı olarak kullanma kararlarını belirleyen ana faktörler olduğunu göstermektedir (Liu ve ark., 2019). Ekonomik bir bakış açısından, tarımda kolektivizasyonun temel amacı, büyüklük ekonomilerini ele geçirerek kaynakların daha verimli bir şekilde tahsis edilmesini sağlamak ve böylece tarımın, aynı doğrultudaki kaynak transferini en üst düzeye çıkararak ekonominin sanayileşmesine katkıda bulunmasını sağlamaktır (Schmitt, 2021).

Kooperatifleşme, tarım ürünlerinin ihraç edilmesi, tarım sektöründe tekelciliğin önüne geçilmesi ve dış piyasa ile rekabet edilebilmesi bakımından oldukça etkilidir. Tahminlere göre küresel tarım mahsullerinin %50'si kooperatifler ile pazarlanmaktadır (Çelik ve ark., 2021). Çiftçi kooperatifleri, tarımsal üretimde teknolojinin benimsenmesini teşvik etmekte ve bu da mahsul verimliliğini ve çiftçilerin gelirini artırmaktadır. Bununla birlikte, bir çiftçi tarafından çok çeşitli tarım teknolojilerinden benimsenen teknolojilerin sayısı olarak tanımlanan, kooperatiflerin teknoloji benimseme yaygınlığını nasıl ve ne ölçüde kolaylaştırdığına dair ampirik kanıtlar belirsizliğini korumaktadır (Zhang ve ark., 2020). Küçük çiftçiler, bilgi asimetrisi nedeniyle girdi piyasaları hakkında daha az bilgiye sahiptir. Genellikle girdi satıcılarıyla girdi fiyatları konusunda pazarlık yapmak konusunda zayıf bir konumdadırlar. Bu, küçük çiftçilerin pazara katılım kararlarını ve tarımsal üretimi olumsuz etkileyebilecek arama ve müzakere maliyetlerine ilişkin daha yüksek işlem maliyetlerine yol açmaktadır. Bu maliyetlerin bir kısmı, tarım kooperatifleri olarak da bilinen ve birçok gelişmekte olan ülkede geniş çapta teşvik edilen ve hızlı büyüme yaşayan çiftçi kooperatifleri tarafından tasarruf edilebilir (Zhang ve ark., 2020). Kırsal yoksulluktan çıkış yolu, küçük ölçekli çiftçilik sistemlerinin üretkenliğini, kârlılığını ve sürdürülebilirliğini iyileştirmektir. Savunmasız küçük çiftçileri hedef alan etkili araçların uygulanmasına bilgi sağlamak için belirli coğrafi ve sosyal bağlamlardan elde edilen bilimsel kanıtlara ihtiyaç duyulmaktadır (Gava ve ark., 2021).

Kısaca, tarımsal kooperatifler başta sürdürülebilir olması ve çiftçi gelirinin yükselmesi bakımından gerekliken diğer taraftan istihdam sağlaması, kırsal sanayinin kurulması, tarımın gelişmesi ve yerel düzeyde kırsal girişimciliğin artırılmasını sağlaması nedeniyle kırsal yörelerin sosyo-ekonomik olarak gelişmesi ve kalkınması ile bölgelerarası yoksulluk ve dengesizliğin giderilmesi bakımından önemlidir (Çelik ve ark., 2021).

4. SONUÇ

Tarım kooperatiflerinin kurulmasının kırsal yoksulluğun azaltılmasında etkili olduğu görülmektedir. Bugüne kadar, kapsamlı arařtırmalar, tarımsal kooperatiflerin çiftçilerin yoksulluğunu azaltabileceđi farklı mekanizmaları saptamıřtır. Kooperatifler, girdiler ve paylařılan makineler tedarik ederek çiftliklerdeki süreçlerin etkinliđini ve üretkenliđini artırabilmekte, daha geniş pazarlara erişimlerini kolaylařtırabilmekte ve çiftçilerin pazarlık gücünü artırabilmektedir. Ayrıca kooperatifleřmeler sayesinde çiftçiler ile tedarik zinciri aktörleri arasında bađlantılar kurulabilmekte ve yerel bilgi inřası ile sosyal sermayenin oluřturulması desteklenebilmektedir.

KAYNAKLAR

- Abate, G.T., Francesconi, G.N., & Getnet, K. (2014). Impact of agricultural cooperatives on smallholders' technical efficiency: empirical evidence from Ethiopia. *Ann. Publ. Cooper. Econ.* 85, 257–286.
- Aydın, C. (2021). Çiftçilerin tarım kredi kooperatifleri üye olmalarını etkileyen faktörler: Samsun ili Bafra ilçesi örneği (Master's thesis, Ondokuz Mayıs Üniversitesi, Lisansüstü Eğitim Enstitüsü).
- Bourlier-Bargues, E., Gond, J. P., & Valiorgue, B. (2022). Fast and spurious: How executives capture governance structures to prevent cooperativization. *Human Relations*. doi: 10.1177/00187267221137872
- Candemir, A., Duvaleix, S., & Latruffe, L. (2021). Agricultural cooperatives and farm sustainability—A literature review. *Journal of Economic Surveys*, 35(4), 1118-1144.
- Çelik, M., & Karaalp-Orhan, H. S. (2021). Tarımsal Kooperatiflerin Mevcut Durum Analizi ve Sorunları: Denizli-Acıpayam İlçesi Süt Kooperatifleri Örneği. *Paradoks Ekonomi Sosyoloji ve Politika Dergisi*, 17(1), 35-64.
- Gava, O., Ardakani, Z., Delalić, A., Azzi, N., & Bartolini, F. (2021). Agricultural cooperatives contributing to the alleviation of rural poverty. The case of Konjic (Bosnia and Herzegovina). *Journal of Rural Studies*, 82, 328-339.
- Ji, C., Jin, S., Wang, H., & Ye, C., (2019). Estimating effects of cooperative membership on farmers' safe production behaviors: evidence from pig sector in China. *Food Pol.* 83, 231–245.
- Kalogiannidis, S. (2020). Economic cooperative models: agricultural cooperatives in Greece and the need to modernize their operation for the sustainable development of local societies. *International Journal of Academic Research in Business and Social Sciences*, 10(11), 452-468.
- Liu, Y., Ma, W., Renwick, A., & Fu, X. (2019). The role of agricultural cooperatives in serving as a marketing channel: evidence from low-income regions of Sichuan province in China. *International Food and Agribusiness Management Review*, 22(2), 265-282.
- Özyücel, M. (2021). Kırsal Kalkınmada Yeni Çözüm Arayışlarında Kooperatifleşme: İnegöl İncelemesi. *European Journal of Managerial Research (Eujmr)*, 5(Özel Sayı 1), 86-97.
- Değer, H. C., Özder, U., Kinikli, F., & Yercan, M. (2020). Muğla İlinde Üreticilerin Domates Pazarlaması Üzerine Kooperatifleşme Eğilimlerinin Belirlenmesi. *Tarım Ekonomisi Dergisi*, 26(2), 121-129.
- Schmitt, G. (2021). Why collectivization of agriculture in socialist countries has failed: a transaction cost approach. In *Agricultural cooperatives in transition* (pp. 143-159). Routledge.
- Yılmaz, A., Soysal, S., Emirlioğlu, O., Yılmaz, H., Soydemir, H. E., & Çiftçi, V. (2021) Sürdürülebilir Tarımda Anıza Ekimin Önemi. M.F. Baran, K. Bellitürk ve A. Çelik (Ed) Türkiye'de Sürdürülebilir Tarım Uygulamaları: Zorluklar ve Potansiyeller (221-230. ss.). Adıyaman; Turkey: İKSAD.
- Zhang, S., Sun, Z., Ma, W., & Valentinov, V. (2020). The effect of cooperative membership on agricultural technology adoption in Sichuan, China. *China Economic Review*, 62, 101334.

**THE INFLUENCE OF DEVIANT BEHAVIOUR AND TRUST ON EMPLOYEE
PRODUCTIVITY**

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ABSTRACT

The aim of the current study is to examine the relationship between deviant behaviour and trust in employee productivity. This new research put up an approach for fostering a culture of trust among employees by identifying and eliminating undesirable behaviours. The self-designed questionnaire was given out to a total of 150 employees in order to collect the information that was required. We got 70 representative samples of people's genuine responses to the questionnaire. We worked with data using the spreadsheet programme Excel. The outcomes of the study indicate that trust has a positive and significant impact on employee productivity. Also, deviant behaviour has a negative impact on employee productivity. An organization's productivity suffers, often to a significant degree, when employees engage in deviant behaviour. An increase in trust in the organisation will result in a significant decrease in deviant behaviour which has an influence on employee productivity within the organisation. The findings of the study contribute to the existing literature of the body of knowledge on organisational behaviour.

Keywords: Deviant Behaviour, Trust, Productivity

1.INTRODUCTION

The study of deviant behaviours and trust is important for understanding why individuals engage in actions that violate social norms and rules, which can lead to improved social policies and interventions. It also sheds light on the reasons behind criminal activity and helps inform efforts to prevent it. Deviant workplace behaviour (DWB) is voluntary behaviour that violates significant organizational norms and is perceived as threatening to the organisation's or its members' well-being ([Bennett and Robinson, 2000](#)). Trust can greatly impact the effectiveness and efficiency of individuals and organizations, as it can lead to decreased motivation and lower levels of cooperation. By studying trust, researchers and organizations can gain insight into how to build and maintain trust, ultimately leading to better outcomes.

Deviant behaviour and trust are two important factors that significantly impact productivity in an organization. Deviant behaviour can have a negative effect on the workplace by creating distractions, decreasing morals, and increasing conflicts, while trust can have a positive impact on productivity by promoting open communication, reducing conflicts, and increasing job satisfaction and motivation. Trust can also facilitate the delegation of tasks and responsibilities, leading to a more efficient and effective workplace ([Fry 2003](#); [Milliman et al., 2003](#)). Understanding the importance of these factors can help organizations create a positive and productive workplace culture.

Deviant behavior has been extensively studied in the fields of sociology, psychology, criminology, and related disciplines. Researchers have used various methodologies to examine the causes and consequences of deviant behavior, such as social and economic conditions, peer pressure, and individual characteristics ([Cortina et al., 2017](#)). Trust and its influence on productivity has been studied in the fields of psychology, management, and organizational behavior. Researchers have investigated the impact of trust on various outcomes, such as job satisfaction, motivation, and collaboration. Additionally, there has been research into the effects of cultural and organizational factors on trust and productivity.

The goal of this research is to gain a better understanding of how deviant behavior and trust interact to affect productivity, and to inform efforts to promote positive and productive behaviors. Studies have found that deviant behaviour, such as theft, harassment, and absenteeism, can lead to decreased productivity in an organization ([Andersson and Pearson, 1999](#); [Collins and Rogers, 2017](#); [Cortina et al., 2017](#)). Trust in the workplace can lead to improved communication, reduced conflicts, increased job satisfaction and motivation, and improved decision-making processes. Deviant behaviour can lead to decreased trust among employees and between departments, which can have a negative impact on productivity. Organizational stress is positively related to

workplace deviant behaviour, organizational deviance, and interpersonal deviance. These findings highlight the importance of addressing deviant behaviour and creating a culture of trust in organizations to improve productivity and create a positive workplace environment.

The need for additional research on deviant behavior and the influence of trust on productivity is due to the dynamic and complex nature of these phenomena. Research is needed to understand how different factors, such as social and economic conditions, individual characteristics, and cultural differences, interact to influence deviant behavior. workplace bullying is typically described as repeated and enduring negative acts that are unwanted by the victim and which cause humiliation, offence, and distress and that may interfere with job performance or cause an unpleasant work environment ([Einar Sen and Raknes, 1997](#); [Rayner and Keashly, 2005](#)). Additionally, more research is needed to understand how trust and productivity are affected by cultural and organizational differences and technological changes. The need for additional research on deviant behaviour and trust and their influence on productivity is driven by the importance of these phenomena for individuals, organizations, and society. There are controversies in the existing literature on the relationship between deviant behaviour, trust, and productivity, such as the definition of deviant behaviour, the impact of deviant behaviour on productivity, the relationship between deviant behaviour and trust, the impact of trust on productivity, and the relationship between deviant behaviour, trust, and productivity. More research is needed to fully understand the impact of these factors on one another.

The purpose and contribution of deviant behaviour and trust and their influence on productivity in the existing literature is to gain a deeper understanding of these phenomena and their impact on individuals, organizations, and society. Employees in the hospitality industry are often exposed to a fast-paced work environment defined by long hours and immense pressure, which creates a physiological load and hinders their emotional regulation over time ([Goh and Lee, 2018](#)). The study of deviant behavior aims to explain why individuals engage in actions that violate social norms and rules. It also helps to shed light on the reasons behind criminal activity, which has implications for crime. The study of trust and its influence on productivity aims to understand the factors that contribute to building and maintaining trust in individuals and organizations. It helps to inform efforts to create positive work environments and foster collaboration, leading to increased productivity.

Additionally, it helps to shed light on how cultural and organizational differences can impact trust and productivity. The purpose and contribution of deviant behaviour and trust and their influence on productivity in the existing literature is to provide a better understanding of these complex and dynamic phenomena, and to inform efforts to promote positive and productive

behaviours. Recent studies by [Shahzad et al. \(2018\)](#) showed that decision making and employees participation eulogies probability of behaviour output. The contribution of research on deviant behaviour and trust and their impact on productivity varies across studies, but some common purposes and contributions include understanding the relationship between deviant behaviour, trust, and productivity, identifying best practices for addressing deviant behaviour, promoting a positive workplace culture, and providing evidence-based insights for organizations to inform their workplace practices. These studies have made a valuable contribution to the existing literature on deviant behaviour, trust, and productivity by providing a deeper understanding of the relationship between these factors and by identifying best practices for promoting a positive and productive workplace.

REVIEW OF LITERATURE

Our research makes the important contributions to the field deviant, trust, and workplace productivity. Employee deviant behaviour has always been a bane to organizations. DWB gained attention from organizational behaviour researchers with its negative psychological, social and tangible consequences for employees and organizations. Destructive behaviour and constructive behaviour are two types of DWBs discussed in literature ([Bennett and Stamper, 2001](#)). How we trust businesses, our employers, and our co-workers has changed substantially over the past two to three decades due to changes in the workplace. Deviant behaviour at work can take many different forms, such as verbal and physical abuse, violence, and corporate fraud. These aberrant behaviours are costly to organisations and individuals on a social, economic, and psychological level. The current study aims to comprehend how organisational stress affects the workplace. The study also examines emotional intelligence as a mediator between workplace misbehaviour and organisational stress.

Literature on organizations indicates potential for or presence of both negative and positive employee-related outcomes in organizations. The negative outcomes include prevalence of politics (e.g., [Gandz and Murray 1980](#)), workplace deviance (e.g., [Bennett and Robinson 2000](#)), and mental health problems ([Hosie et al. 2006](#)). Potential positive outcomes suggested in the literature include employee commitment, productivity (e.g., [Fry et al. 2005](#)), positive work adjustment ([Vandenberg et al., 2002](#)), sense of spiritual survival (e.g., [Fry 2003](#)), organization-based self-esteem ([Milliman et al. 2003](#)), and employees' performance of organizational citizenship behaviors (e.g., [Bolino and Turnley 2003](#)).

2.1 Trust and Deviant Behaviour

Changes in trust between workers, between employees and management, and between the company and its clients can be caused by deviant behaviour at work. When employees do things like steal, lie, or harass other employees, it can make it harder for other employees to trust them. This can make people less ready to work with or depend on co-workers who have done this, which can lead to less cooperation, lower confidence, and lower productivity. Also, inappropriate conduct can make it hard for workers and managers to trust each other. If workers think that management isn't doing enough to stop bad behaviour or is doing it themselves, they may stop trusting the company as a whole ([Shahzad et al., 2018](#)).

When employees act badly at work, it can hurt the company's image and make it harder for customers, suppliers, and investors to trust the company. This can cause sales to go down, business partners to leave, and investment to go down, all of which are bad for the organization's finances. Overall, deviant behaviour at work can make it hard for people inside and outside the organisation to trust each other. Organisations need to take steps to stop and deal with this kind of behaviour if they want to keep their workplaces healthy and productive. This can be done by setting clear standards and goals, giving workers training and support, and making sure there are good ways to report and deal with deviant behaviour when it happens.

H1: Trust is negatively related to workplace deviant behaviour

2.2 Deviant Behaviour and Productivity

Deviant behavior can have a negative impact on productivity in various ways. It decreases motivation when individuals engage in deviant behavior, such as theft or absenteeism, their co-workers may become demotivated and lose their sense of trust in the organization. This can result in decreased productivity and a decline in overall morale. Additionally, increased Costs, as they may need to invest in security measures to prevent theft or in human resources to manage absenteeism. Subsequently, decrease collaboration among co-workers, as they may feel less inclined to work together when they don't trust their colleagues ([Bennett and Robinson, 2000](#); [Hosie et al., 2006](#)). Deviant behaviour can also result in a loss of reputation for organizations, as customers and clients may be less likely to do business with companies that have a history of deviant behaviour among their employees.

Social and economic conditions, such as poverty, unemployment, and social inequality, can contribute to deviant behaviour by creating a sense of frustration and despair among individuals. Peer pressure can influence individuals to engage in deviant behaviour, as they may feel pressure to conform to the norms and values of their social group. Individual Characteristics: Individual characteristics, such as personality, cognitive abilities, and temperament, can also play a role in deviant behaviour. For example, individuals with impulsive or risk-taking personalities may be more likely to engage in deviant behaviour. Deviant behaviour can have a significant negative impact on productivity, as it can decrease motivation, increase costs, decrease collaboration, and harm the reputation of organizations.

H2: Deviant behaviour negatively related to employee productivity

2.3 Trust and Productivity

Trust can have a significant positive impact on productivity. When individuals trust their co-workers and the organization they work for, they are more likely to be motivated and engaged in their work. This can result in higher levels of productivity and a more positive work environment. Trust can also improve collaboration among co-workers, as individuals are more likely to work together effectively when they trust each other. This can result in increased efficiency and more effective problem-solving. Trust can also improve decision-making, as individuals are more likely to seek out and consider the opinions of others when they trust them. This can lead to better decision-making and more informed choices. Trust can also promote innovation, as individuals are more likely to share their ideas and take risks when they trust their co-workers and the organization they work for. This can result in new and improved products and services.

Communication plays a crucial role in building and maintaining trust. Transparency and openness in communication can promote trust, while secrecy and misinformation can erode it. Transparency refers to the extent to which individuals and organizations are open and honest about their actions, decisions, and intentions. High levels of transparency can promote trust and increase productivity (Milliman et al. 2003; Bolino and Turnley 2003). Accountability refers to the extent to which individuals and organizations are responsible for their actions and decisions. High levels of accountability can promote trust, as individuals are more likely to trust those who are responsible for their actions. Cultural differences can also impact trust and productivity. Organizational factors, such as the structure and policies of organizations, can also influence trust

and productivity. For example, hierarchical organizations may have lower levels of trust and productivity compared to flat, democratic organizations.

H3: Trust is positively related to productivity

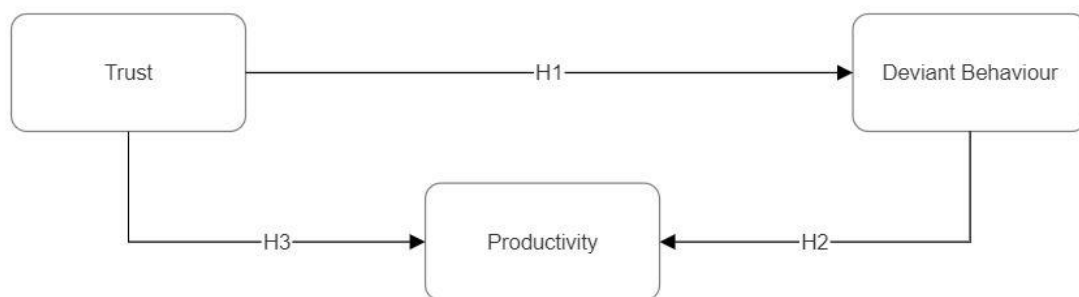


Fig 1. Hypothetical Framework

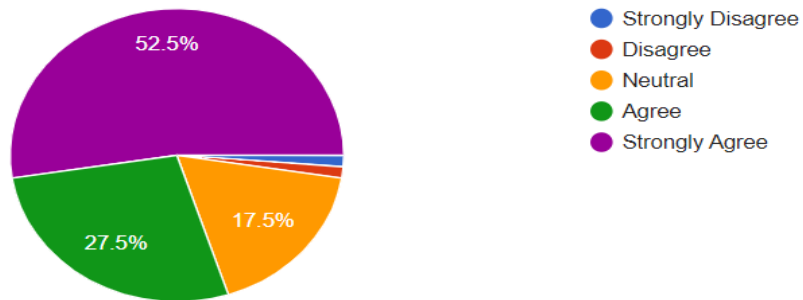
3. METHODOLOGY

The current study was a quantitative research study and used structured questionnaire to collect the data from the respondents. Quantitative research methods are used to test hypotheses and measure the impact of deviant behaviour and trust on employee productivity. This methodology involves collecting data through surveys or questionnaires to identify the significant factors of employee productivity. This new research put up an approach for fostering a culture of trust among employees by identifying and eliminating undesirable behaviours. The self-designed questionnaire was given out to a total of 150 employees in order to collect the information that was required. We got 70 representative samples of people's genuine responses to the questionnaire. We worked with data using the spreadsheet programme Excel. The outcomes of the study indicate that trust has a positive and significant impact on employee productivity. Also, deviant behaviour has a negative impact on employee productivity.

4. RESULTS AND ANALYSIS

Deviant behavior can have a negative impact on workplace productivity in several ways ?

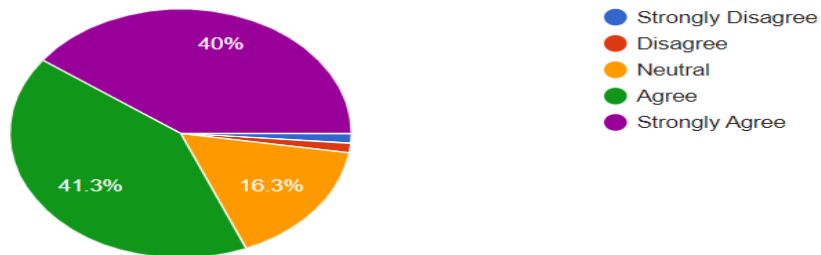
80 responses



We received a total of 80 replies, and after reviewing them, we found that 52.5% of respondents strongly agreed with the statement in question, and the next highest response was recorded for those who agreed with the statement, which was 27.5%.

Deviant behavior can cause decreased motivation and engagement, which can result in decreased productivity.

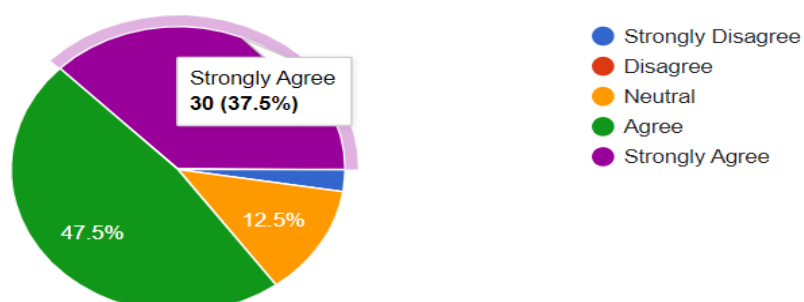
80 responses



According to our data, 41.3% of respondents agreed with the aforementioned statement, with 40% recording themselves as strongly agreeing.

Deviant behavior can damage trust and relationships among coworkers, which are essential for effective collaboration and teamwork?

80 responses

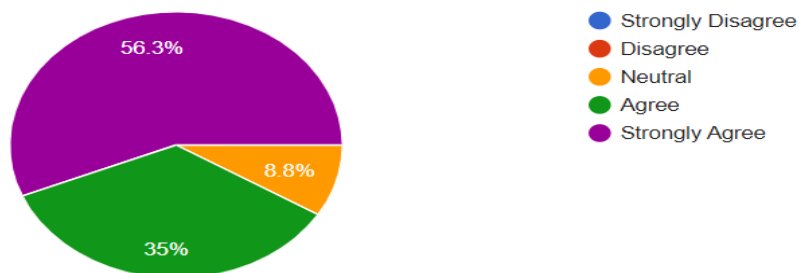


International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

In accordance to the results of our research, 47.5% of respondents agreed that the aforementioned statement is true, and the next highest response was obtained for those who strongly agreed with the statement 37.5% of the time.

If employees don't trust each other, it can be difficult to work together effectively and productively?

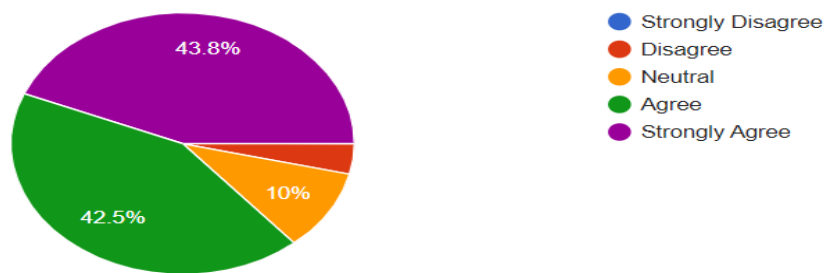
80 responses



The analysis indicates that 56.3% of the people surveyed strongly agreed with the aforementioned statement, while the second highest response was recorded for the agree category, with a percentage of 35%.

Managers should communicate openly and honestly with their employees, even when the news is difficult or unpleasant?

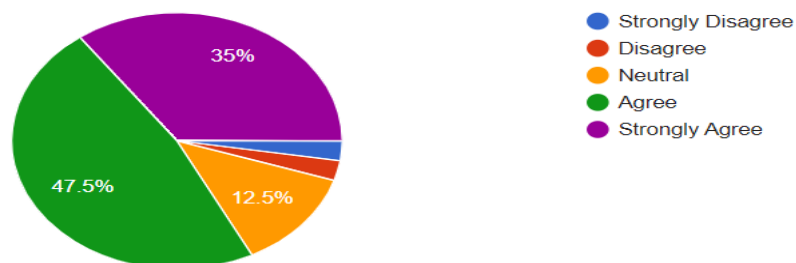
80 responses



We concluded that 43.8% of those questioned strongly agreed with the statement in question, with 42.5% of respondents agreeing being the option that received the second highest percentage of votes.

Employees who are dissatisfied with their jobs may engage in deviant behavior as a way to cope with their negative feelings?

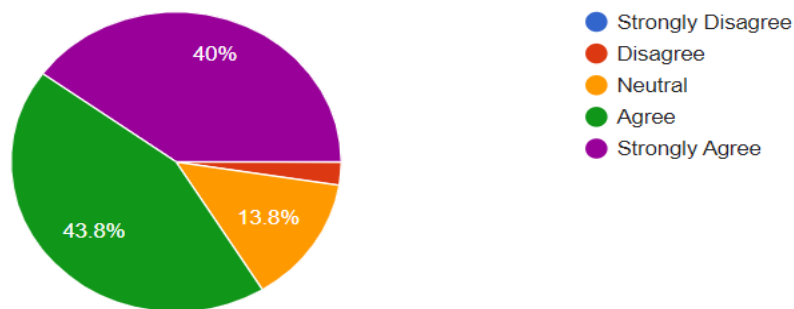
80 responses



We came to the conclusion that 47.5% of the people we asked agreed with the statement in question, with 35% of respondents strongly agreeing being the choice that got the second highest number of votes.

Lack of trust in the workplace can lead to more deviant behavior among employees?

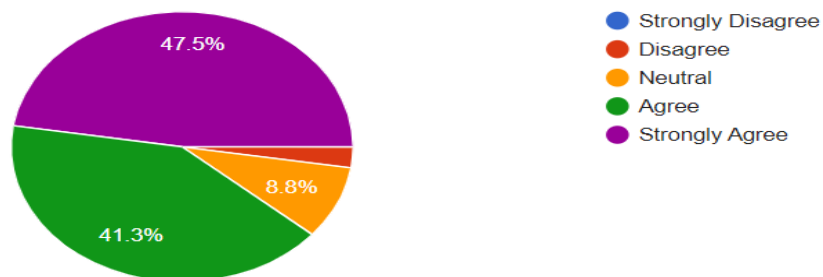
80 responses



We came to the conclusion that 43.8% of those who were questioned strongly agreed with the statement in question, and the alternative that garnered the second largest proportion of votes was that 40% of respondents agreed.

When employees feel that they are not valued or respected, they may become more disengaged and less motivated to follow rules or norms?

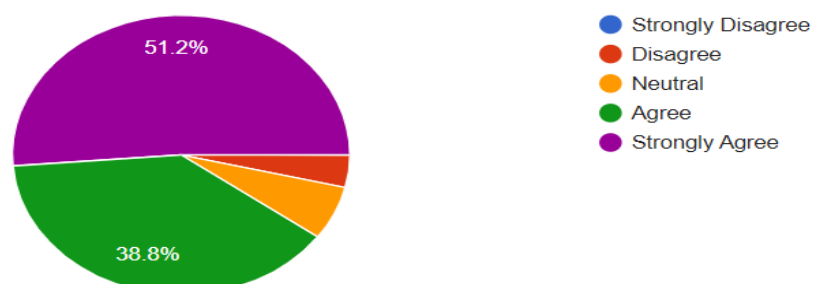
80 responses



We found that 47.5% of respondents strongly agreed with the statement in question, and the next highest response was recorded for those who agreed with the statement, which was 41.3%.

Trust is an important foundation for a positive and productive work environment?

80 responses

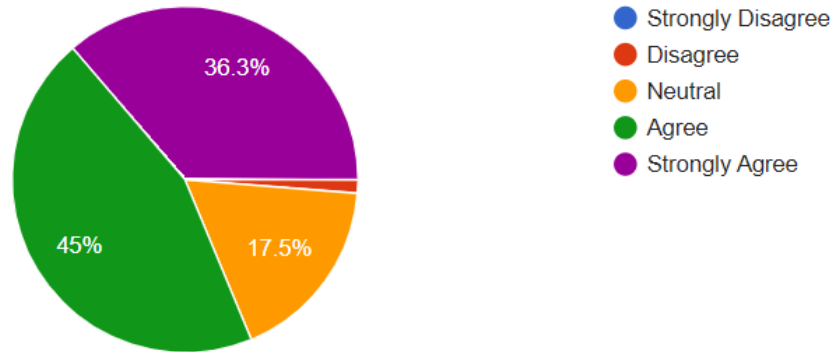


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We observed that 51.2% of those polled strongly agreed with the aforementioned statement, with the second greatest answer being 38.8% agreeing.

Do you think support from higher officials will get rid of stress in work place ?

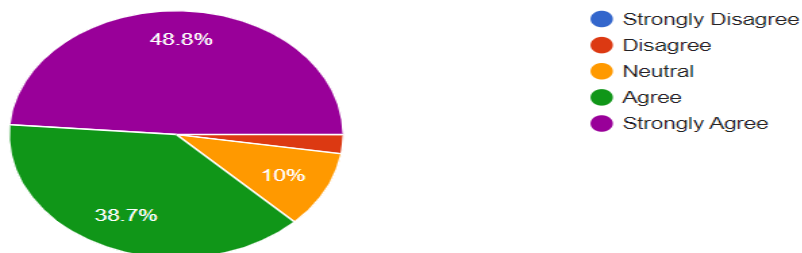
80 responses



In accordance to the results of our research, 45% of respondents agreed that the aforementioned statement is true, and the next highest response was obtained for those who strongly agreed with the statement 36.3% of the time.

Motivating and giving positive feed backs to employees helps in overcoming deviant behavior ?

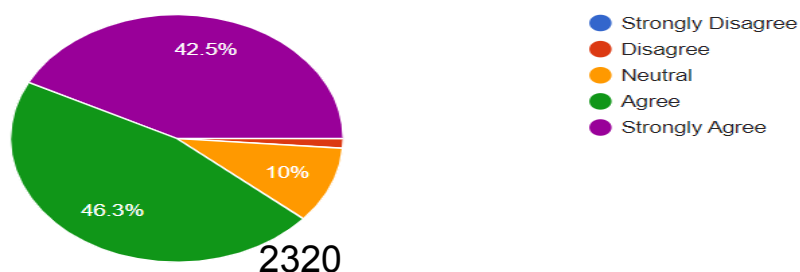
80 responses



The analysis indicates that 48.8% of the people surveyed strongly agreed with the aforementioned statement, while the second highest response was recorded for the agree category, with a percentage of 38.7%.

Do you think importance of trust creates a positive and productive workplace culture?

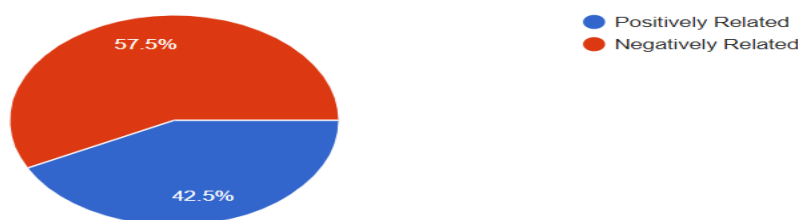
80 responses



We observed that 46.3% of those polled agreed with the aforementioned statement, with the second greatest answer being 42.5% strongly agreeing.

Do you think pressure from higher officials depends on productivity? If yes, what do you think of that relation?

80 responses



We came to the conclusion that 57.5% of the people we asked negatively related with the statement in question, with 42.5% of respondents positively related being the choice that got the second highest number of votes.

Discussion

The pie chart shows that the majority of responses are recorded for neutral and agree. This indicates that the positive and negative impact on workplace productivity depends on individual's perspective. Most of the people agree that deviant behaviour can cause decreased motivation and engagement, resulting in decreased productivity. Motivation and productivity are directly proportional to each other, and team work plays a major role in achieving the goal. Trust and communication among the workers increase the rate of performance and unity in the team.

Trust is the most important factor in everyone's life, and studies have shown that there is a positive relationship between organizational trust and performance. Clear and open communication ensures everyone is on the same page about objectives, expectations, directions, and everyone knows where they stand. Job dissatisfaction can arise from a variety of professional and personal reasons, such as being under paid, lack of career growth, poor management, flexible working, proper communication, etc. Working in a trusting environment will make people feel energetic and productive, and building trust improves problem solving and comfort in the workplace. Trust is an important factor in the workplace, as it creates a sense of security, respect, and openness among people.

It is important to foster trust by being open, truthful, and dependable in your actions and communication, as well as acting with respect and empathy for others. Ultimately, getting feedback from the higher officials will help the employee to work better in the organization and enhances the motivation of the individuals. Getting feedback from the higher officials will minimize the communication gap between the employees and enhances the team work, which improves the performance in the workplace. The most important details in this text are that

employees may be motivated by acknowledging their accomplishments, giving chances for growth and development, and delivering incentives and prizes ([Collins and Rogers, 2017](#)) to encourage and redirect unwanted behaviour in a positive manner.

Trust is positively related to productivity in the work place, as it enhances communication, cooperation, dedication, and production. Pressure from higher officials has both positive and negative relation on productivity, with more than three-quarters of respondents viewed pressure as a means of boosting productivity ([Cortina et al., 2017](#)). It is important to keep in mind that being put under a certain amount of pressure may actually be motivating and lead to improved levels of productivity, but too much pressure may have a negative effect when it is applied over an extended period of time. Additionally, various people may react differently to pressure, so it is essential to achieve a balance that is appropriate for each individual.

Implications and contributions

The morale of teams and organizations can take a hit, along with their production and turnover rate, when deviant behaviour occurs. Getting beyond the deviation: Establishing concrete goals for performance and behaviour is essential. Ensure that everyone is aware of the expectations, as well as the consequences that come with not meeting them. Praise in a positive light may be an effective motivator for collaboration. To encourage the learning and development of team members. It may be possible to prevent abnormal behaviour by filling knowledge or skill deficiencies. An open exchange of ideas and prompt resolution of issues can be helpful in preventing aberrant behaviour. Encourage collaboration, provide training, and consistently enforce rules as a way for organisations to combat negative conduct and create a healthy and productive working environment. A successful business must first and foremost earn its customers' trust. Provide employees the flexibility and the tools they require to execute their jobs. Having more say over one's work environment increases both productivity and engagement. Creating an environment in which employees may openly discuss their thoughts, concerns, and observations without being concerned about consequences. Workers should be recognised for their accomplishments. Rewards like as rewards, promotions, and recognition are effective. Workers who feel appreciated are both more productive and loyal to their employers. Workers who are trusted and supported are more involved in their job and more committed to the success of the organisation.

Deviant behaviour is influenced by trust. Deviant behaviour violates societal norms, regulations, and values. Trust increases social conformity and acceptable behaviour. However, low trust increases deviance. Trust deters deviance. Deviant behaviour decreases when people believe their

behaviours will be watched and punished. They fear their acts will have terrible repercussions that exceed any rewards. However, if people don't feel their behaviours will be watched and penalised, they're more inclined to deviate. Trust also impacts decision-making. People are more inclined to behave socially acceptable when they trust others. They assume others will follow societal standards and values, and they don't want to be unusual or deviant. However, when people don't trust others to act socially, they're more inclined to deviate since they think others would too. Trust allows exploitation, which can lead to deviance. Trust makes people more vulnerable to abuse. Financial exploitation, abuse, and other damage can occur. Trust fosters an environment where people feel safe taking advantage of others. Thus, trust determines deviant behaviour. It can prevent, influence decisions, and generate exploitation possibilities. Understanding how trust affects deviant behaviour can help people and communities foster trust and reduce deviance.

Suggestions and Recommendations

Depending on the conduct and circumstances, deviant behaviour can boost or lower productivity. Deviant conduct can disrupt work processes, reducing productivity. Deviant conduct can produce a bad work atmosphere, lowering employee morale and motivation. Interpersonal conflict: Deviant behaviour can cause workplace friction and lower productivity. Deviant conduct can increase employee absenteeism, lowering productivity and costing more.

Creativity: Deviant conduct may lead to creative problem-solving and novel work methods, increasing productivity over time. ***Flexibility:*** Deviant conduct can boost work process flexibility, which improves productivity and adaptability.

Motivation: Deviant conduct might indicate great drive and devotion to work, increasing productivity and job satisfaction. Deviant conduct can inspire risk-taking and innovation. Deviant conduct usually outweighs its productivity gains. Yet, creative and risk-taking deviant behaviour may boost productivity if directed properly. Deviant conduct that is damaging and disruptive must be distinguished from unusual or non-conforming behaviour.

Collaboration: Trust promotes staff collaboration and resource sharing, increasing productivity. ***Communication:*** Trust helps employees and management communicate, improving problem-solving and efficiency. ***Innovation:*** Trust encourages risk-taking and experimentation, resulting to new work procedures and higher production. Trust boosts worker happiness and productivity.

Vulnerability: Employees may be afraid to offer ideas or take risks for fear of being appraised or rejected. ***Mistrust:*** Trusting teammates can lead to mistakes, missed deadlines, and lower productivity. ***Unfairness:*** Managers may favour trusted staff, causing resentment and lower

productivity. Overreliance: Trusting specific personnel can lead to burnout and lower productivity when they are absent or overburdened.

Trust increases productivity more than it hurts. Trust fosters teamwork, creativity, and motivation. Yet, trust and responsibility must be balanced to avoid misdirected or unfair trust.

Conclusion

In the workplace, dishonest behaviour and a lack of trust may be detrimental to a company's reputation, productivity, and bottom line. The general public has an expectation that businesses would give their employees with a workplace that is both safe and polite, as well as one in which they may advance their careers and contribute to the overall success of the organization. Interactions between professionals must be based on respect in order to be effective and efficient. The general public has high expectations that businesses would prevent and eliminate workplace deviance, as well as build trust. This may require defining rules to avoid deviant behaviour, training managers and personnel, and implementing a way of reporting that is both secure and confidential. Trust may be increased through encouraging clear and open communication at all levels of the organisation, recognising employees for their achievements, and providing opportunities for professional growth. Companies that do so have a better chance of increasing productivity, development of relations with both employees and customers, and gaining a reputation as a responsible and ethical employer.

References:

1. [Appelbaum, S.H.](#), [Iaconi, G.D.](#) and [Matousek, A.](#) (2007), "Positive and negative deviant workplace behaviors: causes, impacts, and solutions", *Corporate Governance*, Vol. 7 No. 5, pp. 586-598.
2. [Gill, A.S.](#) (2008), "The role of trust in employee-manager relationship", *International Journal of Contemporary Hospitality Management*, Vol. 20 No. 1, pp. 98-103.
3. [Chan, S.C.H.](#) and [Mak, W.-m.](#) (2016), "Have you experienced fun in the workplace? An empirical study of workplace fun, trust-in-management and job satisfaction", *Journal of Chinese Human Resource Management*, Vol. 7 No. 1, pp. 27-38.
4. [Kalemci, R.A.](#), [Kalemci-Tuzun, I.](#) and [Ozkan-Canbolat, E.](#) (2019), "Employee deviant behavior: role of culture and organizational relevant support", *European Journal of Management and Business Economics*, Vol. 28 No. 2, pp. 126-141.
5. [Sharkie, R.](#) (2009), "Trust in leadership is vital for employee performance", *Management Research News*, Vol. 32 No. 5, pp. 491-498.
6. Tanny, T.F., Zafarullah, H. Performance Values, Service Delivery and Citizen Satisfaction: A Study of Institutional Trust in Bangladesh. *Public Organiz Rev* **23**, 225–244 (2023).
7. Pawar, B.S. A Proposed Model of Organizational Behavior Aspects for Employee Performance and Well-being. *Applied Research Quality Life* **8**, 339–359 (2013).
8. [Akella, D.](#) and [Eid, N.](#) (2021), "An institutional perspective on workplace incivility: case studies from academia", *Qualitative Research in Organizations and Management*, Vol. 16 No. 1, pp. 54-75.
9. [Hodgins, M.](#) and [Mannix McNamara, P.](#) (2017), "Bullying and incivility in higher education workplaces: Micropolitics and the abuse of power", *Qualitative Research in Organizations and Management*, Vol. 12 No. 3, pp. 190-206.
10. [Catley, B.](#), [Blackwood, K.](#), [Forsyth, D.](#), [Tappin, D.](#) and [Bentley, T.](#) (2017), "Workplace bullying complaints: lessons for "good HR practice"", *Personnel Review*, Vol. 46 No. 1, pp. 100-114.
11. [Geldart, S.](#), [Langlois, L.](#), [Shannon, H.S.](#), [Cortina, L.M.](#), [Griffith, L.](#) and [Haines, T.](#) (2018), "Workplace incivility, psychological distress, and the protective effect of co-worker support", *International Journal of Workplace Health Management*, Vol. 11 No. 2, pp. 96-110.
12. [Wang, C.-H.](#) and [Chen, H.-T.](#) (2020), "Relationships among workplace incivility, work engagement and job performance", *Journal of Hospitality and Tourism Insights*, Vol. 3 No. 4, pp. 415-429.
13. [Taheri, F.](#), [Asarian, M.](#) and [Shahhosseini, P.](#) (2021), "Workaholism and workplace incivility: the role of work–family enrichment", *Management Decision*, Vol. 59 No. 2, pp. 372-389.
14. [Akella, D.](#) and [Eid, N.](#) (2021), "An institutional perspective on workplace incivility: case studies from academia", *Qualitative Research in Organizations and Management*, Vol. 16 No. 1, pp. 54-75.
15. [Chaudhary, R.](#), [Lata, M.](#) and [Firoz, M.](#) (2022), "Workplace incivility and its socio-demographic determinants in India", *International Journal of Conflict Management*, Vol. 33 No. 3, pp. 357-384.
16. [Rahim, A.](#) and [Cosby, D.M.](#) (2016), "A model of workplace incivility, job burnout, turnover intentions, and job performance", *Journal of Management Development*, Vol. 35 No. 10, pp. 1255-1265.
17. [Leon-Perez, J.M.](#), [Medina, F.J.](#), [Arenas, A.](#) and [Munduate, L.](#) (2015), "The relationship between interpersonal conflict and workplace bullying", *Journal of Managerial Psychology*, Vol. 30 No. 3, pp. 250-263.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

18. [Rai, A.](#) and [Agarwal, U.A.](#) (2018), "A review of literature on mediators and moderators of workplace bullying: Agenda for future research", *Management Research Review*, Vol. 41 No. 7, pp. 822-859.
19. [Işıl Karatuna](#), [Sandra Jönsson](#), [Tuija Muhonen](#) , “Workplace bullying in the nursing profession: A cross-cultural scoping review”, *Volume 111*, November 2020, 103628.
20. [Parul Yadav](#); [Anand Rai](#), “The Moderating Role of Emotional Intelligence in the Relation Between Organizational Stress and Workplace Deviant Behavior”, *IEEE*, 978-1-7281-0666-3, 19495409.

A COMPARISON ANALYSIS OF SIMULATION TOOLS FOR INTERNET OF
THINGS

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Abstract The Internet of Things (IoT) paradigm promises to bring about substantial advancements in a variety of fields, including smart housing and infrastructure, smart agriculture, smart cities, smart energy, smart transportation and portability, smart manufacturing and retail, and so on. This study provides a thorough review and analysis of some Internet of Things (IoT) simulation tools, including IoTify, Cooja Simulator, Netsim, NS-3, Mat lab, J-Sim, and Omnet, to assist researchers and developers in selecting the best device for research investigations while navigating ongoing IoT application scenarios and addressing issues in the real world. This study also examines and compares IoT simulation tools in detail for the benefit of the future.

Index Terms—IOT, Simulation Tools, networks, pros, and cons, working

II. INTRODUCTION

The new Internet of Things worldview is one of the most recent developments and a hot topic in software engineering, communications, and construction. These Internet of Things (IoT) concepts were integrated into a variety of individual endeavors to enable improved living with individual prosperity. IoT links physical and digital objects through a variety of systems, enabling the useful use of the data such objects collect. The physical objects are equipped with key enabling factors, for example, implanted programming, detecting abilities, and information exchange capabilities, which portray them as "bright" objects.

III. SMART AQUARIUM

The current aquarium system available is a typical aquarium. With a variety of fish and plants in the tank, the aquarium system currently available on the market is already fascinating. However, if the aquarium is kept indoors, the manual distribution of fish food remains a problem. Aquarium owners must physically feed their fish at least once every day. An aquarium system that is both aesthetically pleasing and fully automated in terms of water-filling and fish feeding when necessary is needed to resolve the current problems. This is particularly problematic if the aquarium owner is very busy because the risk of forgetting to feed the fish is very high. A sophisticated aquarium setup that can support both aquarium hobbyists and the owner's daily activities. IoT technology is one of the tools created to make it simpler for people to keep an eye on and manage an

internet-based system. The Internet of Things (IoT) is a system in which objects are given distinct identities and the capacity to transfer data over a network without necessitating back-and-forth communication between people or computers.

IV IOT SIMULATION

IoT Device Simulator enables us to create, test, and deploy any type of configurable IoT application in the absence of physical devices. This makes it easier to almost perfectly replicate the original setting. We must concentrate on the heterogeneous nature of the sensor in the era of large-scale simulation. Despite combining several networks in one location, it insists on using highly developed tools and technology for effective simulation. Through both qualitative and quantitative factors, the internet of things simulation can occasionally result in a variety of technological problems. The next section will go over the main strategies used to increase scalability in large-scale IoT projects as they are simulated in the real world.

TO SIMULATE IOT ENVIRONMENT

- Install the necessary IoT devices and use them.
- Connect the existing system to the virtual framework and enable the repositories.
- Visualize the simulated environments by developing suitable software

EMULATE / SIMULATE IOT

The Cooja tool is utilized in IoT developments for simulation, and the Enzo Unified tool is used for emulation. Any real-time scenario can be created and analyzed with the use of these technologies. It is also prepared to add actual hardware to the testbed, if necessary, to confirm the network's behavior. We cannot observe technology and simulation tools for the internet of things that provide a comprehensive framework for successful implementation. The Internet of Things (IoT) features wonderful visions that are formed into various measurements used to utilize smart objects, sensors, and technologies with a system of communication and attestation of knowledge. Thus, before setting up an IoT application in the real-world scenarios depicted in figure 1, it is crucial to have a potent simulation tool that might be used in realistic formative and exploratory settings

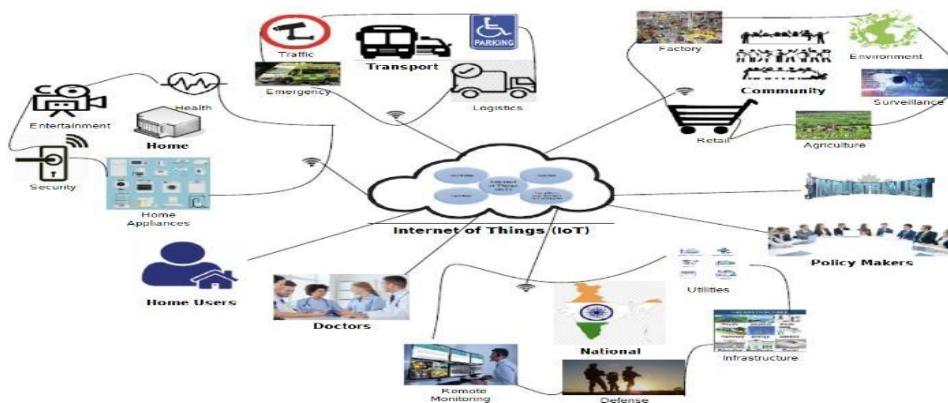


Figure 1: Quality Applications in IoT

IV. TOOLS FOR IOT SIMULATION

- IOTIFY

IoTify is a fantastic IoT test system that enables you to quickly build IoT configurations in the cloud. It is used on a broad scale in your own virtual IoT environment. To identify and address problems before presenting the final item, the tool may generate flexible traffic from a large number of virtual endpoints and test your foundation for scale, security, and unwavering quality.

- COOJA

A system test system that enables the imitation of authentic equipment stages exists, as demonstrated by COOJA. COOJA uses the Contiki OS with a focus on organized behavior. Without a specific bit, COOJA is capable of imitating remote sensor organizations. A series of standards, including TR 1100, TI CC2420, Contiki-RPL, IEEE 802.15.4, uIPv6 stack, and uIPv4 stack, were upheld by Cooja. Before starting a new rebuilding, one of the COOJA test system's four spread models must be selected.

- NETSIM

It's a simple network simulator. Give a graphical user interface (GUI) to simplify the coding process. Simple to create custom protocols for both real-world and hypothetical purposes.

- NS-3

Simulator for discrete event networks – 3. Encourage quick and effective prototyping.

- MATLAB

MATLAB features an exciting IoT module that enables you to develop and test smart devices as well as acquire and analyze IoT data on the cloud. IoT platforms receive data from clever devices, total it in the cloud, and then gradually analyze it. Following the separation of examples and calculations, experts can use this information to create model calculations and carry them out in the cloud.

V. A REVIEW OF IOTIFY, MATLAB AND COOJA IOT SIMULATION TOOLS

A. IOTIFY

This simulates high system traffic to show how planned inactivity affects your overall framework performance. Recreating an associated vehicle armada or a network of observation cameras has never been easier. The client allows you to develop your IoT models using JavaScript formats and send traffic continuously to any cloud platform provider via MQTT, HTTP, or CoAP.

Virtual Lab of IOTiFy:

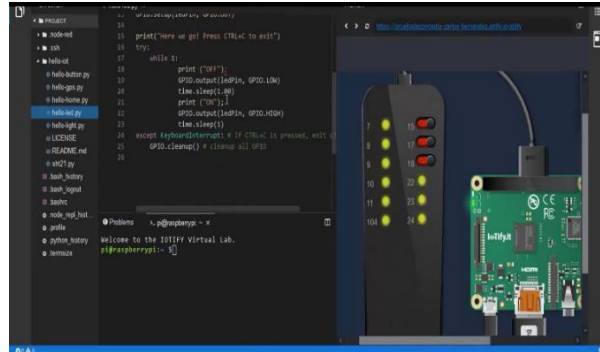


Figure 2 – Open simulator

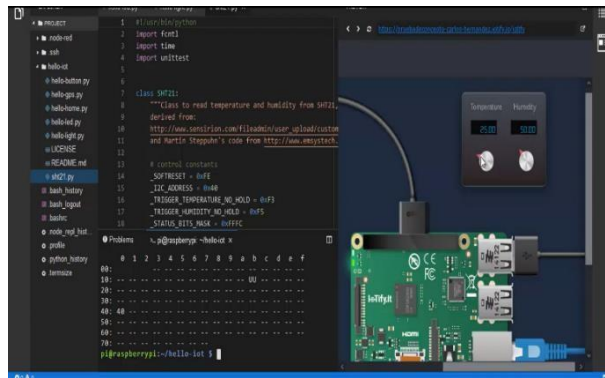


Figure 3 – Connecting Sensor

carry them out in the cloud. The user can create and model IoT frameworks using MATLAB. Simulink allows you to generate calculations and then transfer them to your implanted technology. You may also use Arduino and Raspberry Pi to model your clever devices.

The detection of water level in the aquarium is detected with help of ultrasonic.

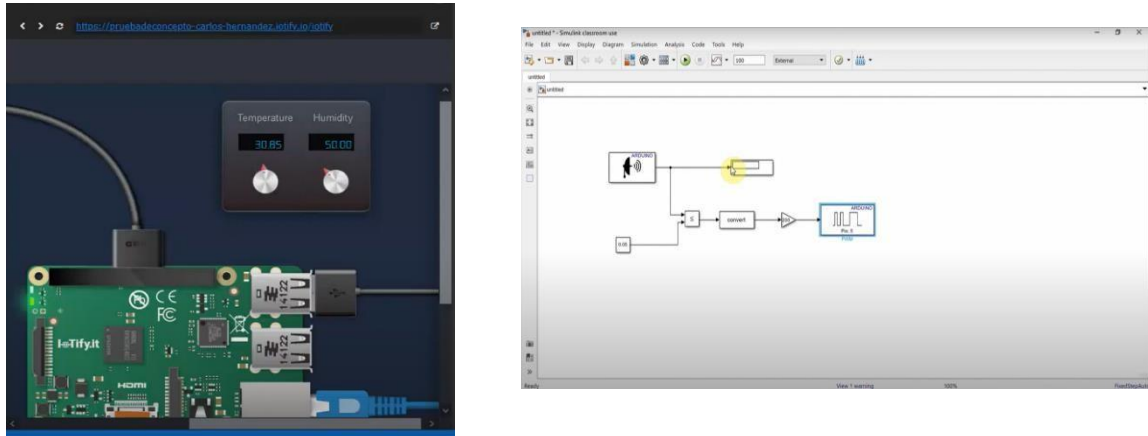


Figure 5 – water level detection using ultrasonic sensor in MATLAB

C. COOJA

COOJA is a system test system that enables the imitation of authentic equipment phases. COOJA uses the Contiki OS with a focus on organized behavior. Without a specific bit, COOJA is capable of imitating remote sensor organizations. A series of standards, including TR 1100, TI CC2420, Contiki-RPL, IEEE 802.15.4, uIPv6 stack, and uIPv4 stack, were upheld by Cooja. Before starting a new rebuilding, one of the COOJA test system's four spread models must be selected.

Voice command using MQTT to ON and OFF the feeder.

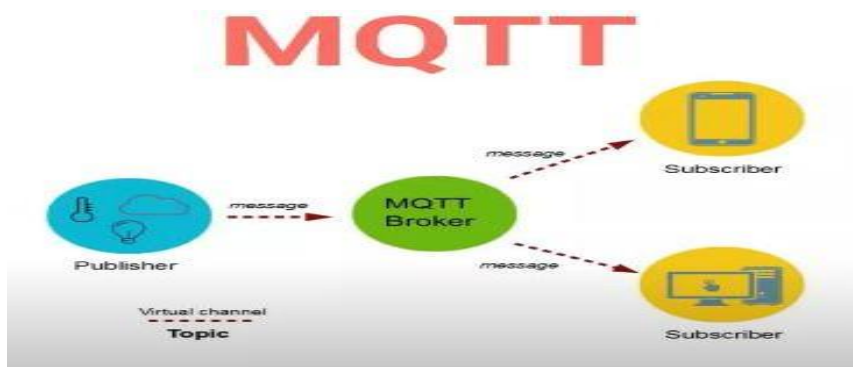


Figure 4 – Data reading

B. MATLAB

MATLAB features an exciting IoT module that enables you to develop and test smart devices as well as acquire and analyze IoT data on the cloud. IoT platforms receive data from clever devices, total it in the cloud, and then gradually analyze it. Following the separation of examples and calculations, experts can use this information to create model calculations and

Figure 6 - MQTT



Figure 7 – MQTT for voice command using COOJASimulator

VI.COMPARISON OF IOTIFY, MATLAB,COOJA

Features	IOTIFY	COOJA	MATLAB
License	GPL	BSD	GPL
Platform Support	Universal	Universal	Universal
Programming Language	Java, Java Script	Java	C/C++, HDL, PLC, GPU, .NET, or Java
Scalability	✓	✓	✓
Protocol Optimization	Possible	Possible	Possible
Mobile Network Support	Yes	Yes	Yes
Dynamic network topology	Dynamic	Dynamic	Dynamic
MAC, Routing support and Standards	MQTT, HTTP or CoAP	IPV4, IPV6, 802.15.4	
Network Support	Custom Development	Multicast N/W	Multicast N/W

VI. MERITS AND DEMERITS OF IOTIFY, COOJA, AND MATLAB SIMULATION TOOLS.

A. IOTIFY Merits:

- It can keep a strategic distance from danger and the death toll
- Critical circumstances may be studied without a chance thanks to the ability to vary the conditions and study the outcomes.
- It is sensible.

Demerits:

- To replicate something, one must have a thorough understanding of all the relevant factors and pay close attention to them all. A reenactment cannot be made without it.

B. COOJA Merits:

- We have shown that cross-level reenactment offers interesting aspects in terms of success and memory utilization.
- It enables a client to connect replicated hubs from several different deliberation levels.

Demerits:

- More Memory
- Simulation levels are high

C. MATLAB:

Merits:

- The computational codes may be created without any issues.
- Utilize a sizable repository of implicit computations

Demerits:

- Cross-collecting or converting Matlab code to another language is difficult
- Cost of License.

VII CONCLUSION

In this study, the simulation tools were selected by the criteria for locating appropriate IoT devices. The entrance using various interchange protocols is the key focus of IoT devices. This investigation offered the chance to solve some of the challenges in locating an IoT simulation stage. This study evaluated ten simulation tools and found that they were useful for both WSN and IoT. Regarding their suitability for IoT conditions and application replication, these devices were assessed. This study will assist the researcher and developer in selecting the best simulation tools for entertainment and problem-solving in the actual world.

VIII. REFERENCES

- [1] Coetzee, Louis, and Johan Eksteen. "The Internet of Things-guarantee for what's to come? A presentation." In 2011 IST-Africa Conference Proceedings, pp. 1-9. IEEE, 2011.
- [2] Gluhak, Alexander, Srdjan Krco, Michele Nati, Dennis Pfisterer, Nathalie Mitton, and Tahiry Razafindralambo. "A study on offices for the trial web of things research." IEEE Communications Magazine 49, no. 11 (2011): 58-67.
- [3] Weingärtner, Elias, Matteo Ceriotti, and Klaus Wehrle. "Step by step instructions to recreate the Internet of Things." Proceedings of the eleventh GI/ITG KuVS Fachgespräch Drahtlose Sensornetze (2012): 27-28.
- [4] Brumbulli, Mihal, and Emmanuel Gaudin. "Towards model-driven reproduction of the web of things." In Complex Systems Design and Management Asia, pp. 17-29. Springer, Cham, 2016.

**APPLYING THE GAP MODEL OF SERVICE QUALITY TO ASSESS INDIVIDUAL
CUSTOMER SATISFACTION WITH ATM CARD SERVICES OF**

Mb Bank Can Tho City Branch In Vietnam

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Abstract

Non-cash payment through Automated Teller Machine (ATM) card service is a potential market and suitable for the development trend of the world economy especially in developing countries. Currently, the economy is showing signs of recovery after the Covid-19 pandemic with many advantages and also challenges. Accordingly, the banking sector is also facing enormous challenges, not only the fierce competition of domestic commercial banks but also foreign commercial banks. Therefore, in order to survive and develop in the market economy, it is essential to find ways to improve service quality to make a difference in the supply and distribution of services of banks in general and ATM cards in particular. This study was conducted by collecting data directly from 135 customers using ATM card services at MB Can Tho branch in Vietnam to assess their satisfaction with the bank's card services. This study employed Parasuraman's 5-distance model and had the appropriate adjustment for the Vietnamese market for analysis. Research results show that the number of customers satisfied with ATM card service is 83% and the percentage of customers who will definitely recommend this service to others is also quite high at 59.3%. Based on the research results, the author proposes relevant solutions to improve service quality in terms of facilities, human resources, culture, monitoring, and brand development, and improving service quality in order to expand this service.

Keywords: service quality model, developing countries, non-cash payment

Introduction

Currently, the use of ATM cards is a solution of modern civilization, a non-cash payment solution in Vietnam in particular and in the world in general, has developed rapidly, is popular, and is considered a trend. Therefore, the use of payment cards helps customers save time and make transactions faster and more convenient. In that common development, the contribution of the banking system is indispensable to the role of payment intermediary in the economy, where new business strategies and the latest products are introduced. attract more customers and play a decisive role in the development of world trade, including Vietnam.

Domestic banks are now competing with each other every day on ATM card services to meet the increasing needs of customers, so they have accelerated their rapid development. In Can Tho city, ATM cards are growing in number of cards issued, card payment sales, and other conveniences on the card. In which, according to Industry and Trade magazine, Military Commercial Joint Stock Bank is one of the top 7 joint stock commercial banks with the largest charter capital in Vietnam with a nationwide network of over 100 branches and over 200 transaction points. spread across the country. According to the information provided by Military Bank on its website, in 2019 MB Bank received 4 major awards from the Japanese international card organization JCB as the leading bank in card transaction sales, the Bank leads the number of new credit cards issued, the Bank leads the number of credit cards in circulation, and the Bank leads the growth rate of credit cards. Especially, the factors that help the Bank survive, develop and achieve today's achievements in the market are satisfying customers' needs and being trusted by customers, so MB always focuses on product quality, researching utility applications to make customer payment more convenient and modern to meet customer satisfaction when using the card.

Recognizing the role and benefits that card business brings, it is necessary to assess the individual customer satisfaction about ATM card service at Military Commercial Joint Stock Bank Can Tho branch in order to evaluate the quality of ATM card service of the Bank. Thereby helping the Bank to have a more objective view, offering better services, helping the Bank to develop more and more in ATM card services in particular and the Bank's development in general.

1. Literature review and theoretical model

In addition to the research mentioning factors about customers choosing to use ATM cards. Following the above studies, there are also studies on the utility of supporting customers in using cards. This is one of the important contributing factors in the use of ATM cards by customers.

Because when customers want to use cards, they will look to reputable and modern banks. When it comes to a modern bank, it is obvious that customers will immediately think of a bank with a modern information technology platform, diverse products and utilities, and good service for customers anytime and anywhere.

Some research models on ATM card service quality such as: Issues affecting customer behavior (First Annapolis, 2007); Factors affecting customers' decision to choose banks to use ATM cards (Sultan Singh & Ms Komal, 2009); ATM service quality in banks in Ghana (Narteh, 2013); Student assessment of e-service quality in Uganda (Katono, 2011); Popularity of ATMs by banks in India by analyzing ATM technology and teller replacement (Kumar et al, 2011); Development of card payment in Vietnam challenges and opportunities (Tran Mai Uoc, 2006); Sustainable development of payment card services in Vietnam (Dang Cong Hoang, 2012); Research solutions to improve customer satisfaction when using ATM cards (Nguyen Viet Hung, 2015); Evaluation of customer satisfaction when using the service (Tran Thi Bao Tran, 2016); Research on factors affecting the decision to use ATM cards (Le Gioi and Le Van Huy, 2015); Research on improving the quality of passenger transport services of Vuong Phu private enterprise (Le Truong Khanh, 2014).

Most of the research on behavior before buying and deciding to choose ATM card service has been conducted quite a lot both in the country and abroad. The topics have discovered the factors affecting customer behavior. Besides the same factors, each topic also brings new elements in the research, contributing to creating a special point for the topic as well as diversifying the factors affecting customer behavior. Through that, it is the basis for banks to build marketing strategies and policies in accordance with customer behavior and needs. Studies on service quality focus on measuring service quality or customer satisfaction using the SERVQUAL model (Sultan Singh & Ms Komal, 2009; Narteh, 2013; Katono, 2011; Nguyen Viet Hung, 2015); Tran Thi Bao Tran, 2016; Le Truong Khanh, 2014) based on each region, there are factors that change to fit the model. In addition, a few authors have used the CES (Constant Elasticity of Substitution) model (Kumar et al, 2011).

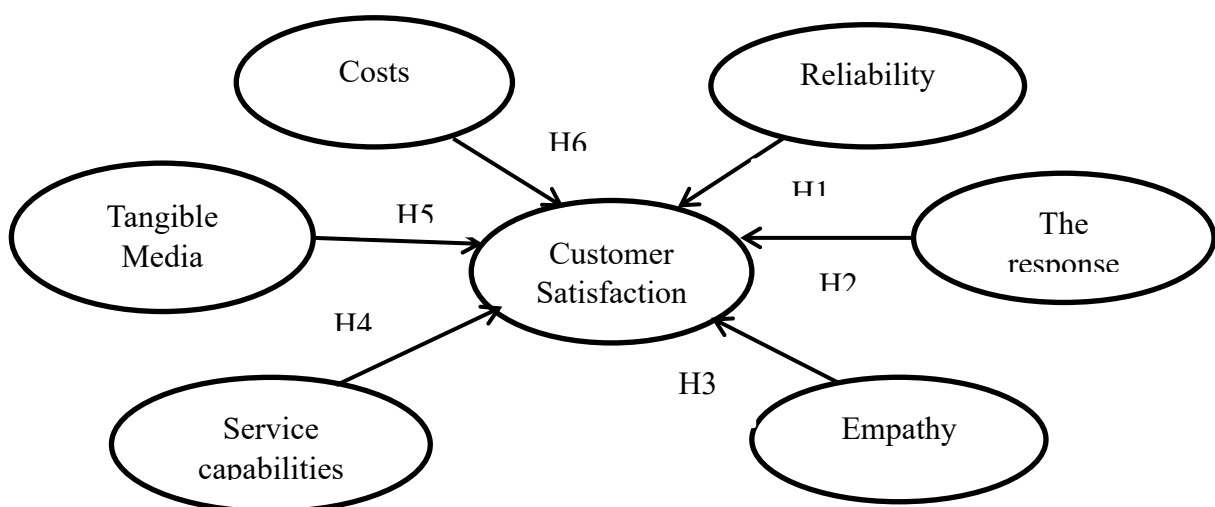
The results of the research model show that the factors affecting the service of using ATM card services such as safety (Tran Thi Bao Tran, 2016; Le The Gioi and Le Van Huy, 2015; Narteh, 2013; Katono), tangible means (Katono, 2011; Kumar et al, 2011; Tran Mai Uoc, 2006), reliability (Narteh, 2013; Katono, 2011; Tran Thi Bao Tran, 2016; Le Gioi and Le Van Huy, 2015; Le Truong Khanh, 2014; Sultan Singh & Ms Komal, 2009), cost (Sultan Singh & Ms Komal, 2009; Katono, 2011), responsiveness (Narteh, 2013; Tran Thi Bao Tran, 2016); Le The Gioi and Le Van Huy, 2015), the convenience of using the card (Narteh, 2013). In addition, age,

habits, marketing policies, and awareness also affect the behavior of using card services (Le Gioi and Le Van Huy, 2015).

Today, it can be said that the quality of service on ATM cards or ATMs has been recognized as a decisive factor in the success or failure of e-commerce. From the perspective of customers, the fact that banks have increased the quality of ATM services shows that customers are more and more interested in and enjoy the results of the latest modern scientific technology brought to them. As for banks, the increase in service quality at ATMs will help banks get a significant source of capital mobilized from deposits in customers' ATM accounts. Therefore, each bank needs to come up with its own service quality development strategy, especially paying attention to improving the quality of ATM services.

By synthesizing groups of factors affecting customers' decision to use ATM cards in the above models will be the basis for forming a research model to assess customer satisfaction when using ATM cards at Military Commercial Joint Stock Bank Can Tho Branch. From there, we propose a model in order to assess the level of satisfaction of individual customers about ATM card services at Military Commercial Joint Stock Bank Can Tho Branch including direct influencing factors such as: Reliability, Service Efficiency, Empathy, Service Competence, Interest and Tangibility.

To measure the quality of ATM card services, the author used Parasuraman's 5-distance model with a correction suitable for the card service sector in Vietnam. The factors affecting ATM card service quality are expressed by 6 factors and 27 observed variables.



Source: Compiled by the author, 2022

Figure 1. Research model of customer satisfaction for card services at MB Bank

Of the above six factors, cost is the factor that many customers are interested in. Through surveying and contacting customers at the card consultation counter, in addition to being concerned about safety, speed, and utility of card products, customers always ask questions about the cost. such as: Does this card have an annual fee? Is the initial issue fee and the reissue fee much different? Is the overdraft interest rate when using the card higher than the normal loan interest rate? When customers spend money to use ATM card services, they want to save costs as much as possible and receive as many benefits as possible. It is from that fact and through reference to a number of documents with research models that mention the cost of using ATM cards, so costs have been strongly incorporated into the research model.

Hypotheses testing

H1: The bank's reliability will be directly proportional to the level of customer satisfaction. When customers feel that the bank's reputation for them is always maintained and reached at the highest level, the higher the reliability appreciated by customers, the higher the customer satisfaction level and vice versa.

H2: Responsiveness is directly proportional to customer satisfaction. The fact that the bank solves questions and responds to customers' requests quickly and effectively makes customers appreciate the bank's responsiveness, which shows that the level of customer satisfaction will be high. and vice versa.

H3: Empathy is directly proportional to customer satisfaction. When customers feel the bank's sympathy, care and customer care, the customer's satisfaction level is higher and vice versa.

H4: Service capacity is directly proportional to customer satisfaction. When employees have a warm attitude, politeness and high professional level, customer satisfaction is higher and vice versa.

H5: Tangibles are directly proportional to customer satisfaction. The bank has a full range of polite clothes and equipment for the use of ATM cards, then the tangible means are appreciated, the customer satisfaction is also high and vice versa.

H6: Cost is inversely related to customer satisfaction. The lower the card service cost, the greater the customer satisfaction and vice versa.

In addition, the author also used SPSS to learn more about variables such as: gender, age, occupation, number of banks that customers transact with, banks that customers frequently transact with, and time of customers. A In the above 06 factors, cost is the factor that many customers are interested in. Through surveying and contacting customers at the card consultation counter, in addition to being concerned about safety, speed, and utility of card products,

customers always ask questions about the cost. such as: Does this card have an annual fee? Is the initial issue fee and the reissue fee much different? Is the overdraft interest rate when using the card higher than the normal loan interest rate? When customers spend money to use ATM card services, they want to save costs as much as possible and receive as many benefits as possible. It is from that fact and through reference to a number of documents with research models that mention the cost of using ATM cards, so costs have been strongly incorporated into the research model.

2. Research methodology

2.1 Data collection method

Primary data is collected from convenient random sampling surveys through face-to-face interviews. The research model in the thesis has 27 independent factors, to ensure that the sample is representative of the population, the lower the error, the higher the reliability, it is necessary to survey 135 observations ($27*5$). Sampling was randomly selected on the bank's database, 135 questionnaires were conducted to interview customers directly at the customer management department or by phone.

2.2 Data analysis method

Descriptive statistics: are used to describe the basic characteristics of the collected data, the description of the data by calculations and common statistical indicators such as the mean, the value of the data. maximum value (Max), minimum value (Min) for continuous variables and ratios for discontinuous variables. The aim is to determine the influence of differences between customer groups (gender, age group, income, service time) on satisfaction.

Likert scale: Likert scale is a scale invented by American psychologist Rensis Likert in 1932, the feature of the scale helps to determine the opinion or attitude of the respondent. The Likert scale is closed-ended and does not require respondents to provide ideas or counter-arguments for their opinions.

To build and test this scale, the following steps should be performed:

Step 1. Identify and name the variables the researcher wants to measure.

Step 2. Make a list of statements or questions that are indicated by the province.

Step 3. Determine the number and type of responses.

Step 4. Check all mined items from respondents.

Step 5. Perform a questionnaire analysis to find a set of items that make up a single-aspect scale that you want to measure.

Step 6. Use the newly built scale and re-analyze the questions to ensure the reliability of the scale.

To assess the level of perception, the author has proposed opinions and criteria based on the conventional 5-level Likert scale from 1: strongly disagree to 5: strongly agree. In addition, the author also uses the distance value to evaluate the meaning of each mean value for each scale in the most accurate way as follows:

$$\begin{aligned} \text{Distance value} &= (\text{maximum value} - \text{minimum value})/n \\ &= (5 - 1)/5 = 0.8 \end{aligned}$$

Average value = Meaning of scalde

Level 1: 1.00 – 1.80: Strongly disagree

Level 2: 1.81 – 2.60: Disagree

Level 3: 2.61 – 3.40: No opinion

Level 4: 3.41 – 4.20: Agree

Level 5: 4.21 – 5.00: Strongly agree

This article uses that Likert scale to assess customer satisfaction with factors affecting customer service quality. The Likert scale is a five-point scale commonly used in research studies to show the extent to which customers agree or disagree with a particular statement. Above all, the Likert scale also helps managers better understand the desires of customers and offer solutions to improve customer satisfaction.

Regression model:

Multivariate linear regression, or multiple linear regression, is used to examine the relationship between independent and dependent variables. To examine the effects of independent variables on the dependent variable under consideration. Specifically: The topic uses multivariable linear regression to measure the impact of dependent variables (customer satisfaction) and independent variables (factors affecting customer satisfaction).). In addition, some independent variables are also considered to be included in the model as control variables: empathy, service capacity, responsiveness, tangible means and trust.

3. Results and Discussion

3.1 Overview of customer characteristics

Table 1. Survey customer information according to the criteria

Indicators	Descriptions	Quantity	Percentage (%)
Gender	Male	67	49.6
	Female	68	50.4
Age	18-29	74	54.8
	30-49	53	39.3
	> 49	8	5.9
Occupation	Public officials	23	17.0
	Office staff	21	15.6
	Trader/Small Trader	26	19.3
	Student	32	23.7
	Army / Working in the army	8	5.9
	Household business	10	7.4
	Worker	15	11.1
Education	Secondary school	20	14.8
	High school	34	25.2
	College	27	20.0
	University	54	40.0
Income	Under 3 million VND	22	16.3
	From 3 to under 5 million VND	36	26.7
	From 5 to less than 10 million VND	49	36.3
	From 10 million or more	28	20.7

Source: Survey data, 2022

In the survey sample of customers by gender structure, 50.4% of female customers represent the population and 49.6% of male customers represent the population. With meaningful numbers above, managers need to pay attention to target customers to have business strategy in the future. aged from 18-29 years old accounted for 54.8%; aged 30-49 accounted for 39.3%; Those aged 50 and over account for 5.9%. Through the structure of customers by age group, we see that 2 groups aged 18-29 and 30-49 years old account for the highest proportion in the research sample, with the above ratio will help the research to have results with high accuracy. High confidence in the two groups of factors above and can be representative of the whole. At the same time, it shows that the majority of ATM card users are young, helping the bank to identify the target customers in its marketing strategy.

Most of the customers using ATM services have high university degrees 40.0% of this group of customers are mainly students and state of 23.45 who use ATM cards partly to receive living

expenses and to use ATM cards. using credit cards for personal expenses; followed by customers with upper secondary education, accounting for 25.2%; customers with college education accounted for 20.0% and the lowest proportion of customers with lower secondary education accounted for 14.8%. income from 3 to less than 5 million VND/month, accounting for 26.7%, the majority of customers are students; income from 5 to 10 million VND/month with the rate of 36.3%, the highest in the survey sample; Customers with incomes below 3 million/month and over 10 million/month have rates of 16.3% and 20.7% respectively, with this ratio showing the average income of people in the city Can Tho is quite high.

3.2 Customer satisfaction with ATM card service

Table 2. Customer satisfaction with ATM card service

Level	Qunatity	Percentage (%)
Dissatisfaction	0	0
Unsatisfied	3	2.2
Neutral	20	14.8
Satisfied	86	63.7
Very pleased	26	19.3

Source: Survery data, 2022

The number of customers with positive reviews about the ATM card service of MB CN Can Tho is 83%, accounting for a very high proportion. In which, the number of customers satisfied with the service accounted for 63.7%, very satisfied accounted for 19.3%. The number of unsatisfied customers accounted for a low rate of 2.2% and no customer was very dissatisfied with this service of the bank. Through this, we can realize that the quality of ATM card service of the bank is now quite good, has met most of the expectations of customers. However, there are also many limitations that banks need to overcome to improve customer satisfaction.

3.3 Evaluation of factors affecting customer satisfaction using ATM card services at MB CN Can Tho through descriptive statistics

Table 3. Evaluation factors for customers satisfaction

Factors	Sign	Variables	Mean	Total Mean	Level
Reliability	TC1	The bank always does exactly what it has introduced.	4.23	4,19	Agree
	TC2	Customer information is always strictly confidential.	4.18		
	TC4	When you have a question or complaint, the bank always solves it satisfactorily.	4.14		
	TC5	The Bank has clear, error-free transaction documents and related documents.	4.21		
	The response	DU1	Staff guides customers fully, easy to understand about transaction operations.		
DU2		Bank staff are always ready to help customers.	4.26	4,16	Agree
DU3		Card payment service always works accurately and quickly.	4.07		
DU4		The banking system is always in good working order.	4.10		
Service capabilities	NL1	Bank employees serve customers politely and courteously.	4.36		
	NL2	Professionally qualified staff to satisfactorily answer customers' questions.	4.27		
	NL3	Employees always have a high sense of responsibility at work.	4.23		
Tangible Media	PT1	The transaction counter is reasonably arranged and impressive.	4.17	4,25	Very agree
	PT2	Parking is very convenient and absolutely safe.	4.25		
	PT3	Services on ATMs are designed to be easy to use.	4.31		
	PT5	The place where the ATM is located is clean, the space is cool and safe.	4.26		
Expense	CP1	The cost per transaction is reasonable.	4.11	4,01	Agree
	CP2	No unreasonable transaction costs.	4.05		
	CP3	Reasonable and stable deposit interest rates.	3.08		

**International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023**

Satisfaction	You are completely satisfied with the quality of ATM card service of Military Bank.	4.26		
HL1				
HL2	You feel satisfied and secure with the service provided by the Bank's staff	4.33	4,32	Very agree
HL3	You will continue to use the Bank's ATM card service.	4.37		

Source: Survey data, 2022

Through the above table, we can see that the average value of the factor ranges from 3.08 to 4.36, the perceived value of customers is quite high, affecting customer satisfaction when using ATM card service of the MB Can Tho branch. Specifically, we see that Service Capacity and Tangible Means have the highest level of agreement showing customer satisfaction at 4.29 and 4.25; The remaining Reliability, Responsiveness at the level of agreement showing customer satisfaction is 4.19, 4.16 and finally 4.01 is the cost factor, interest rate. The results show that customers do not really feel high about the factors affecting satisfaction when using ATM services. This is the basis for proposing solutions to improve customer satisfaction in the future.

3.4 Regression model results

From the results in the sample, we will determine the causal relationship between the dependent variables (HL) with the independent variables (TC, DU, DC, NL, PT, CP). The regression analysis model will describe the form of the relationship and thereby help us predict the degree of the dependent variable when the values of the independent variables are known in advance.

Table 4. Analysis of regression coefficients

R	R ²	Adjusted R ²	Adjusted R2 Estimated Standard Error
0.886 ^a	0.785	0.775	0.25251

Adjusted R2 Estimated standard error The model has R2 = 0.785 and adjusted R2 = 0.775, meaning that 77.5% of the change in HL is explained by 6 groups of factors: TC, DU, DC, NL, PT, The remaining CP 23.5% of the change in HL is due to other factors not included in the research model.

Table 5. Variation analysis – ANOVA

Model	Sum of Square	df	Std. Err.	F	Sig.
1					
Regression model	29,809	6	4,968	77,921	0,000 ^b
Residual	8,161	128	0,064		
Total	37,970	134			

We have the following hypothesis:

$H_0: \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0 \rightarrow$ unfit model

$H_1: \text{at least one } \beta_j \neq 0 (\beta_0 + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 \neq 0) \rightarrow$ Fit model.

Hypothesis testing:

Based on the results in the table above, we see that the significance level = 0.000 < 0.05, so we reject hypothesis H_0 and accept hypothesis H_1 . Therefore, it is possible to conclude suitable model.

In addition, the variance inflation factor (VIF) is also used to determine multicollinearity, here we determine that $VIF < 2$ is satisfactory. Besides, the significance level of the factors ≤ 0.05 is statistically significant

Table 6. Regression model

Model	Unstandandized		Standar	t	P-value	Mul. En.	
	B	Độ lệch chuẩn	dized Beta			Std. Err.	VIF
(Constant)	-0.601	0.247		-2.435	0.016		
TC	0.300	0.059	0.276	5.122	0.000	0.577	1.732
DU	0.226	0.058	0.221	3.880	0.000	0.518	1.931
DC	0.045	0.039	0.050	1.133	0.259	0.851	1.175
NL	0.158	0.050	0.156	3.139	0.002	0.683	1.464
PT	0.180	0.057	0.175	3.135	0.002	0.539	1.855
CP	0.243	0.046	0.286	5.252	0.000	0.565	1.770

Through the above table, we can see that the coefficient of variance of the independent variables in the model are all < 2. Conclusion the model does not have multicollinearity. Based on the standardized Beta number, the factors TC, DU, DC, NL, PT, CP all have a linear relationship with HL. The significance level of TC, DU, NL, PT, CP are all < 0.05, while the significance level of DC = 0.259 is greater than 0.05, so we exclude this factor from the research model.

Thus, the regression results show that satisfaction is affected by 4 factors TC, DU, NL, PT, CP. The coefficient β indicates the degree of impact of each independent variable on the dependent variable. We have the following normalized regression equation:

$$HL = - 0,601 + 0,276TC + 0,221DU + 0,156NL + 0,175PT + 0,286CP$$

Through regression analysis method, we can conclude that customer satisfaction about ATM card service quality at MB Can Tho branch is currently influenced by 5 factors including: reliability, responsiveness, service capacity, tangibles, and costs. These factors have a positive impact on customer satisfaction at different levels, based on the standardized regression coefficient (Beta),

we find that the cost factor has the strongest impact on customer satisfaction because there is a system the standardized Beta is 0.286 followed by a confidence factor with a standardized Beta coefficient of 0.276; the response factor to Beta is normalized by 0.221; tangible means factor with standardized beta is 0.175 and service capacity factor with Beta is 0.156.

4. Conclusions

In the current period, the economy is showing signs of recovery after the epidemic with the advantages and opportunities available in the area. Accordingly, bank branches are also facing enormous challenges, not only the fierce competition of domestic commercial banks but also foreign commercial banks that will be present and compete in a playing field. fair. Therefore, in order to survive and stand firm in the market economy, it is essential to find ways to improve service quality. target to make a difference in the supply and distribution of services of banks in general and ATM cards in particular.

The ATM card market is a potential market, in line with the world economic trend and in line with the direction and policy of our State. The current ATM card has not really been used according to its functions and utilities. Local customers still mainly use cards to withdraw money or transfer money, but do not have the habit of paying via card. Therefore, it is necessary to promote the use of existing services by customers on ATM cards first, and then gradually improve the quality and utility of services and direct customers to more popular ATM card payments.

In recent years, Military Commercial Joint Stock Bank Can Tho branch has significantly contributed to the general economic development of Ninh Kieu district in particular and Can Tho city in general. As a currency trading unit serving all customers in the area, both doing business and serving banks, has really become a solid support in terms of finance for individual customers, production households, businesses. businesses, companies, helping customers feel secure to take care of their production and business activities.

Surveying the opinions of 135 customers using ATM card service at MB Can Tho branch shows that the number of customers satisfied with ATM card service is 83% and the percentage of customers will definitely recommend the service. This service is also quite high for everyone at 59.3%. This proves that customers appreciate and feel satisfied with the quality of ATM card services provided by MB Can Tho branch.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Solutions to improve the quality of physical and technical facilities, Solutions to improve the quality of human resources, Solutions to enhance inspection and supervision, Solutions to build a behavioral culture for customers when using card services ATM, Solution for image promotion, brand development, Solution for building and setting up a hotline, Solution for expanding the area of ATM card service provision, Solution for building quality assessment criteria ATM card.

5. Reference

- Parasuraman, Zeithaml & Berry (1988), "SERVQUAL: A multiple – item scale for measuring consumer perception of service quality". *Journal of Retailing*.
- Parasuraman, Zeithaml, Berry (1985). A conceptual model of services quality and its implication for future research, *Journal of Marketing*, 49:41-50.
- Narteh, 2013. *Service quality in automated teller machines: An empirical investigation*, Managing Service Quality.
- Kumar, Lakshmi, D. Malathy, and L. S. Ganesh, 2011. *The diffusion of ATM technology in Indian banking*, *Journal of Economic Studies*.
- Katono, 2011. *Student evaluation of e-service quality criteria in Uganda: the case of automatic teller machines*, *International Journal of Emerging Markets*.
- Hair & ctg (1998), *Multivariate Data Analysis*, Prentice-Hall International.
- Oliver, R. L., 1997. *Satisfaction: A bihavioral Perspective on The Consumer*. McGraw-Hill, New York, NY.
- Oliver, R. L., 1980. A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions. *Journal of Marketing Research*, 17(4): 460-469.
- Kotler, P., & Keller, K. L., 2012. *Marketing Management (14th ed.)*. New Jersey: Pearson-Prentice Hall.
- Zeithaml, V. A & M . J. Bitner, 2000. *Services Marketing, McGraw-Hill: Integrating*.
- Bitner, M. J., Hubbert, A. R., 1994. Encounter Satisfaction versus Overall Satisfaction versus Quality. *Service quality: New directions in theory and practice*. Sage Publications, Inc. New York, pp. 72-94.
- Gronross, C., 1984. A Service Quality Model and its Marketing Implications. *European Journal of Marketing*, vol.18 Issue: 4, pp. 36-44.
- Hansemark & Albinson, 2004. Customer Satisfaction and Retention: The Experiences of Individual Employees. *Managing Service Quality*, 14(1), 40-57.
- Cronin, J.J., Taylor, S.A., 1992. Measuring Service Quality: A Reexamination and Extension. *Journal of Marketing*, 56 (7): 55-68.
- Lassar W.M., Manolis C. & Winsor R.D., 2000. Service Quality Perspectives and Satisfaction in Private Banking. *International Journal of Bank Marketing*, 14(3): 244-271.
- Heskett, J. L., Jones, T. O., Loveman, G. W., Sasser, W. E., & Schlesinger, L. A., 1994. Putting the Service-Profit Chain to Work. <<http://www.hbs.edu/faculty/Pages/item.aspx?num=9149>>
- Hair J.F., Tatham R.L., Anderson R.E. and Black W., 1998. *Multivariate Data Analysis*. 5th Ed. New Jersey: Prentice-Hall, Inc.
- 1Ladhari, R., Souiden, N., & Ladhari, I., 2011. Determinants of loyalty and recommendation: The role of perceived service quality, emotional satisfaction and image. *Journal of Financial Services Marketing*, 16(2):111-124. <<https://doi.org/10.1057/fsm.2011.10>>
- Gerbing, W. D., and Anderson, R. E., 1988. An update paradigm for scale development incorporating unidimensionality and its assessments. *Journal of Marketing Research*, 25(2), pp. 186-192.

**BRIDGING GENDER GAPS IN AGRICULTURE: UNLOCKING RURAL
DEVELOPMENT IN PAKISTAN**

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ABSTRACT

It is essential that women take part in improving Pakistan's rural communities' socioeconomic standing. In Pakistan's rural areas, women frequently experience various forms of discrimination and are excluded from essential amenities like education and healthcare. According to previous studies, the lives of rural women's families, communities, and themselves can all be significantly improved by providing them with resources, training, and education. In Pakistan, women are essential to improving the socioeconomic standing of rural communities. Women in rural regions have shown their potential as change agents and important contributions to local development while confronting major obstacles connected to gender discrimination and restricted access to resources. Women frequently help with farming tasks including planting, harvesting, and weeding. They also oversee a few small fish, cattle, and poultry farms. For future planting, women can also generate and save seeds. Women may help with soil and water conservation by controlling soil erosion, growing cover crops, and utilizing irrigation methods that use little water. Women can take part in agroforestry practices by maintaining forest resources and growing trees. A woman's ability to process and market agricultural goods can increase her income and aid the community's economy. Informing other farmers about sustainable farming methods and distributing knowledge about cutting-edge technology and best practices are vital roles that women may play. Women have shown their potential as change agents and important contributors to regional development via their involvement in agriculture, income-generating activities, and community-based organizations. Realizing women's full potential and fostering inclusive and sustainable rural development depend on removing the obstacles that prevent them from participating fully. In conclusion, women are essential to improving the socioeconomic standing of rural Pakistani areas. The essay will examine how women might improve socioeconomic conditions in rural Pakistan and highlight some of the research that has been done in this area.

Key words: Female, Gender equality, Farming, Income-generating, Village life

Enhancing Agricultural Productivity through Women's Empowerment:

Agriculture is one of the main ways that women in Pakistan contribute to rural development. Women in rural regions frequently engage in subsistence farming and livestock raising, which is essential to guaranteeing household income and food security [1]. One of previous research found that women's involvement in agriculture might boost agricultural output and boost food security in families, especially those headed by women [2].

Women in rural regions work in a variety of additional occupations that provide money in addition to agriculture, such as handicrafts, microfinance, and small businesses [3]. Particularly in places with few alternatives for conventional work, these activities may be significant sources of revenue and employment. Women in rural communities are essential for advancing.

Importance of education and training for women in agriculture:

Women in rural regions still encounter considerable obstacles to participating in development initiatives, despite their significant contributions. These obstacles include societal norms that restrict women's mobility and involvement in public life as well as limited access to education, financial resources, and decision-making capacity [1]. For women to be able to fully engage in and contribute to local development activities, these barriers must be removed.

Through entrepreneurship, women may make a significant contribution to Pakistan's rural communities' socioeconomic development. Women entrepreneurs may produce revenue, open up job possibilities, and help local economies thrive, according to studies [5]. But women business owners in Pakistan confront a number of obstacles, such as restricted access to financing, a lack of education and training, and social and cultural impediments [6].

Another crucial element in empowering rural Pakistani women is education. Studies have demonstrated that educating females may significantly improve social, economic, and health results. Women with greater levels of education are more likely to work and earn more money, as well as choose better options for their family' health and education [7].

Policymakers and stakeholders to prioritize women's empowerment in agriculture:

Participation of women in decision-making is essential for both their empowerment and the improvement of rural Pakistani living. According to studies, women's involvement in local government and organizations can improve conditions in fields including infrastructure, health, and education. Women in Pakistan, however, encounter a number of obstacles to involvement, such as restricted access to resources and social and cultural conventions that give preference to the opinions and experiences of males [8].

Rural women may benefit themselves, their families, and their communities by becoming more educated, entrepreneurial, and involved in decision-making processes. Government, civic

society, and other stakeholders must work together in a continuous and concerted effort to address the obstacles to women's empowerment.

In Pakistan, women play a crucial role in improving the socioeconomic standing of rural life. In Pakistan's rural areas, women frequently experience various types of discrimination and are excluded from essential amenities like education and healthcare. The lives of rural women's families, communities, and themselves may all be significantly improved by providing them with resources, education, and training.

For instance, one of the research carried out in rural Pakistan found that women's involvement in local government and community-based organizations may improve outcomes in fields like infrastructure, health, and education. Women in Pakistan, however, have a number of obstacles to involvement, such as restricted access to resources and social and cultural norms that give men's views and experiences priority.

Education and training for women in agriculture:

In Pakistan, education is also essential for empowering rural women. A research has found that educating girls can significantly improve social, economic, and health results [7]. Women with greater levels of education are more likely to work and earn more money, as well as choose better options for their families' health and education.

Another significant method that women may improve the socioeconomic conditions of rural Pakistani living is through entrepreneurship. Women business owners may boost local economies by generating revenue, creating jobs, and increasing employment prospects. But women business owners in Pakistan confront a number of obstacles, such as restricted access to financing, a lack of education and training, and social and cultural impediments [6].

The Pakistan Economic Survey 2020-21 states that women make up 49.2% of Pakistan's overall population, with 63.5% of them living in rural regions. Despite this, just 22% of women and 81% of males participate in the labor force respectively. With barely 14% of rural women engaging in the labor force, women in these areas are moreover at a distinct disadvantage [9].

With over 63% of Pakistan's female labor force working in agriculture-related jobs, women play a key part in the country's agricultural industry [9]. However, women's involvement in agriculture is frequently restricted to subsistence farming, and they encounter a number of difficulties, including a lack of resources, information, and markets. Women's access to resources, education, and training can significantly increase their ability to produce agriculturally.

Diversification of Agricultural Activities through Women's Participation:

Adopting contemporary farming methods is one-way women may contribute to Pakistan's agriculture industry. For instance, one of the research conducted in the Punjab province of

Pakistan discovered that women who got instruction in contemporary agricultural methods had considerable increases in production and revenue [10]. Women who got training also reported having better decision-making abilities and feeling more confident about engaging in agricultural activities.

Women may also improve rural living by working in non-traditional agricultural pursuits including horticulture, livestock raising, and fishing. Women's involvement in non-traditional agricultural pursuits can boost their income and contribute to the diversification of the rural economy [11].

Participation in agricultural value chains:

Women's involvement in agricultural value chains can help improve rural living. According to a research conducted in Pakistan, for instance, women who worked in the dairy value chain were able to raise their income and enhance their level of life [12]. However, there are a number of obstacles that prevent women from taking part in agricultural value chains, such as their restricted access to markets, knowledge, and financing.

Last but not least, women's involvement in agricultural decision-making may help improve rural living. Making sure that women's perspectives and experiences are heard and represented can result in more inclusive and equitable outcomes when they participate in decision-making processes [13].

CONCLUSION: As a result, women's involvement in agriculture can significantly improve rural living in Pakistan. Women's empowerment via education, training, and resource access can boost their agricultural production and support the expansion and improvement of rural economies. Government, civic society, and other stakeholders must coordinate and maintain their efforts to overcome the obstacles to women's empowerment in rural Pakistan. Rural women may benefit themselves, their families, and their communities by becoming more educated, entrepreneurial, and involved in decision-making processes.

References:

1. Kabeer, N. 2019. Women's economic empowerment and inclusive growth: Labour markets and enterprise development. *Journal of International Development*, 31(5): 383-393.
2. Ahmed, N. and A. Rashid, 2019. Women participation in agriculture and food security in Pakistan. *International Journal of Social Economics*, 46(4): 532-548.
3. Khan, A. H. and A. A. Khan, 2017. Role of women entrepreneurs in rural development: A case study of Khyber Pakhtunkhwa, Pakistan. *Journal of Rural Studies*, 53: 141-149.
4. Niaz, U. 2018. Women's participation in local governance in Pakistan: The case of district councils. *Commonwealth Journal of Local Governance*, 19(2): 120-137.
5. Khan, M. A. and M. Ehsan, 2017. Women's entrepreneurship development in rural areas of Pakistan: A review of literature. *Journal of Small Business and Entrepreneurship Development*, 5(1): 1-12.
6. Hameed, I., S. Bashir and S. Rana, 2021. Barriers to women entrepreneurship in Pakistan: A qualitative study. *Asia Pacific Journal of Management*, 38(3): 879-904.
7. Memon, M. A. and R. A. Soomro, 2019. Female education and rural development: A case study of Sindh, Pakistan. *Journal of Rural Studies*, 70: 133-141.
8. Akram, W. and M. Hussain, 2019. Women's participation in community-based organizations and local government in rural Pakistan. *Journal of Rural Studies*, 69: 26-35.
9. Government of Pakistan, 2021. Pakistan Economic Survey 2020-21. Retrieved from http://www.finance.gov.pk/survey_2020_21.html
10. Afzal, M., A. Iqbal and S. Ahmed, 2020. Women's empowerment and adoption of modern agricultural practices: Evidence from Punjab, Pakistan. *Journal of Agricultural Education and Extension*, 26(4): 353-370.
11. Bano, S. and D. B. Rahut, 2021. Women's participation in non-traditional agricultural activities and household welfare in rural Pakistan. *Journal of Rural Studies*, 82: 326-335.
12. Abid, M., M. N. Iqbal and M. N. Hanif, 2021. Gender roles and women's empowerment in the dairy value chain in Pakistan. *Gender, Technology and Development*, 25(1): 1-20.
13. Rasheed, F., M., Azeem and S. R. A. Shamsi, 2020. Women's participation in agricultural decision-making in rural Pakistan. *Journal of Rural Studies*, 75: 191-199.

**MARKETING ACTIVITIES AND FINANCIAL MANAGEMENT IN COMPANIES
WITH INTERNAL CONTROL MECHANISMS FOR THE EXAMPLE OF THE
REPUBLIC OF SERBIA**

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ABSTRACT

Marketing activities and financial management in companies can be seen in the context of the existence of internal control mechanisms that are normatively introduced into the business of a large number of heterogeneous companies. It is of particular importance for the business of the public sector, but also other sectors in transition economies. The work of the authors stated the business of a large number of companies that introduced the introduces formal control as a mechanism by means of better business results, a given example of a more accurate development is given to an example of operations in the Republic of Serbia. Financial management in modern business conditions can be seen in the context of numerous influences on the adoption of top management business decisions. One way to improve total safety in the context of making business decisions is the introduction of internal controls in business management processes.

Keywords: introduction of financial management, marketing, operations of companies.

1. INTRODUCTION

Marketing activities and financial management in companies should be seen in the context of internal control mechanisms that are normatively introduced in the business of a large number of heterogeneous companies and which essentially affect the function of top management in order to achieve profits [1-5].

It is assigned particular importance for the operations of top management that brings numerous valid decisions in heterogeneous companies. The essence is that such a personal should be treated as normal and usually in the business of a large number of countries [6-10].

Thus, business in transition and countries that are small has a real need to introduce one of the forms of application of control in regular business. In such terms of business, the application of marketing is important, because its application can be affected by a large number of various businesses in size, activities, and commonly for the entire such business is to highlight the right and appropriate product that the company must be in law

Time, in the right place, in a real quantity, at the right price. The essentially observed product should be placed on the market [11-15].

2. THE BASIS FOR THE EXISTENCE OF INTRODUCED FORM OF CONTROL SUCH AS INTERNAL AUDIT IN HETEROGENEOUS COMPANIES IN DEVELOPING COUNTRIES

Internal audit should organize their work and its business in a way that will basically be in accordance with the adopted professional standards of the audit profession. In addition, the internal auditor within the course of the overall internal audit activities in companies should present its conclusions to the top management as follows:

- To be impartial,
- To be actual,
- To be delivered in a timely manner,
- To be brought in the best intention and
- To be adopted with the optimal use of available resources in the company.

A general diagram of internal audit in the company's in Figure 1.

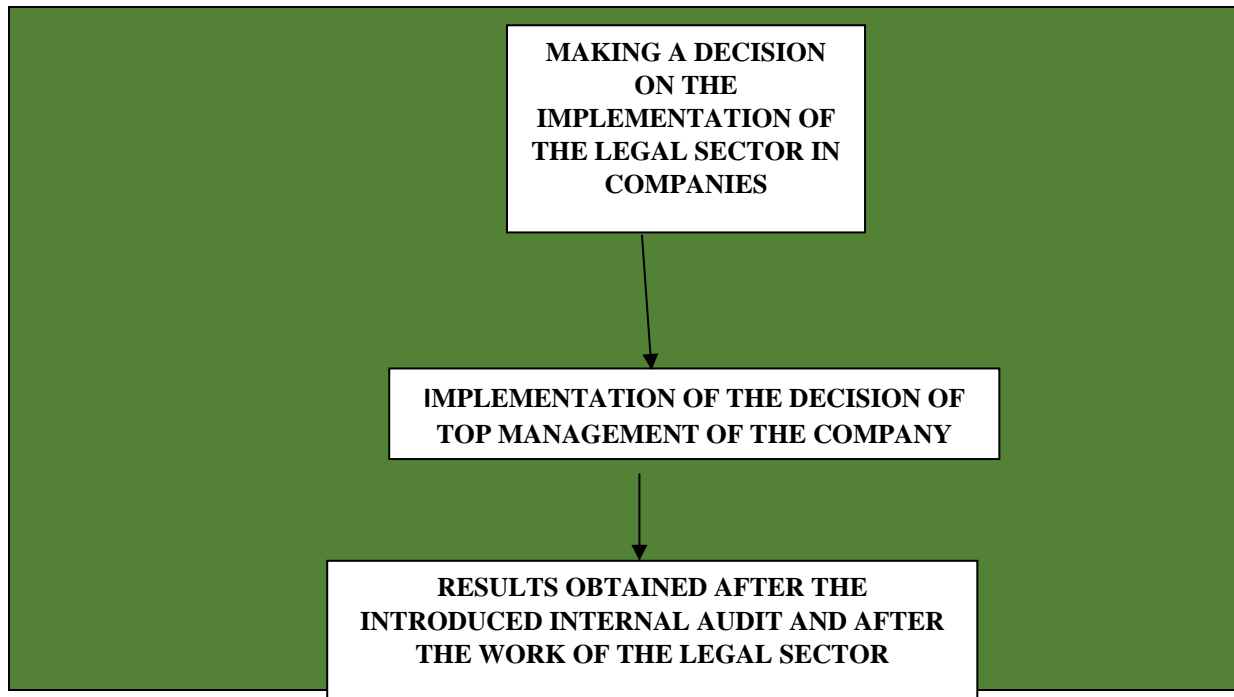


Figure 1: Presentation of what is necessary for the work of internal audit in companies.

3. THE IMPORTANCE OF MARKETING POSITIONING IN TOTAL MANAGEMENT ACTIVITIES IN COMPANIES

The importance of marketing marketing in total management activities in companies can be displayed through a display in Fig. 2 through the so-called.

Flow of activities that can be played in the existence of such a realistic application of the same.

The description of the activity is given by the author in the view of Figure 2.

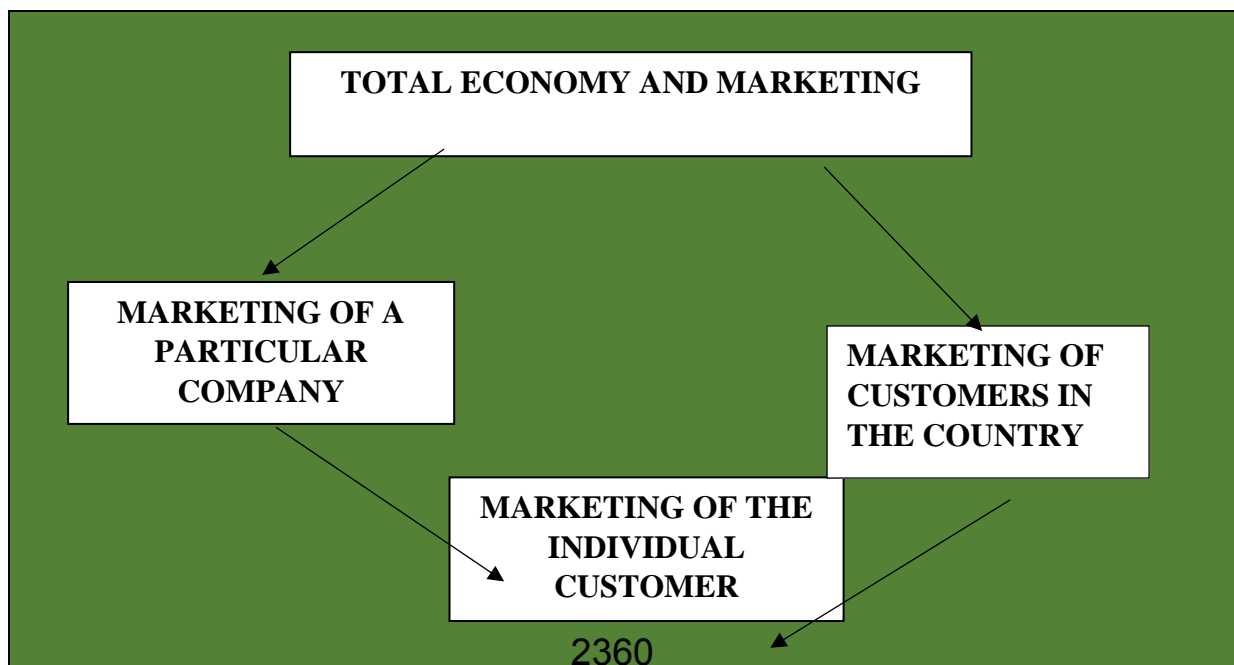




Figure 2: Presentation of marketing in business operations.

4. BASIC INTERNAL AUDIT ACTIVITIES IN THE WORK OF THE COMPANY

The most common activities in the work of internal audit that are entrusted to the internal auditor within the scope of work of internal audit are:

1. careful planning of each audit,
2. determine where activities are directed,
3. consider the risks and their significance,
4. take care that each audit is adjusted to the circumstances of the company's operations,
5. view each element of the audit as part of the company's operations,
6. adopt a constructive and positive approach to auditing,
7. encourage changes in the work of the audited entity,
8. perform a careful audit review,
9. provide an independent opinion of the internal auditor,

10. fulfillment of professional and legal obligations based on the audit of the company,
11. Regularly and appropriately reporting to management on material issues that arose during the preparation of the audit,
12. make appropriate recommendations for the implementation of corrective measures,
13. ensure that the audit adequately takes into account all issues identified during the audit and
14. activities of the top management of the company that it carries out after the internal audit.

The basic activities of the internal audit in the work of the company can be shown in a general scheme, which is also given in figure 3.

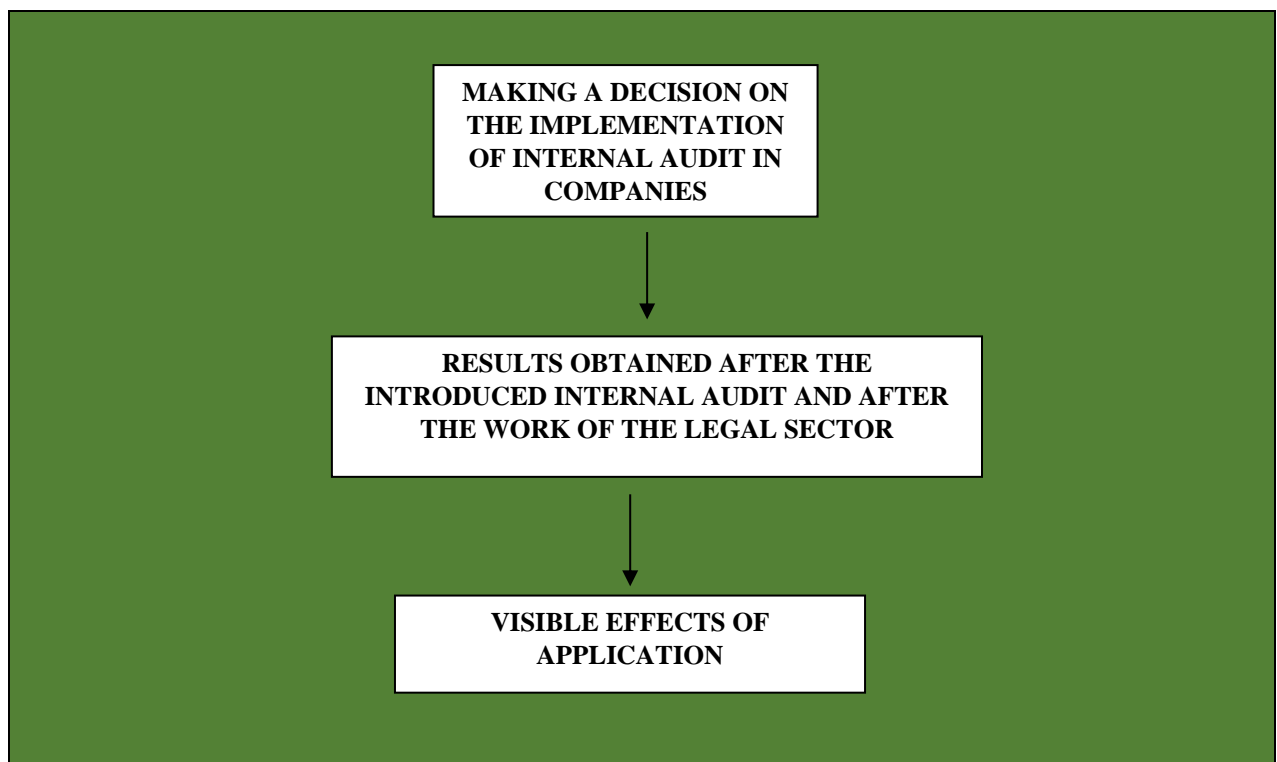


Figure 3: Presentation of the basic activities of internal audit work in companies

4.1. APPLICATION OF MARKETING MIXES IN COMPANIES THAT INTRODUCED CONTROL IN ITS BUSINESS

Application of marketing mix in companies that introduced control in its business is given in the Figure 4.

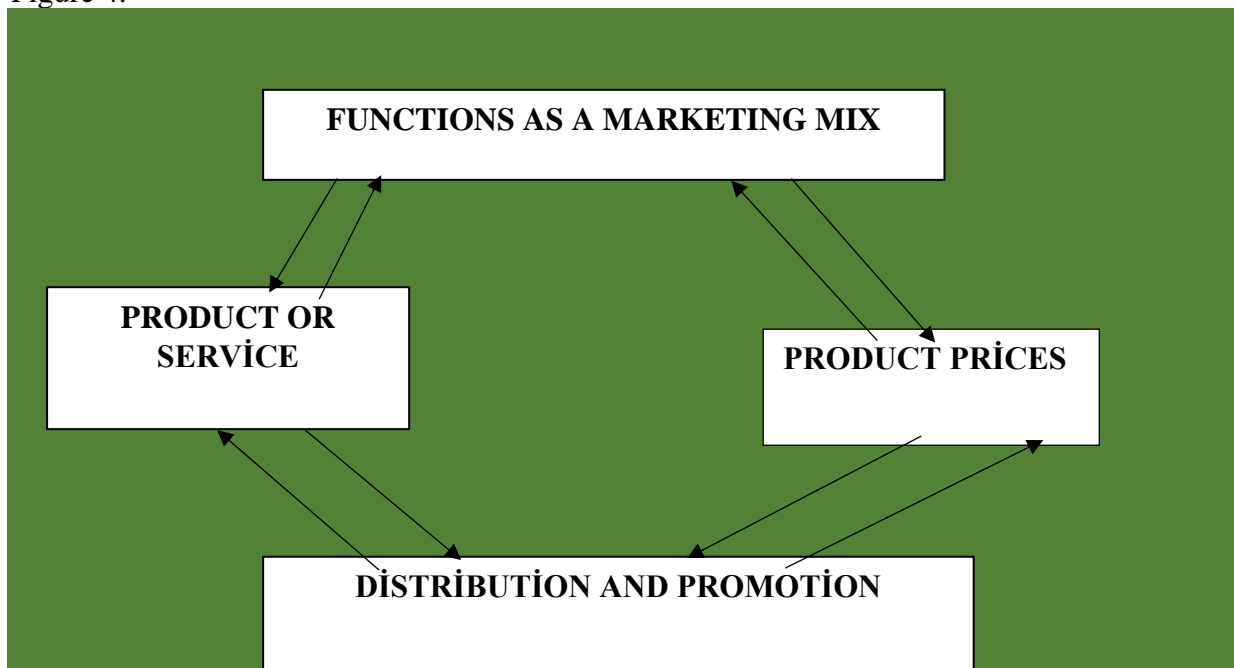


Figure 4: The impact of the marketing mix on the overall business in the economy.

5. CONCLUSION

Marketing activities and financial management in companies should be seen in the context of the existence of business improvement mechanisms, the overall business of the company. One way to enhance business is the process of introducing internal controls and internal audits in the company's representative operations. It should be seen as a continuous activity. It must be introduced through which are normatively introduced in the business of a large number of heterogeneous companies and which essentially affect the function of top management funds in order to achieve profits, but also the safety of total business decisions. The authors pointed out the existence of the flow of displayed activities in terms of control, marketing and management in companies. The application is possible in a large number of countries in transition, and everything was discussed on the example of the Republic of Serbia.

REFERENCES

- [1] Popović, S., (2014) Socio-ekonomski faktori ograničenja razvoja agrara, Univerzitet Privredna akademija u Novom Sadu, monografija, ISBN 978-86-87619-555
- [2] Bakmaz, O., Bjelica, B. & Vitomir, J. (2023). Application of software solutions in companies that strive to achieve increased financial stability in their regular business, Temel-II, Vol.7.Iss.1. (Mar.2023) 13 - 20 <https://doi.org/10.52576/TEMEL237.1013b>
- [3] Bakmaz, O., Milošević, M. & Marković, N. (2020). Poslovna Ekonomija, Business Economics, Regionalno planiranje-pojam, teorije i modeli, 2: 75-86, doi: 10.5937/poseko18-30482.
- [4] Bakmaz, O., Bjelica, B., Ivić, Lj., Volf, D. & Majstorović, A. (2017). The significance of the audit profession in the financial analysis of agricultural enterprises of the Republic of Serbia. Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, pp. 117-123, ISSN 2344 – 3685/ISSN-L1844–7007.
- [5] Radović, M., Vitomir, J., Laban, B., Jovin, S., Nastić, S., Popović, V. & Popović S. (2019). Management of joint stock companies and farms by using fair value of agricultural equipment in financial statements on the example of IMT 533 Tractor, Economics of Agriculture, 1: 35-50.
- [6] Popović S, (2015). Implementacija heterogenih rizika u radu interne revizije, Revizor 69/2015.
- [7] Popović, S., Novaković, S., Đuranović, D., Mijić, R., Grublješić, Ž, Aničić, J. & Majstorović, A. (2017). Application of international accounting standard-16 in a public company with predominantly agricultural activities, Economic Research-Ekonomska Istraživanja, 30(1):1850–1864.
- [8] Popović, S., Tošković, J., Majstorović, A., Brkanlić, S. & Katić, A. (2015). The importance of continuous audit of financial statements of the company of countries joining the EU, Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, Special Issue, 241-246.
- [9] Radović, M., Vitomir, J. & Popović, S. (2021). Impact of internal control in enterprises founded by local self government units: the case of Republic of Serbia, Inzinerine Ekonomika-Engineering Economics, 32(1): 82–90.
- [10] Vitomir, J., Laban, B., Bakmaz, O., Nikolić, N., Čolović, M. (2019). Audit as a possible way to improve corporate governance with an overview of possible models of determining the risk interval and some of the basic impact factors identified by top management. Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, Issue 2/2019, ISSN 2344 – 3685/ISSN-L 1844 – 7007.
- [11] Bjelica, B., Bakmaz, O., Mijić, R., Popović, S. & Popović, V. (2017). The implementation of heterogeneous risk to the company's operations and transition countries respecting the behavior of agricultural enterprises in the republic of Serbia. Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, 3/2017, 207-213, ISSN 2344 – 3685/ISSN-L 1844 –7007.
- [12] Bakmaz, O., Bjelica, B. & Vitomir, J. (2023). Application of internal audit in processes of reducing corruption in a transitional economy like the Republic of Serbia, Temel-II, Vol.7.Iss.1. (Mar.2023) 36 - 42 <https://doi.org/10.52576/TEMEL237.1036b>
- [13] Bojović, R., Popović, V., Ikanović, J., Živanović, Lj., Rakašćan, N., Popović, S., Ugrenović, V. & Simić, D. (2019). Morphological characterization of sweet sorghum genotypes across environments, The Journal of Anim.Plant Sciences, 29 (3): 721-729.

- [14] Bjelica, B., Bakmaz, O. & Vitomir, J. (2023). The importance of accounting policy in the context of strengthening financial stability in a company that previously implemented internal audit as a mechanism of regular business decision-making, *Temel-IJ*, Vol.7.Iss.1. (Mar.2023) 57 - 63 <https://doi.org/10.52576/TEMEL237.1057b>
- [15] Ugrenović, V., Popović, V., Ugrinović, M., Filipović, V., Mačkić, K., Ljubičić, N., Popović, S. & Lakić, Ž. (2021). Black Oat (*Avena strigosa* Schreb.) Ontogenesis and Agronomic Performance in Organic Cropping System and Pannonian Environments, *Agriculture* 2021, 11(1): 55.

**THE USE OF INTERNAL AUDIT AS A FORM OF CONTROL IN CREATING AND
MANAGING THE MARKETING AND FINANCIAL MANAGEMENT OF
NUMEROUS VARIOUS COMPANIES IN DEVELOPING COUNTRIES**

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ABSTRACT

The use of internal audit as a form of control in creating and managing the marketing and financial management of numerous diverse companies in developing countries is one of the real forms of possible business improvement activities. Marketing activities and financial management in companies can be seen in the context of the mechanisms introduced by internal audit created by the rarely decision by the top management. The acts of establishment are adopted, the Code of Conduct between the Top Management and the Appointed Internal Auditor is signed. It is presented to the basis for introducing such business in a large number of heterogeneous companies. It is essential to the basis of normative organization of operations in terms of internal audit, marketing and financial management.

Keywords: internal audit, introduction of financial management, company.

1. INTRODUCTION

The use of internal audit can be multiple. It is one of the forms of control in creating and managing a marketing and financial management of numerous various companies. The application is universal both in developed countries and in developing countries [1-4].

It is one of the real forms of possible business improvement activities. Marketing activities and financial management in companies can be seen in the context of mechanisms introduced and the total business results can be positive if the internal audit control is used, which was introduced into regular business operations [5-9].

Internal audit occurs based on the decision made by the top management to introduce the same to regular business operations. The acts of establishment are adopted, the Code of Conduct between the Top Management and the Appointed Internal Auditor is signed. It is presented to the basis for introducing such business in a large number of heterogeneous companies.

It is essential, it is the basis of normative organization of operations in terms of internal audit, marketing and financial management [10-12].

The entire business was observed in such a combination of internal audit introduced as a large number of heterogeneous companies, to improve the business of raising operations by introducing marketing activities, and then financial management as a system of real activities in companies [13 -15].

2. USE OF CONTROLS IN THE CREATION AND MANAGEMENT OF MARKETING AND FINANCIAL MANAGEMENT IN COMPANIES

The use of controls in the creation and management of marketing and financial management in companies should be viewed in the long term.

Such observation should be in the context of making business decisions of top management in numerous companies.

The view of Figure 1 is given.

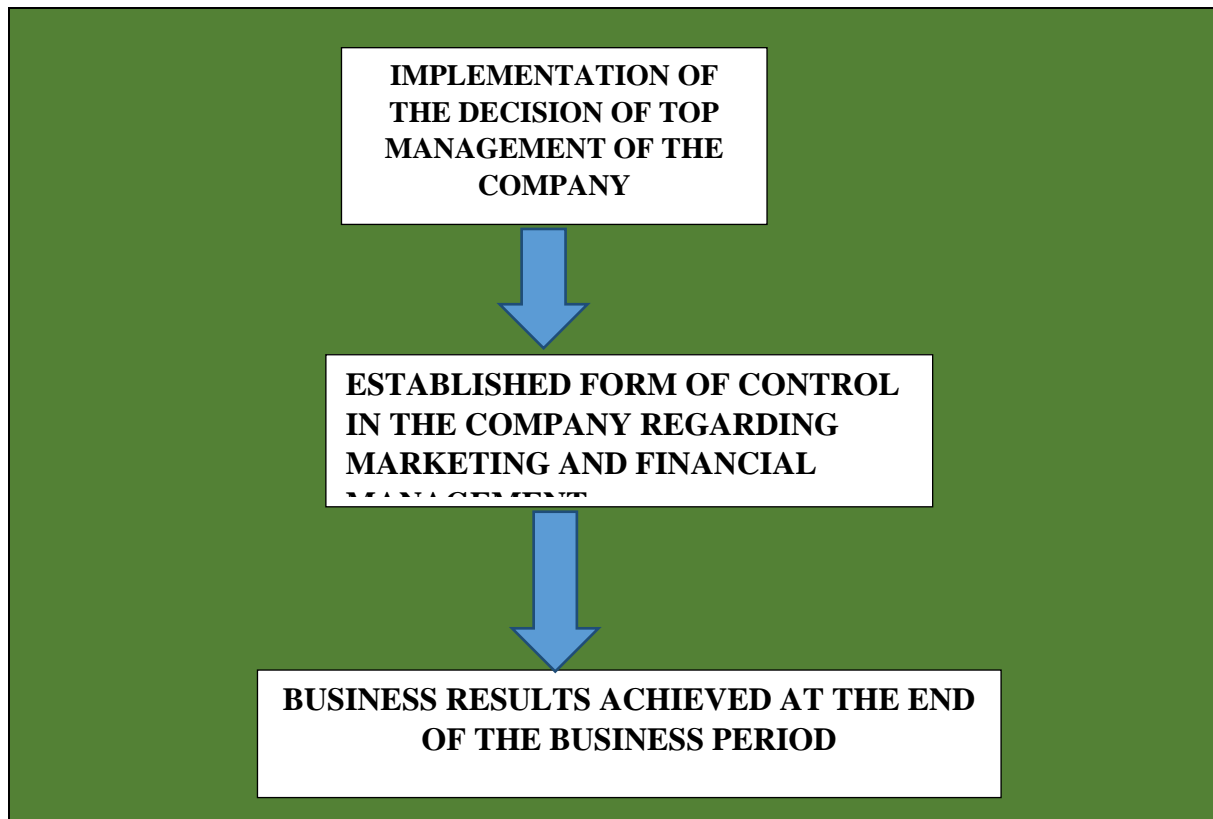


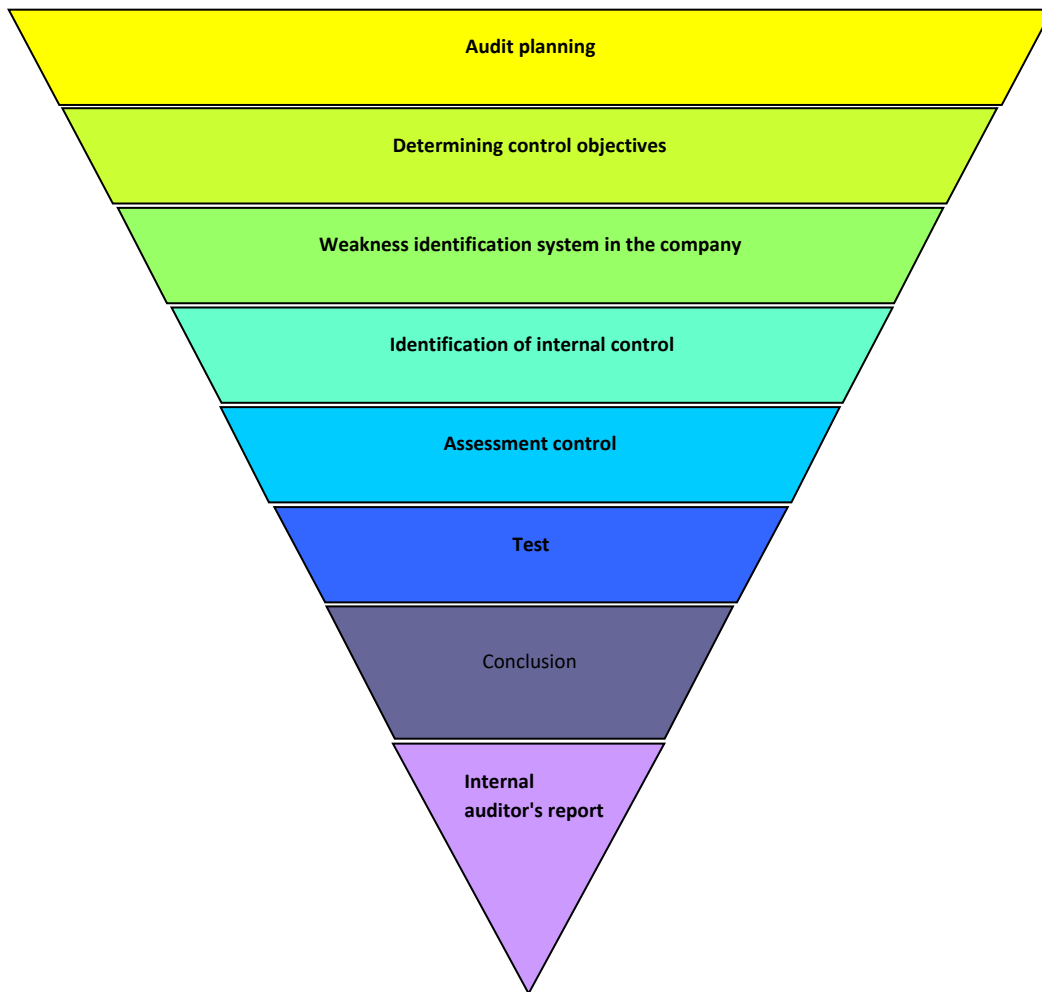
Figure 1: Flow of movement and business results after marketing implementation.

3. IMPROVING THE WORK FLOW AND FUNCTIONING OF INTERNAL AUDIT IN COMPANIES

The management effects of top management in companies should be focused on the company's operations, in which all management functions in the company can be improved in the right and essential way, and therefore the effects of management decisions are visible in a short time after making important decisions such as to introduce an internal audit in the company's operations.

The final effects of such management and decision-making in companies are visible in the financial statements, that is, in the profit and loss statements in each accounting period in which they were adopted in the company.

The authors presented an overview of internal audit activities in the form of Figure 2.



4. MANAGEMENT IN COMPANIES ORIENTED ON CUSTOMER RESPECT

Management in companies that is oriented to the appreciation of customers should be seen as a process of focusing on increasing the discovery of customers' desires and needs in shaping the marketing strategy and delivering superior value to target customers.

The management functions of the company are improved when the identification of numerous opportunities and the introduction of long-term strategies that have potential for the business of numerous legal entities are carried out in the right way.

An overview of management in companies that is oriented towards customer appreciation is shown in Figure 3.

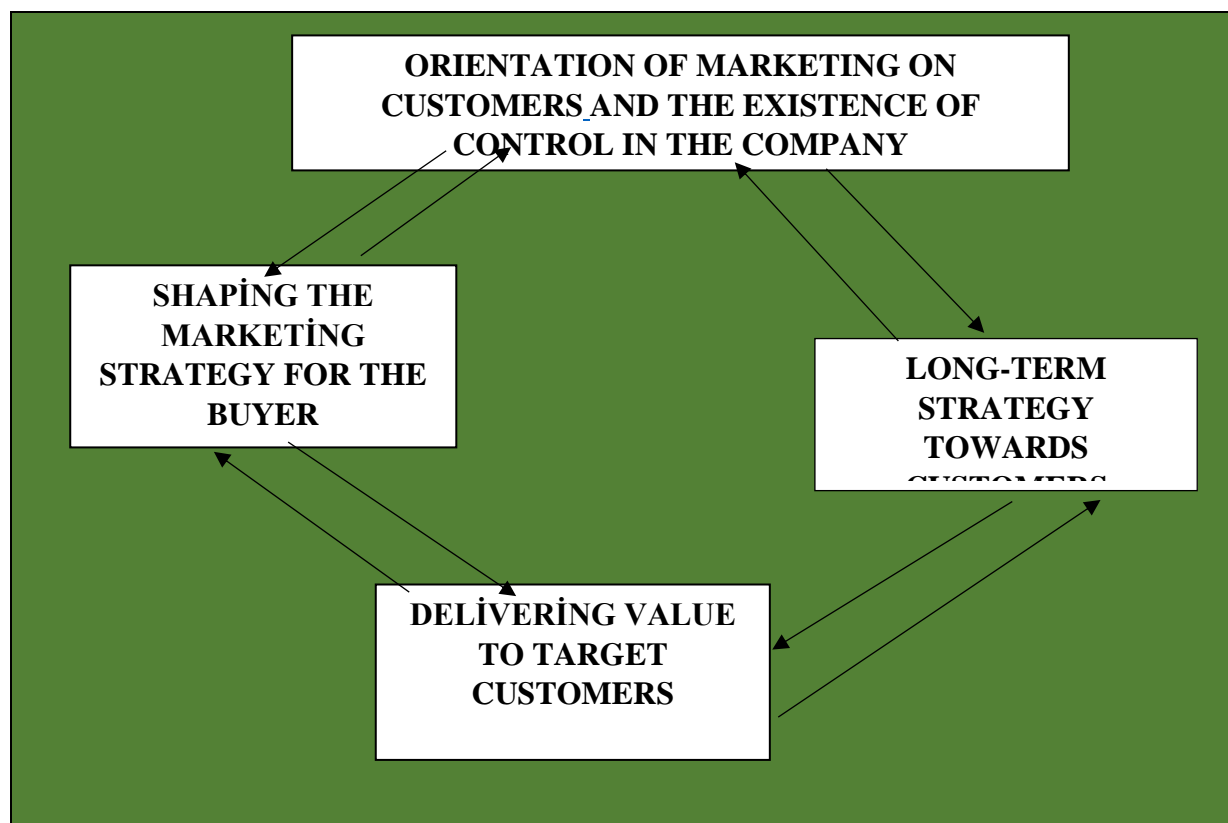


Figure 3: Presentation of management in companies that is oriented towards customer appreciation.

5. CONCLUSION

The use of internal audit as a form of control in creating and managing the marketing and financial management of numerous diverse companies in developing countries is one of the real forms of possible business improvement activities. It is the essence of highlighting the author, especially as marketing activities and financial management in companies can be seen in the context of the mechanisms introduced by internal audit created by the rarely decision by the top management. The authors pointed out the importance of the acts on the establishment of the same, the Code of Conduct between the Code between Top Management and the Appointed Internal Auditor is signed. It is presented to the basis for introducing such business in a large number of heterogeneous companies. It is essential to the basis of normative organization of operations in terms of internal audit, marketing and financial management. The application is possible in the business of a large number of companies that introduce a introducing form of control as a mechanism by means of achieving better business results, a given example of a more accurate development is a more precise example of business in the Republic of Serbia.

REFERENCES

- Privredna akademija u Novom Sadu, monografija, ISBN 978-86-87619-555
- [2] Bakmaz, O., Bjelica, B. & Vitomir, J. (2023). Application of software solutions in companies that strive to achieve increased financial stability in their regular business, *Temel-II*, Vol.7.Iss.1. (Mar.2023) 13 - 20 <https://doi.org/10.52576/TEMEL237.1013b>
- [3] Bakmaz, O., Milošević, M. & Marković, N. (2020). *Poslovna Ekonomija, Business Economics, Regionalno planiranje-pojam, teorije i modeli*, 2: 75-86, doi: 10.5937/poseko18-30482.
- [4] Bakmaz, O., Bjelica, B., Ivić, Lj., Volf, D. & Majstorović, A. (2017). The significance of the audit profession in the financial analysis of agricultural enterprises of the Republic of Serbia. *Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series*, pp. 117-123, ISSN 2344 – 3685/ISSN-L1844–7007.
- [5] Radović, M., Vitomir, J., Laban, B., Jovin, S., Nastić, S., Popović, V. & Popović S. (2019). Management of joint stock companies and farms by using fair value of agricultural equipment in financial statements on the example of IMT 533 Tractor, *Economics of Agriculture*, 1: 35-50.
- [6] Popović S, (2015). Implementacija heterogenih rizika u radu interne revizije, *Revizor* 69/2015.
- [7] Popović, S., Novaković, S., Đuranović, D., Mijić, R., Grublješić, Ž, Aničić, J. & Majstorović, A. (2017). Application of international accounting standard-16 in a public company with predominantly agricultural activities, *Economic Research-Ekonomska Istraživanja*, 30(1):1850–1864.
- [8] Popović, S., Tošković, J., Majstorović, A., Brkanlić, S. & Katić, A. (2015). The importance of continuous audit of financial statements of the company of countries joining the EU, *Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, Special Issue*, 241-246.
- [9] Radović, M., Vitomir, J. & Popović, S. (2021). Impact of internal control in enterprises founded by local self government units: the case of Republic of Serbia, *Inžinerine Ekonomika-Engineering Economics*, 32(1): 82–90.
- [10] Vitomir, J., Laban, B., Bakmaz, O., Nikolić, N., Čolović, M. (2019). Audit as a possible way to improve corporate governance with an overview of possible models of determining the risk interval and some of the basic impact factors identified by top management. *Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series, Issue 2/2019*, ISSN 2344 – 3685/ISSN-L 1844 – 7007.
- [11] Bjelica, B., Bakmaz, O., Mijić, R., Popović, S. & Popović, V. (2017). The implementation of heterogeneous risk to the company's operations and transition countries respecting the behavior of agricultural enterprises in the republic of Serbia. *Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series*, 3/2017, 207-213, ISSN 2344 – 3685/ISSN-L 1844 – 7007.
- [12] Bakmaz, O., Bjelica, B. & Vitomir, J. (2023). Application of internal audit in processes of reducing corruption in a transitional economy like the Republic of Serbia, *Temel-II*, Vol.7.Iss.1. (Mar.2023) 36 - 42 <https://doi.org/10.52576/TEMEL237.1036b>
- [13] Bojović, R., Popović, V., Ikanović, J., Živanović, Lj., Rakašćan, N., Popović, S., Ugrenović, V. & Simić, D. (2019). Morphological characterization of sweet sorghum genotypes across environments, *The Journal of Anim.Plant Sciences*, 29 (3): 721-729.

- [14] Bjelica, B., Bakmaz, O. & Vitomir, J. (2023). The importance of accounting policy in the context of strengthening financial stability in a company that previously implemented internal audit as a mechanism of regular business decision-making, *Temel-IJ*, Vol.7.Iss.1. (Mar.2023) 57 - 63 <https://doi.org/10.52576/TEMEL237.1057b>
- [15] Ugrenović, V., Popović, V., Ugrinović, M., Filipović, V., Mačkić, K., Ljubičić, N., Popović, S. & Lakić, Ž. (2021). Black Oat (*Avena strigosa* Schreb.) Ontogenesis and Agronomic Performance in Organic Cropping System and Pannonian Environments, *Agriculture* 2021, 11(1): 55.

CUTANEOUS FIBROSARCOMA IN A PERSIAN CAT

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ABSTRACT

Fibrosarcoma is a mesenchymal tumor of malignant fibroblasts in a collagen background. It was reported in all species, but most commonly in older dogs and cats. This tumor often occurs on the head and limbs, but may also occur anywhere on the body. A 6-year-old male Persian cat (3/5 kg) with a raised mass on the right anterior limb was referred to the veterinary hospital. Based on owner information, within the previous 2-month period, the mass had become evident and grew larger. Finally, complete surgical removal was selected. On gross examination, the mass was approximately 8×10×12 mm in size. Macroscopically, the mass was well circumscribed, ulcerated, firm and white to yellow. Tissue samples of the mass were fixed in 10% neutral buffered formalin and routinely processed, dehydrated, embedded in paraffin wax, sectioned at 5µm in thickness and stained with Hematoxylin and Eosin and Masson's trichrome. Immunohistochemical studies of the mass sections were performed using Vimentin, SMA and Desmin. Microscopically, the mass was encapsulated and the dermis and subcutaneous area were expanded by spindle-shaped to polygonal neoplastic cells in the interwoven pattern and contained a single ovoid to polygonal nucleus and a moderate amount of eosinophilic cytoplasm. Nucleoli were often prominent. Mitotic figures were infrequent. The sections were positive for Masson's trichrome and Vimentin and negative for Desmin and SMA. Based on histopathological features, a well differentiated fibrosarcoma was diagnosed. No new growth of the mass was observed six months following the surgical procedures. The incidence of fibrosarcoma in cats has been rising in the last 20 years, most likely associated with vaccination. Similar to this case, surgical excision is the treatment of choice in this tumor.

Keyword: Cat, Cutaneous, Fibrosarcoma, Pathology

INTRODUCTION

Fibrosarcoma is a mesenchymal tumor of malignant fibroblasts in a collagen background with immature proliferating fibroblasts or undifferentiated anaplastic spindle-shaped cells arranged in distinct interwoven patterns (Hendrick, 2017). These tumors occur commonly in all domestic animal species (Hendrick, 2017; Modiano & Breen, 2007) and have been reported in cats (Strong et al., 2016), dogs (de Paula et al., 2021) and horses (Bass et al., 2017). This paper is about the macroscopic, surgical, and histopathological findings of a well differentiated cutaneous fibrosarcoma in a Persian cat.

CASE DESCRIPTION

In December 2022, a 6-year-old male Persian cat (3.5 Kg) with a raised mass on the lateral side of its right hind limb was referred to the hospital. Based on owner information, within the previous 2-month period the mass had become evident and grew larger. On physical examination vital signs such as pulse rate and respiratory rate were normal. Further clinical examination revealed no other physical abnormalities and complete surgical removal of the mass was chosen. The cat was anaesthetized with intravenous injections of ketamine and diazepam and maintained with 1%-2% isoflurane in oxygen. Analgesia was provided by subcutaneous injection of ketoprofen (for 3 days). On gross examination, the mass was approximately 8×10×12 mm in size. It was well circumscribed, ulcerated, firm and white to yellow. Tissue samples of the mass were fixed in 10% neutral buffered formalin, routinely processed, dehydrated, embedded in paraffin wax blocks, sectioned at 5µm thicknesses (Rotary Microtome RM2 145; Leica, Wetzlar, Germany) and stained with Hematoxylin & Eosin and Masson's Trichrome (Luna, 1968). Immunohistochemical studies of the mass were performed using Vimentin (V9, mouse monoclonal, dilution: 1/50, Dako, Denmark) (Luna, 1968), SMA (1A4, mouse monoclonal, dilution: 1/50, Dako, Denmark), and Desmin (D33, mouse monoclonal, dilution: 1/50, Dako, Denmark) (Vascellari et al., 2006). Sections were examined using a light microscope (E600; Nikon, Tokyo, Japan) and representative images were taken. Hemorrhage, necrosis and peripheral aggregates of lymphocytes were observed in the histopathological sections. Microscopically, the mass was encapsulated and the dermis were expanded by spindle-shaped to polygonal neoplastic cells. These cells were arranged in an interwoven pattern and contained a single ovoid to polygonal nucleus. Nucleoli were often prominent. Mitotic figures were infrequent. Some neoplastic cells had cellular and nuclear pleomorphism (Fig 1). Masson's trichrome demonstrated the positive and blue staining of collagen. Immunohistochemically, the sections were uniformly positive for Vimentin and negative for Desmin and SMA. Based on

histopathological, histochemical and immunohistochemical features, a well differentiated fibrosarcoma was diagnosed.

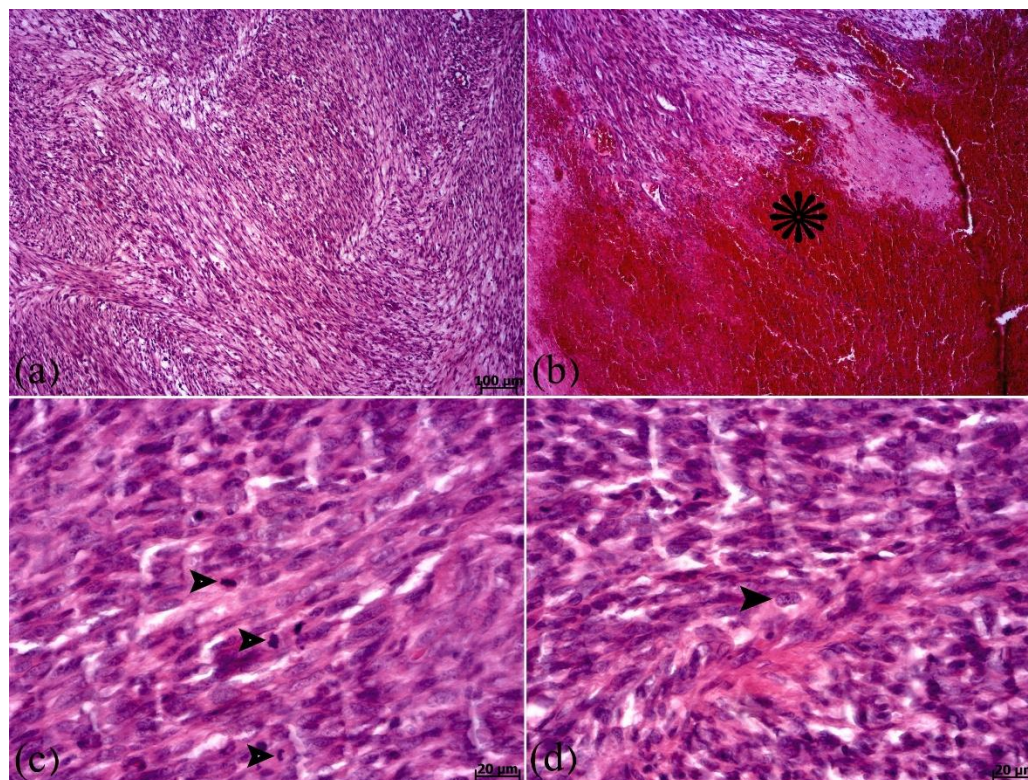


Figure 1: Well differentiated fibrosarcoma in a Persian cat. (a): spindle-shaped to polygonal neoplastic cells in an interwoven pattern. (b): Severe Hemorrhage (*). (c): Mitotic figures (arrowheads). (d): bizarre cell (arrowhead), H&E.

DISCUSSION

fibrosarcomas occur in all domestic animal species, but most commonly occur in adult and aged cats and dogs and can appear anywhere on the body (Hendrick, 2017). These tumors can range from well differentiated to more aggressive, but metastasis is uncommon (Hendrick, 2017). A well differentiated fibrosarcoma is composed of spindle cells, collagen and rare mitotic figures in the herringbone pattern (Hendrick, 2017; Van den Top et al, 2008). FeSV can also induce a rare and aggressive fibrosarcoma in cats. FeSV-induced tumors are multicentric and are found most frequently in young cats (Hartmann, 2011). These tumors are characterised by rapid growth. Metastasis to the lungs or other organs occurs with approximately 30% of virally induced fibrosarcomas in cats. However, only 2% of fibrosarcomas in cats are virally induced (Vail et al. (2020). Fibrosarcoma is the most common tumor of the cat. Its incidence has increased over the past 20 years, most probably due to its association with vaccination. There is significant overlap between fibrosarcomas and leiomyosarcomas in histopathological findings, thus making the use of special stains and immunohistochemical identification, essential for the final diagnosis.

Microscopically, leiomyosarcomas, unlike fibrosarcomas, have elongated nuclei, with blunt rounded ends and eosinophilic cytoplasm. Spindle cells with red cytoplasmic stain were not found among the blue collagen bundles on Masson's trichrome staining. The mass also stained negative for Desmin and SMA and positive for Vimentin. These results prove that this tumor could not have originated from muscle cells and it is a well differentiated fibrosarcoma. (Hendrick, 2017; Roccabianca et al, 2020). Similar this case, surgical excision is the treatment of choice for well differentiated fibrosarcoma (Hendrick, 2017).

CONCLUSION

Surgical excision remains the treatment of choice for fibrosarcomas in cats with radiation therapy as secondary treatment, particularly if surgical removal is difficult.

REFERENCES

1. Bass, K., Mochal-King, C. A., Cooley, A. J., & Brinkman, E. (2017). Equine mandibular fibrosarcoma in two horses: clinical, diagnostic, and therapeutic considerations. *Journal of Equine Veterinary Science*, 48, 31-38.
2. de Paula, L. V., do Amaral, A. V. C., Saturnino, K. C., & de Souza Ramos, D. G. (2021). Canine primary corneal fibrosarcoma—case report. *Topics in Companion Animal Medicine*, 42, 100494.
3. Hartmann, K. (2011). Clinical aspects of feline immunodeficiency and feline leukemia virus infection. *Veterinary immunology and immunopathology*, 143(3-4), 190-201.
4. Hendrick, M. J. (2017). Mesenchymal tumors of the skin and soft tissues. *Tumors in domestic animals*, 5, 142-175.
5. Luna, L.G., 1968. Manual of histologic staining methods of the Armed Forces Institute of Pathology.
6. Modiano, J., & Breen, M. (2007). The etiology of cancer. *Withrow and MacEwen's Small Animal Clinical Oncology*.
7. Roccabianca, P., Schulman, Y., Avallone, G., Foster, R., Scruggs, J., Dittmer, K. & Kiupel, M. (2020). *Surgical Pathology of Tumors of Domestic Animals. 3: Tumors of Soft Tissue*.
8. Strong, T. D., Tangeman, S., Ben-Shlomo, G., Haynes, J., & Allbaugh, R. A. (2016). Corneal fibrosarcoma in a cat. *Veterinary Ophthalmology*, 19, 131-135.
9. Van den Top, J. G. B., De Heer, N., Klein, W. R., & Ensink, J. M. (2008). Penile and preputial tumours in the horse: a retrospective study of 114 affected horses. *Equine Veterinary Journal*, 40(6), 528-532.
10. Vail, D. M., Thamm, D. H., & Liptak, J. (2019). *Withrow and MacEwen's Small Animal Clinical Oncology-E-Book*. Elsevier Health Sciences.
11. Vascellari, M., Melchiotti, E & Mutinelli, F. (2006). Fibrosarcoma with typical features of post injection sarcoma at site of microchip implant in a dog: histologic and immunohistochemical study. *Veterinary Pathology*, 43, 545-448.

**A STUDY ON IMPACT OF EMPLOYABILITY SKILL ON CAREER
DEVELOPMENT OF COLLEGE STUDENTS**

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Abstract

In today's highly competitive job market, the demand for employable graduates who possess the necessary skills to succeed in their careers is on the rise. The aim of this study is to investigate the impact of employability skills on the career development of college students in Sangli district Maharashtra. The study employs a quantitative research design, utilizing surveys to collect data from college students. The study focuses on several key employability skills including communication skills, problem-solving skills, teamwork skills, leadership skills, and adaptability skills. These skills are widely recognized as critical for career success in various industries and are often sought after by employer. The research has conducted among a sample of 384 college students from diverse disciplines and academic backgrounds. The data has analyzed using statistical techniques such as regression analysis and correlation analysis to determine the relationship between employability skills and career development outcomes. The results of the study indicate that employability skills have a significant positive impact on the career development of college students in the Sangli district. The study further highlights the importance of specific employability skills. The findings of this study have important implications for educational institutions, policymakers, and employers in promoting the development of employability skills among college students and enhancing their career prospects.

Key words- Employability skills, career development, college students, educational institute.

Introduction

A strong academic record, along with the abilities and traits to adapt to and handle the ever-changing workplace environment, will increase your employability. For all employees nowadays, employability skills are crucial. The three key employability skills are fundamental abilities, personal development abilities, and time management. The employment market is more competitive today in a whole new way. The nature of technological abilities is evolving constantly. Basic knowledge is taught to students in institutions, but marketable skills are crucial for pupils. Employability is about a larger set of talents and traits that will enable a graduate to succeed throughout their work, not only about landing a job.

By choosing the Sangli District, we will assess the effect of employable skills on career development. We discovered that the researcher concentrates on the employability issue, which is now gaining a lot of attention, as well as the elements impacting employability abilities by critically assessing several literature reviews of different researchers from diverse fields of interest.

Research Problem

Here, we may observe different employability skills affect students' improvement in career development. Here, we can discover what kind of employability skills are needed by the industry. When students enhance skills that are useful for achieving targets and goals.

Statement of Research Problem

“A study on Impact of Employability Skill on Career Development of college students regarding Sangli District”

Objectives of the Study

1. To study the connection between career development and employability skills.
2. To learn more about employability skills' role in career progression.
3. To identify the impact of employability skills on job performance.
4. To examine the impact of employable skills on the degree of satisfaction.

Hypothesis

H0: There is a correlation between employability skills and career development.

H1: There is no correlation between employability skills and career development.

Importance of the study

The primary driving forces behind this study are students' perceptions of employability skills, their attitudes about career development, and whether or not they are aware of the kinds of skills that the market will want.

Research Methodology:

Type of Research: The social sciences frequently employ qualitative approaches to gather, contrast, and interpret data. These techniques include discourse analysis, interviews, surveys, records, and participant observation and have a linguistic-semiotic foundation. We are utilizing qualitative research in this study.

Data Required: For this study, primary or recent data have to be collected through a questionnaire, schedule, or interview.

Data Sources

Primary Data: Data are currently being gathered for research for the first time. It can be gathered using a variety of techniques, including in-person interviews, questionnaires, timetables, and observations. In this study, the main data collection tools were questionnaires and interviews.

Secondary Data: It is data that has already been released in publications such as books, journals, research papers, articles, periodicals, etc. Secondary data for this study was acquired through a review of earlier research papers.

Sampling:

A sample design is a predetermined strategy for choosing a population-representative sample. We employ the primary data and a snowball sampling strategy to collect the data for this study.

• **Qualitative research is a type of research.**

• **Primary and secondary data collection**

• **Number of Samples: 384**

Since it is hard to determine the precise number of responders in the Sangli District, we assume that there are an infinite number of persons. Therefore, we were going to use the following formula to determine the sample size:

The sample unit is equal to $Z^2 * P (1 - P) / e^2$.

We can get the sample size as **384** responders thanks to the formula.

Instrument: Several Excel formulas, graphs, and strategies will be used to analyze the data entered into an Excel spreadsheet once it has been collected using a questionnaire form. Excel and SPSS (Statistical Package for Social Sciences) are two of the best data analysis programs. It will be used under the guidance of qualified lecturers.

Data Analysis: SPSS and Excel is the greatest application for data analysis (Statistical Package for Social Sciences). I'll analyze the data with the help of this software. It is easy to operate.

Limitations of the study

1. The geographical area is vast and the total number of responses is limitless.
2. Time limit of research study.

3. Employer busy schedule they proper not responding on the questions.
4. Most of the student are not aware about employability skills how to developed.
5. Not easy to interact with all student personally.

Review of Literature

Kalbande and Handa (2015), and Mishra and Khurana (2017) Explaining selecting wisely employability abilities for graduates in engineering cannot be disregarded in terms of the global economy. The results of their investigation center on six crucial IT employment skills in industrial sectors like technological, individual, collective, general, and self-perceived skills.

Ahangar (2012) recognized that people with high emotional intelligence succeed more than persons with poor emotional intelligence because the former can manage people well, perform well under pressure, and adjust to organizational change. People with strong emotional intelligence also perform better under pressure.

Fajaryati, N.(2020) this study aimed to identify the employability skills needed in the targeted industry and how to incorporate them into the schooling process. In this study, a review of the literature showed that employability skills, including communication, teamwork, problem-solving, and technical aptitudes, are necessary for relation to future job needs, as decided by employers. The study found that integrating employability skills into all of the lessons students are taught in the classroom is the most effective way to educate them.

Fraser (2018) According to the report, it is becoming more crucial to understand how well higher education institutions prepare students for the workforce at all program levels. Vocational education training is one area where this is particularly clear. According to the study, the most important finding is that vocational educators are utilizing overt and covert strategies to improve their students' employability. This research has enhanced awareness of these strategies and intentionality.

S.K. Dhar (2012) it is irrelevant whether a business school receives the endorsement of government regulating authorities like the University Grant Commission (UGC) and the All India Council for Technical Education (AICTE). The organizations' offering of management degrees, diplomas, or certificate programs also ceases to matter. In the end, what matters is if the business school can alter the nature of learning through its cutting-edge course offerings, creative pedagogy, and andragogy. If students truly benefit from the MBA program, even if they do not receive campus placement, they will be able to join a reputable company through the procedure of off-campus placement.

S. Ravan (2016) did a study on the "Employability Skills Need of An Hour For MBA Students" and discovered that these days, employability skills are a must for all MBA students to land a job. Since just 10% of MBA students in India are reported to be employable, Therefore, these abilities are

taken into account by employers, and they include problem-solving abilities, interpersonal abilities, communication abilities, integrated and value-oriented abilities, result-oriented abilities, domain knowledge expertise, decision-making abilities, leadership abilities, team player abilities, etc. According to the findings mentioned above, there is a skills gap between the workforce and students as well as between the workplace and educational institutions. The university must adapt to meet industry needs and must respond to them.

K. A. Gowsalya (2016) found in their study "A study on the factors affecting employability skills among college students in Namakkal District of Tamil Nadu" that educators needed to incorporate employability skills into lessons and work more closely with employers to supplement academic learning while society and policymakers needed to ensure they had the proper data to make decisions and the stimulate economy and foster job creation as well as ensure young people. The curriculum continues to place more emphasis on academic than experiential learning.

Shah, Rajanibala J. (2014) the main determinants include self-awareness and analytical skills, general management and workplace culture, leadership, problem-solving skills, and communication. According to the report, management institutes should begin offering workshops and ongoing training to their students to familiarize them with the demands of the market and the many employers in various industries.

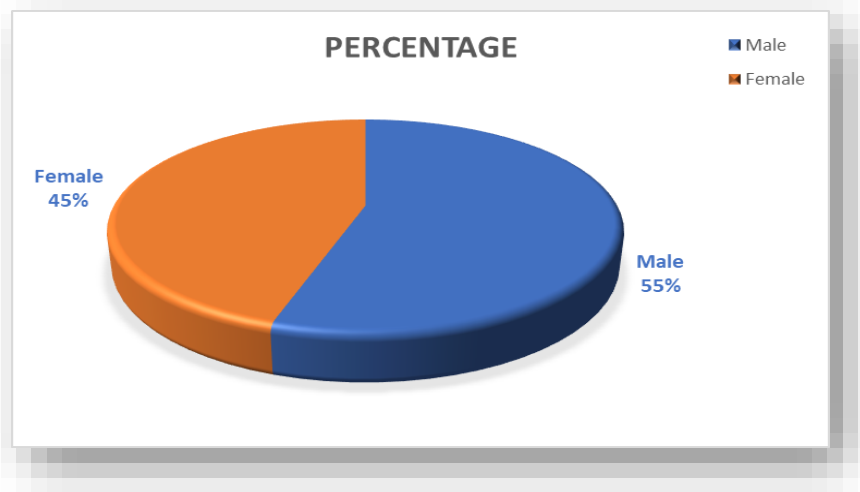
Bhatt (2011) noted that collaboration between business and academia is one way to address the issue of a lack of work readiness in the Indian IT sector. Many organizations have undertaken such initiatives to assist in bridging the training gap needed for the constantly shifting nature of the job market by helping to provide hopefuls with practical and soft skills as well as hands-on experience. However, there aren't many of these kinds of programs.

Rao (2010) (2010) argued that expert management of intellectual capital is essential for the Indian economy and might be a growth driver. Using pedagogy, evaluation procedures, and feedback systems, he advised the institutes to determine the employability skills needed by recent graduates and determine how they might provide value through effective knowledge management.

Data Analysis & Interpretation

i. Classification of responses based on gender

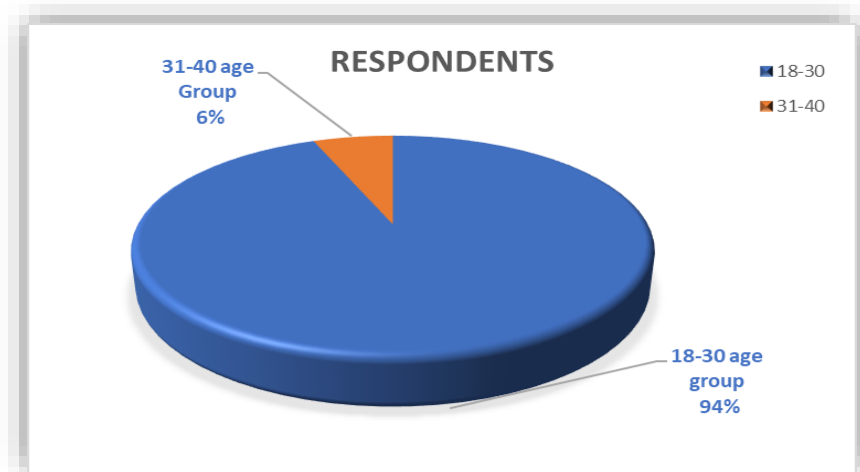
Gender	Respondents	Percentage
Male	210	55.00%
Female	174	45.00%
Total	384	100%



Interpretation:In this study it found that 55% respondents were male and remaining 45% respondents were female. Most of the respondents are students.

ii. Classification of responses based on age

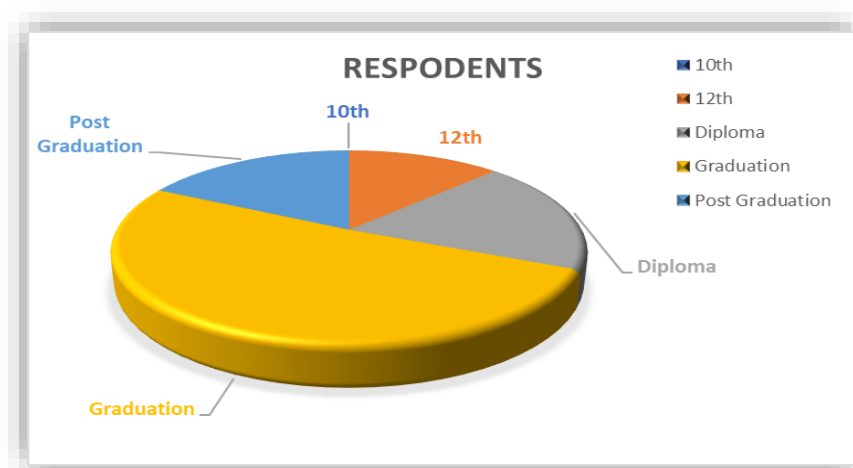
Age	Respondents	Percentage
18-30	360	93.75%
31-40	24	6.25%
Total	384	100%



Interpretation:In this study it is found that 94% respondents are were between 13-30 age group and 6% respondents were between 31-40 age group.

iii. Classification of responses based on education

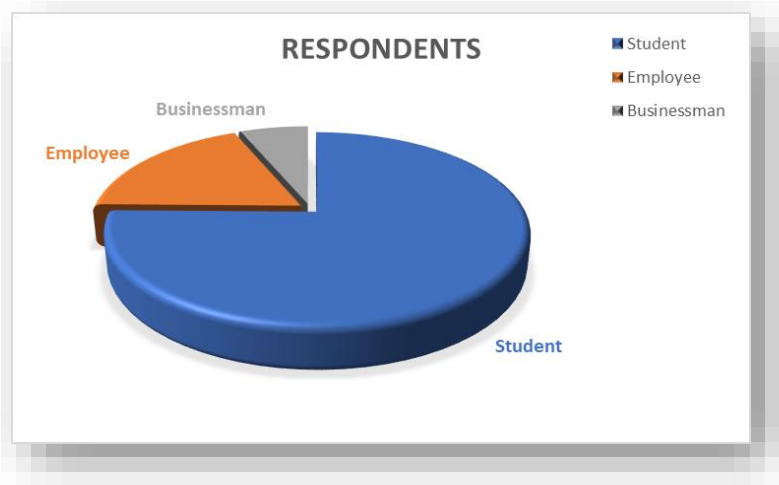
Education	Respondents	Percentage
Up to 10 th	0	0.00%
Up to 12 th	48	12.50%
Diploma	73	19.01%
Graduation	196	51.04%
Post-Graduation	67	17.45%
Total	384	100%



Interpretation:In this study it is found that out of 384 respondents, 51% respondents were graduated, 13% respondents were up to 12th, 19% respondents were Diploma pass, and remaining 17% were post-graduates. All were aware about employability skills.

iv. Classification of responses based on occupation

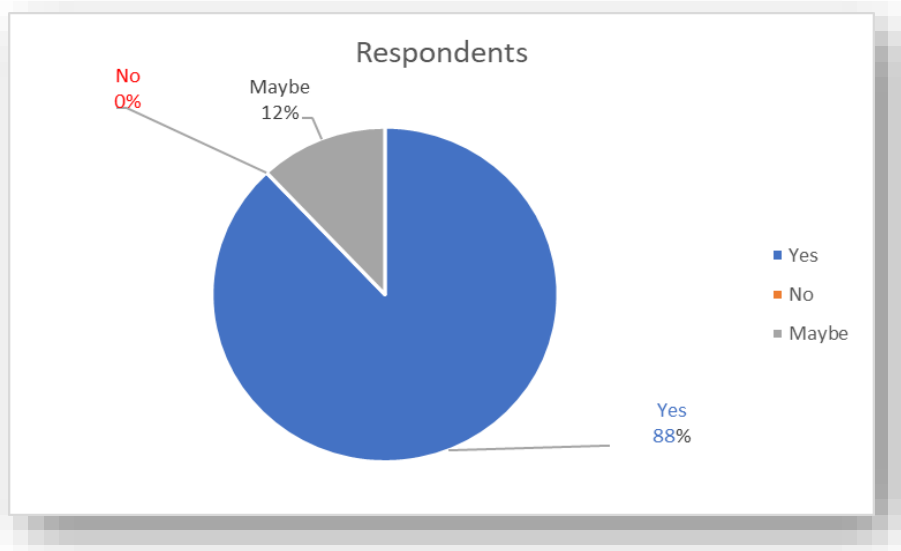
Occupation	Respondents	Percentage
Student	289	75.26%
Employee	71	18.49%
Businessman	24	6.25%
Total	384	100%



Interpretation:In this study it is found, students make up a significant portion of 384 respondents (75%, as shown in the following graph), 18% respondents were employee, and remaining 6% respondents were businessman.

v. Classification of responses based on awareness about industry needs

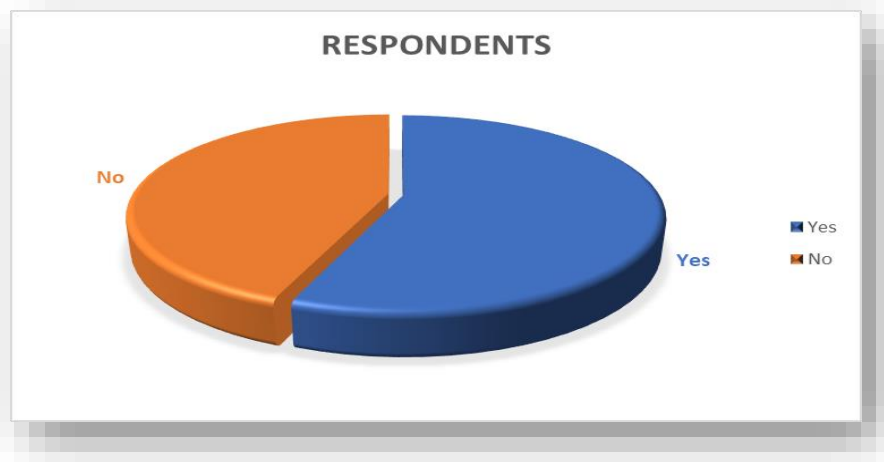
Awareness	Respondents	Percentage
Yes	337	87.76%
No	0	0.00%
Maybe	47	12.24%
Total	384	100%



Interpretation:In this study it is found 88% respondents were aware about the industry needs of employability skill and remaining 12% respondents are aware about industry needs but they don't know what type of skills are needed.

vi. Classification of responses based on work experience

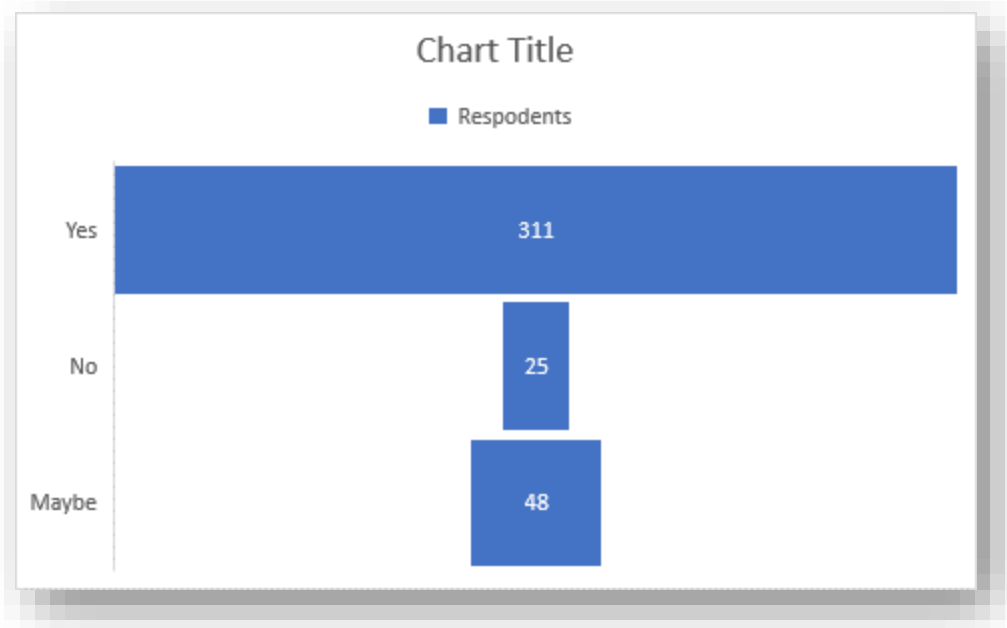
Work Experience	Respondents	Percentage
Yes	215	55.99%
No	169	44.01%
Total	384	100%



Interpretation: In this study it is found that 56% respondents have a work experience, 26% respondents were don't have a work experience. Employe were aware about the industry need skills for career development.

vii. Classification of responses based on work experience impacts job performance

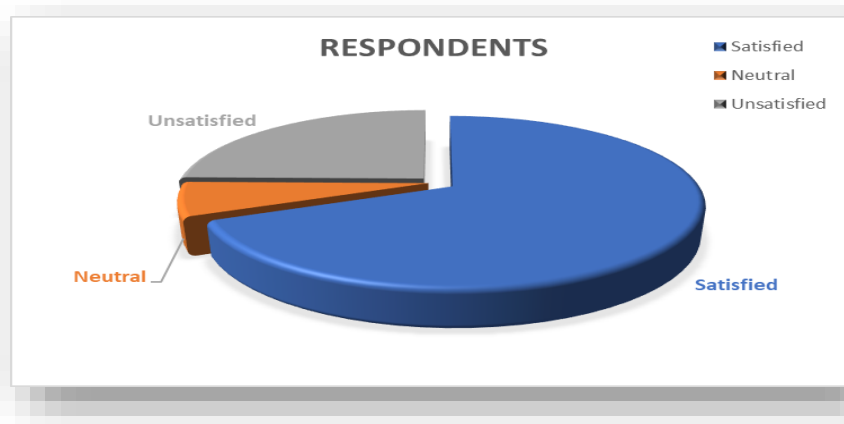
Impact on Job	Respondents	Percentage
Yes	311	80.99%
No	25	6.41%
Maybe	48	12.50%
Total	384	100%



Interpretation: In this study it is found that out of 384 respondent, 81% respondents were know employability skill impact on job performance, 6% respondents were choose no because skill are not impact on job performance, remaining 13% respondents were unaware about skills are impact on job performance.

viii. Classification of responses based on need skills of students by the industry

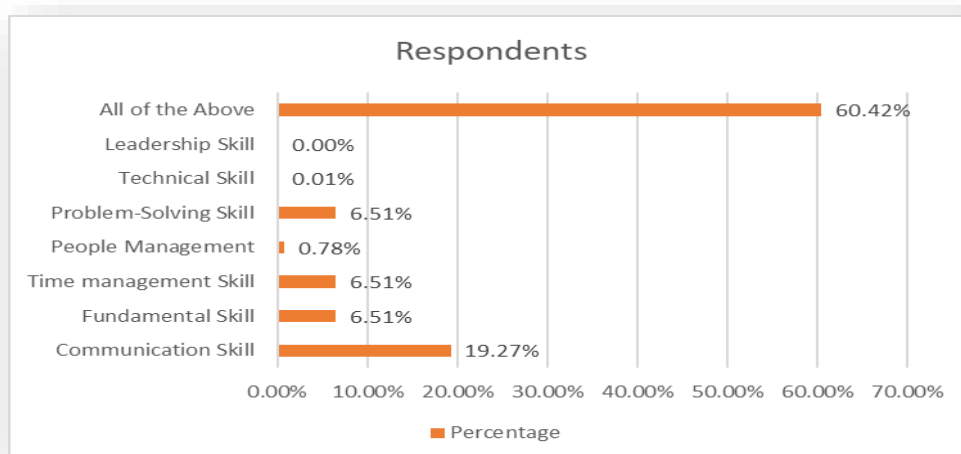
Satisfied with your Skill	Respondents	Percentage
Satisfied	264	68.75%
Neutral	25	6.51%
Unsatisfied	95	24.74%
Total	384	100%



Interpretation: In this study it is found that out of 384 respondent, 69% respondents were satisfied with their skills, 24% respondents were unsatisfied with their skills it want to improve their skills, and remaining 7% respondents were neutral.

ix. Classification of responses based on needs skills of students by the industry

Industry needs	Respondents	Percentage
Communication Skill	74	19.27%
Fundamental Skill	25	6.51%
Time management Skill	25	6.51%
People Management	3	0.78%
Problem-Solving Skill	25	6.51%
Technical Skill	0	0.005%
Leadership Skill	0	0.00%
All of the Above	232	60.42%
Total	384	100%

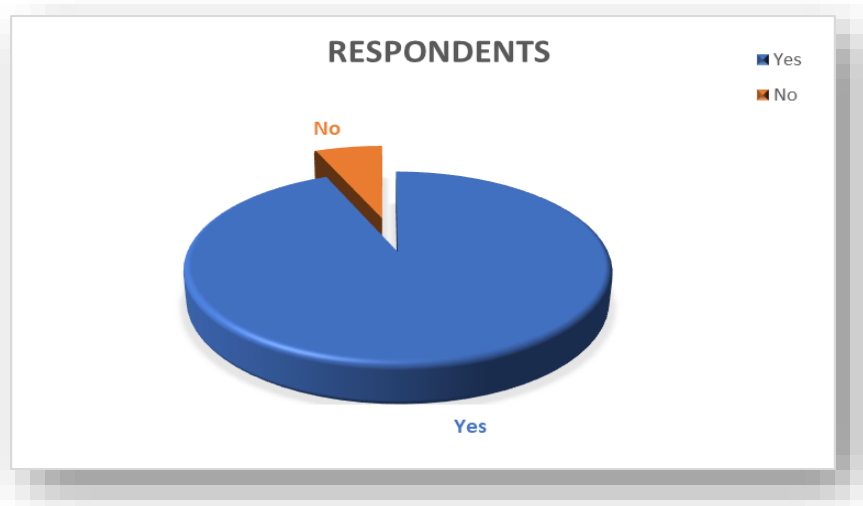


International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

Interpretation:In this study it is found that now a day in industry communication skill is must. 19% respondents were communication is must, 7% respondents were need fundamental skills, time management skill and problem solving skills, 1% respondents were need technical and people management skills and remaining 60% were all skill are prefeed as a industry need.

x. Classification of responses based on collage had organized any skill development program

Skill training	Respondents	Percentage
Yes	360	93.75%
No	24	6.25%
Total	384	100%



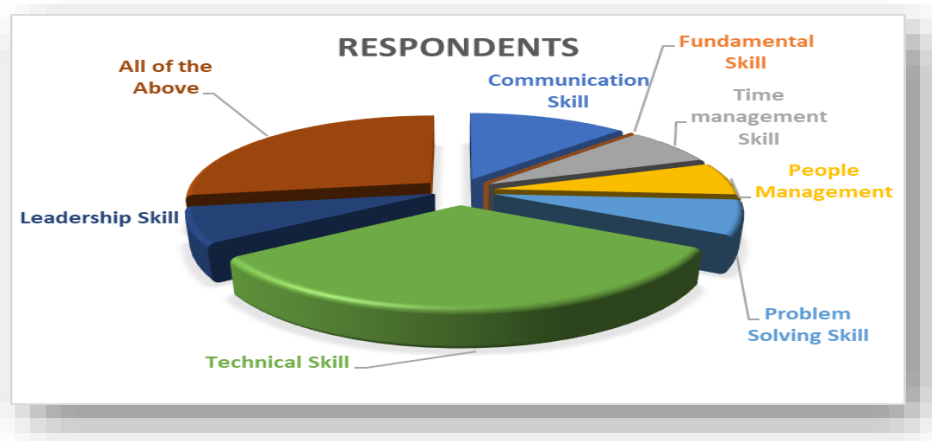
Interpretation:In this study it is found that out of 384 respondent, 94% respondents were colleges organized skill development program for students' career growth and remaining 6% were colleges are not organize skills development programs.

xi. Classification of responses based on the type of skill development program organized by the collage

Training Program	Respondents	Percentage
Communication Skill	45	11.72%
Fundamental Skill	0	0.00%
Time management Skill	26	6.77%
People Management	23	5.99%

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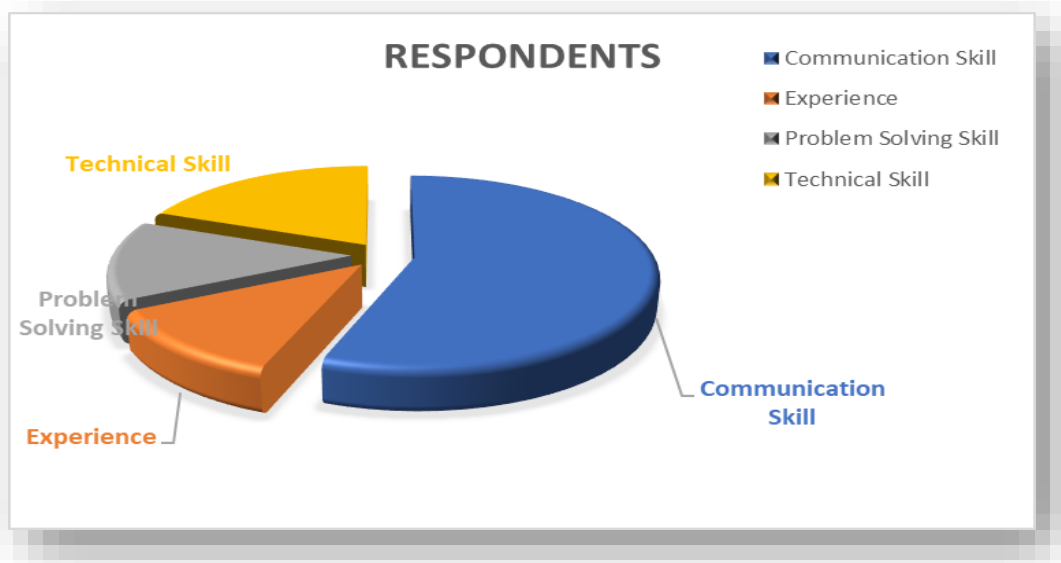
Problem Solving Skill	24	6.25%
Technical Skill	119	30.99%
Leadership Skill	25	6.51%
All of the Above	99	25.78%
Total	384	100%



Interpretation:In this study it is found that. 11% respondents were collages organize communication skills development program, 7% to 8% collages were organize time management skills, people management skills, leadership skill and problem solving skills for students, 31% collages were organize technical skill development programs for students, and remaining 26% collages were organize all type of employability skill program for student.

xi. Classification of responses based on the improvement of skill

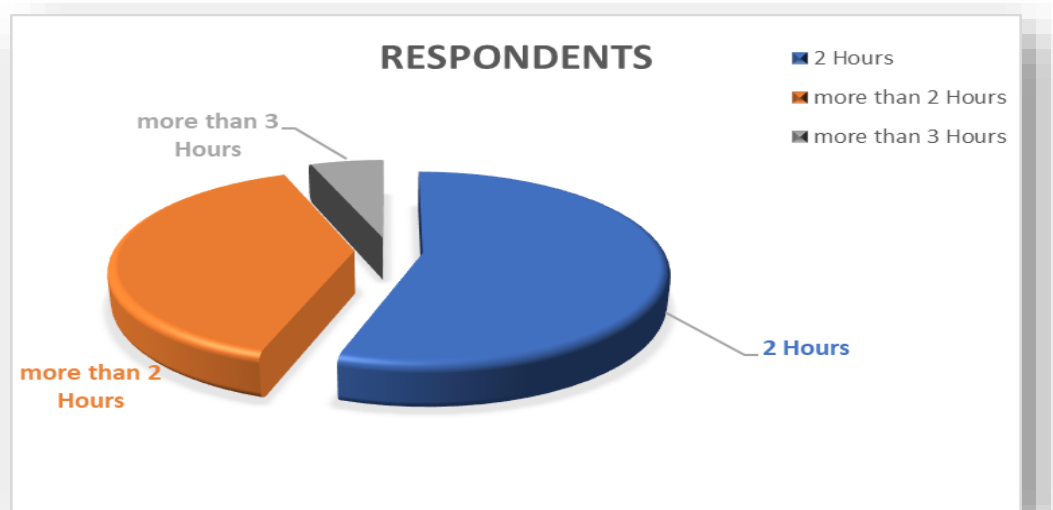
Improvement in Skills	Respondents	Percentage
Communication Skill	211	54.95%
Experience	45	11.72%
Problem Solving Skill	51	13.28%
Technical Skill	72	18.75%
Total	384	100%



Interpretation: In this study it is found that out of 384 respondent, 55% respondents were improve the communication skill because industry need communication for interact with each other's, 13% respondents were improve problem solving skills, and 19% respondents were improve their technical skills for better performance in industry, remaining 12% respondents were need experience.

xii. Classification of responses based on time gives for personal development

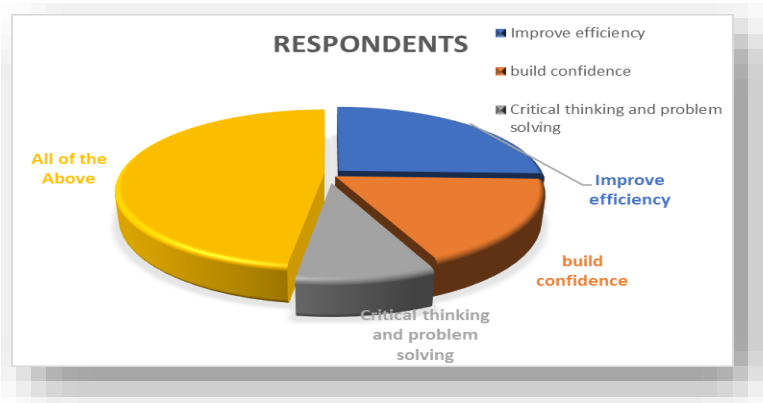
Time	Respondents	Percentage
2 Hours	212	55.21%
more than 2 Hours	150	39.06%
more than 3 Hours	22	5.73%
Total	384	100%



Interpretation:In this study it found that 55% students and employes were send 2 hours for personal development, 39% students and employes were send more than 2 hours for personal development, and remaining 6% students and employes were send more than 3 hours for personal development.

xiii. Classification of responses based on importance of employability skill

Importance of skill	Respondents	Percentage
Improve efficiency	98	25.52%
build confidence	68	17.71%
Critical thinking and problem solving	35	9.11%
All of the Above	183	47.66%
Total	384	100%



Interpretation:In this study it is found that, 26% students were want to improve their efficiency, 18% students were want to build their confidence for face any type of problem, 9% students were want to improve problem solving skill and critical thinking skill, and remaining 47% student and employee want to enhance all type of employability skill for career growth.

xiv. Classification of responses based on improvement on employability skill

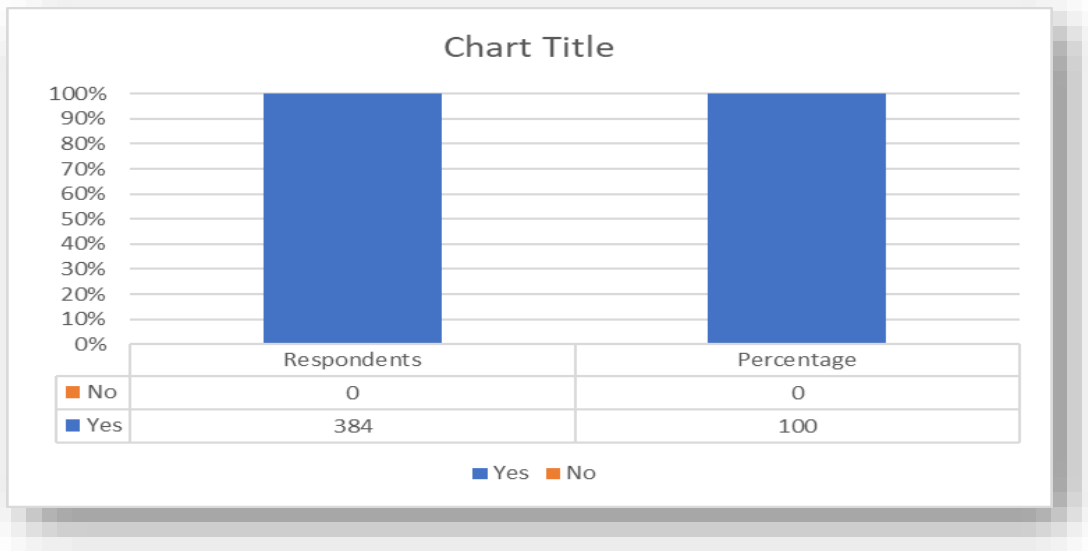
Improvement through	Respondents	Percentage
Taking challenges	50	13.02%
Think creative	97	25.26%
Job rotation	45	11.72%
Get opportunities	44	11.46%
All of above	148	38.54% ⁰⁰
Total	384	100%



Interpretation: In this study it is found that 13% student and employees were improve their skill through taking challenges, 25% students were improve their skill through creative thinking, 12% students were improve skills through job rotation and getting new opportunities, and remaining 39% were improve through all of above.

xv. Classification of responses based on relation between career development and skill development

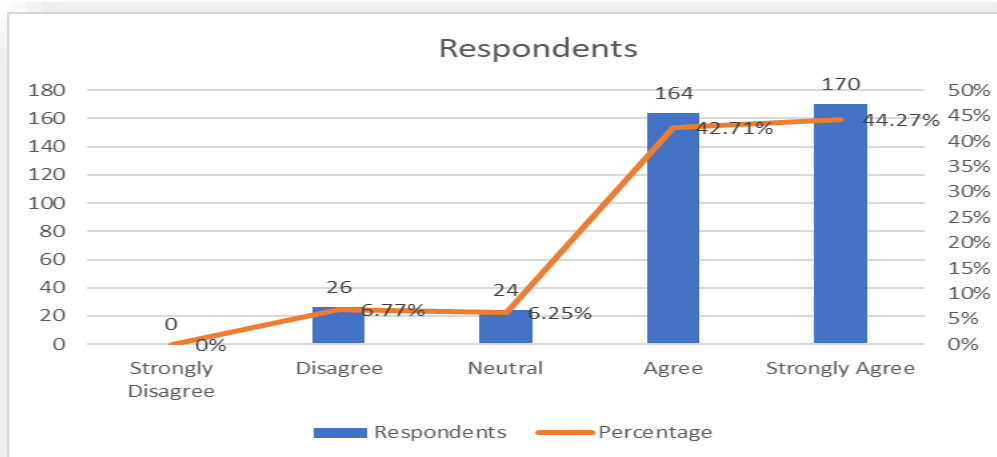
Relation between carer and skills	Respondents	Percentage
Yes	384	100%
No	0	0.00%
Total	384	100%



Interpretation: In this study it is found that there is relation between skills development and career development.

xvi. Classification of responses based on skills helpful for growth

Skills helpful for growth	Respondents	Percentage
Strongly Disagree	0	0%
Disagree	26	6.77%
Neutral	24	6.25%
Agree	164	42.71%
Strongly Agree	170	44.27%
Total	384	100%



Interpretation: In this study it is found that, 44% respondents were strongly agreed skills helpful for career development, 43% respondents were agreed with skill helpful for career growth and 6% respondents were disagree and natural about the statement.

Hypothesis Testing

H₀ - There is a correlation between employability skills and career development.

H₁ - There is no correlation between employability skills and career development.

The sum of $(O - E^2)/E$	143.44
Square Root	11.95
Degree of Freedom	28
Significance level	0.05
χ^2 tabular value	41.33
χ^2 calculated value	11.95

Null Hypothesis (H₀): Calculated Value < Tabular Value

Alternative Hypothesis (H₁): Calculated Value > Tabular Value

Here, **11.95 < 41.33**

Through the above calculation, calculated value < Tabular value, so it is proved that Null hypothesis is accepted... There is a correlation between employability skills and career development.

Null (H₀) Hypothesis (Accepted): There is a correlation between employability skills and career development.

Alternative (H₁) Hypothesis (Rejected): There is no correlation between employability skills and career development.

Findings

- 1) Students make up a significant portion of 384 respondents (75%) 18% respondents were employee, and remaining 6% respondents were businessman.
- 2) 55% respondents were male and remaining 45% respondents were female. Most of the respondents are students.
- 3) 94% respondents are were between 13-30 age group and 6% respondents were between 31-40 age group.
- 4) 51% of respondents were graduated, 13% respondents were up to 12th, 19% respondents were Diploma pass, and remaining 17% were post-graduates. All were aware about employability skills.

- 5) 88% respondents were aware about the industry needs of employability skill and remaining 12% respondents are aware about industry needs but they don't know what type of skills are needed.
- 6) 56% respondents have a work experience, 26% respondents were don't have a work experience.
- 7) 81% respondents were know employability skill impact on job performance, 6% respondents were choose no because skill are not impact on job performance, remaining 13% respondents were unaware about skills are impact on job performance.
- 8) 69% respondents were satisfied with their skills, 24% respondents were unsatisfied with their skills it want to improve their skills, and remaining 7% respondents were neutral.
- 9) Now a day in industry communication skill is must. 19% respondents were communication is must, 7% respondents were need fundamental skills, time management skill and problem solving skills, and remaining 60% were all skill are prefeed as per industry need
- 10) As per the responses 94% respondents were colleges organized skill development program for students' career growth and remaining 6% were colleges are not organize skills development programs.
- 11) 11% respondents were collages organize communication skills development program, 7% to 8% collages were organize time management skills, people management skills, leadership skill and problem solving skills for students, 31% collages were organize technical skill development programs for students, and remaining 26% collages were organize all type of employability skill program for student.
- 12) As per the responses 55% respondents were improve the communication skill because industry need communication for interact with each other's, and 19% respondents were improve their technical skills for better performance in industry, remaining 12% respondents were need experience.
- 13) 55% students and employes were send 2 hours for personal development, 39% students and employes were send more than 2 hours for personal development.
- 14) As per the responses 26% students were want to improve their efficiency, 18% students were want to build their confidence for face any type of problem, 9% students were want to improve problem solving skill and critical thinking skill, and remaining 47% student and employee want to enhance all type of employability skill for career growth.
- 15) As per the responses, 13% student and employees were improve their skill through taking challenges, 25% students were improve their skill through creative thinking, 12% students were

improve skills through job rotation and getting new opportunities, and remaining 39% were improve through all of above.

16) As per the responses, 100% respondents are know there is relation between skills development and career development.

17) 44% respondents were strongly agreed skills helpful for career development, 43% respondents were agreed with skill helpful for career growth and 6% respondents were disagree and natural about the statement.

With the help of hypothesis testing, we are able to conclude that,

- There is a correlation between employability skills and career development.

Suggestions

1) Hold additional conference on employability skills development training programmer department will aid employees and assists business become more productive.

2) Lack of knowledge of employability skills programs and how it benefits both employer and students while working in the organization.

3) Student need improved their skills seriously

4) While college institution provides employability skills training program student have to attended need to mandatory from collages.

5) Most of the student are need to improved them communication skills because most of the organization needs good communication while presenting new idea.

6) According to student work skills strength student have to get these opportunities.

7) College institution need to motivated the all students by organizing motivational programmers

Conclusion:

When student get skills for the improving employability skill are given all of their legal rights and possibilities at work, the company will eventually expand. When a worker are fully skilled or student feel secure and comprehend the significance of the the task or job that has been assigned to them. By encouraging students to work hard for their jobs and the possibilities that are provided to them, you may gradually strengthen their resolve to put in even more effort for the firm. Provide career development opportunities. And student with high skills can easily get any opportunities for the career development. And get respect with in the organization equal opportunity will improve and competition increased in the organization that all helps to improved organization strengthen their resolve the problems and put in even more effort for the firm. giving all employees training

from the organization and improved organization's reputational society. Employability skills helps to improved individual strength. It will be helpful if they are aware of the issues that employees are having as result of not receiving training properly it is morally correct to do research on impact of employability skills on career development on students. In order to provide workers more training for skills development training. The company should provide more training session to newly joined employees. Proper career guidance can help to lead the student are not career focused when they lack the knowledge about the new and emerging careers and the factors around that could influence their career choice decisions.

REFERENCES:

- Kalbande, V. N., &Handa, C. C. (2015).* Identification of Important Parameters and Skills Required by Engineering Students in Campus Placement Process. *International Journal of Engineering Research-Online*, 3(2), 1-7.
- Ahangar, R. G. (2012).* Emotional Intelligence: The Most Potent Factor of Job Performance among Executives. *Emotional Intelligence-New Perspectives and Applications*, 1(1), 121- 138.
- Fajaryati, N. (2020).* The employability skills needed to face the demands of work in the future: Systematic literature reviews. *Open Engineering*, 10(1), 595-603.
- Fraser (2019).* Overt and covert: Strategies for building employability skills of vocational education graduates. *Journal of Teaching and Learning for Graduate Employability*, 10(1), 157-172.
- Dhar Sujoy, (2012).* Employability of Management Students in India: Some concerns and Considerations. *AIMA Journal of Management & Research*, November 2012, Volume, Issue 4/4, ISSN 0974-497.
- Gowsalya, Kumar Ashok, (2016).* A study on the factors affecting employability skills among college students in Namakkal District of Tamil Nadu. *International Journal of Commerce and Management Research*, ISSN: 2455-1627, Volume 2; Issue 11; November 2016; pp 09-14.
- Bhatt, S (2011):* ‘The option of an explicitly vocational university education’, paper to Society for Research into Higher Education Summer Conference on Changing Student Experience, University of Central England, Birmingham. pp. 15-19. Y Cranmer, S. (2006). Enhancing graduate employment.
- Rao, R. (2010):* Higher Education in the Learning Society. Report of the National Committee of Inquiry into Higher Education, HMSO, pp. 64-69.

Book :

- Kothari, C. R. (1985). *Research Methodology Methods and Techniques*. New Delhi, india: New Age International Pvt. Ltd. publishers

INTERNET OF THINGS BASED PATIENT HEALTH MONITORING SYSTEM

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Abstract

We live in a developing world. Nowadays everything is connected with technology. In this era, the Internet of things plays a significant role. Using the Internet of things makes technology very efficient. The Internet of Things (IoT) vision is increasingly being realized to facilitate convenient and efficient human living. To conduct effective IoT research using the most appropriate tools and techniques, we discuss recent research trends in the IoT area along with current challenges faced by the IoT research community. It is impossible to make things which we are thinking at one go so in this case the simulator plays a vital role. Developers use a simulator to structure their idea. Using a simulator makes their work productive and effective. Simulation helps them make critical changes without worrying too much. Using simulation reduces cost, wastage of time, modifies our product and stops the physical damage of product due to wrong connection.

Keywords: Internet of things, Sensor, health

INTRODUCTION

We can say technology is changing the world or we can say technology is ruling the world. In every field we use technology. We keep on depending on technology. Maybe in the future we will be depending on technology for everything. The Internet of things plays a key role in this part. IoT based systems are used for communication between sensed data and things and all other real-world objects/humans. So, it is impossible to make things which we are thinking at one go so in this case the simulator plays a vital role. Basically IoT simulators platform contains several types of virtual controllers' sensors /things so the developer can easily take all these things and design a circuit of the proposed system and write a code for all processing and execution. So, it can be quite easy to understand the requirements and manage cost efficiency and can know the real result of our proposed system.

According to that result the developer can easily modify and speed up the entire process of the system and develop a more powerful and effective system.

Domain

We all have heard somewhere that health is wealth from someone. But in this hectic era, we do not have time to take care of our health and our elder's health. Being healthy does not consist only of a healthy body but it also includes a healthy mind. Without being healthy you cannot get peace and a happy soul. Health is our treasure but we are losing it in present time. In this busy schedule people do not have time to keep track on their health that is why a health monitoring system that can automatically keep track on health status is a must. Nowadays technology is in every field. It will be better if we use technology in our health care system. Noticing all these points we develop a health monitoring system that automatically keeps track of our heart rate, temperature because due to heart attack many elder people die because no one feels this issue once the pain becomes various serious then people notice on that case people die so in this system one alarm system us about the condition of our health. That's why we use things speak. ThingSpeak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. So the family member/Doctor can keep track of her/him health and decided to hospitalize or not or else take suggestion from family doctor. The traditional health monitoring system requires a lot of time like you have to go to hospital for your regular check up and then you have to wait for your turn. This takes a lot of time and effort. Sometime people do not want to see the doctor because they do not have time. The traditional health monitoring system is expensive too. But our proposed system is very efficient and does not take much time. You can check your status whenever you want. This proposed system will be extremely helpful for doctors too.

Because of this health monitoring system doctors will have more time to take care of other serious patient. Doctors can check patient's heart rate and temperature by our proposed health monitoring system.

Methodology

As we discussed previously, IoT simulator is used for creating a virtual circuit diagram and to write a program for all processes and execute it so the developer and researcher can simply test their hypothesis and develop a system without investing money and taking care of risk. If any kind of issue occurs then easily replicating and modifying also increases the performance of systems. Simulators have various simulation tools to develop a system and full-fill the research and customer recruitments. Simulators have sped up research and development in the field of cloud computing because it is difficult to gauge how well services are delivered in actual cloud settings. There are various open source IoT simulators available on the internet. Using those simulators we develop various systems after that we develop a real-world system. So, in simple words we can say that Simulation tools have also shown their significance in IoT systems and networks to bridge the gap between conceptual research and proof-of-concept execution.

In this paper we discussed three simulators

1. Tinkercad
2. Wokwi
3. Arduino on cloud

1. Tinkercad

Tinkercad is an open-source IoT simulators software. It is a one of the famous IoT simulators and user-friendly software which is used to design and develop a IoT based system. This software is quite easy to use and the beginners can also use this software to design a system. This software Facilitate the user to work on one side and all the list of components on another side of the screen so the user can easily drag and drop the components according to the recruitments for design our proposed system. So this system provides a web based user interface for interactive learning. It can be expressed as blocks, text options, or both in the code section. The simulation can begin, and the serial monitor will display the logs.

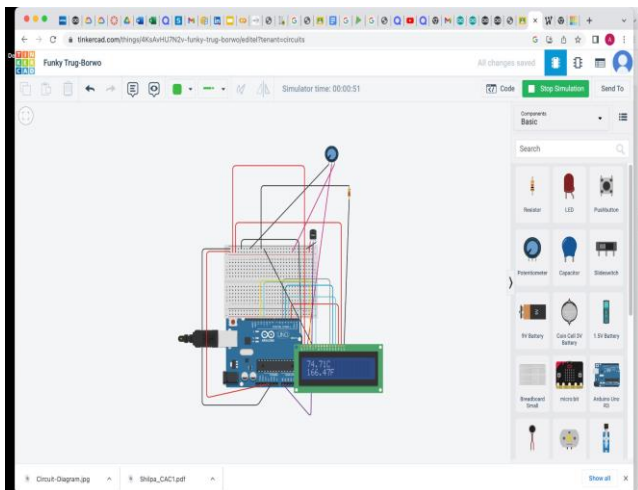
For Example: To implement patient health monitoring system requires a various sensor such as temperature sensor, pulse sensor, LCD(16X2) display, Buzzer and potentiometer..etc so some thesensor are available in this software.

Advantage

- It is user friendly
- It is easy to use
- It is open-source software
- Consist of various sensor
- It is very popular
- All the components are specified on a specific block.

Disadvantage

- It does not contain Pulse sensor
- It does not contain ESP 8266 wifimodule and esp 32



2. Wokwi

Wokwi is another open-source IoT simulator software. It is also trending software and also user-friendly. This software contains various controllers such as Arduino UNO, Mega, Nano, and several additional boards. This software is also easy to use by beginners because it does not require hardware. Just simply learn the Arduino programming language and design a circuit. In this software there are three buttons on top of the screen. The first one is play button for execution, the second one is the plus (+) button so clicking on that button we can easily select a controller, sensors, and things. ESP32 simulation on

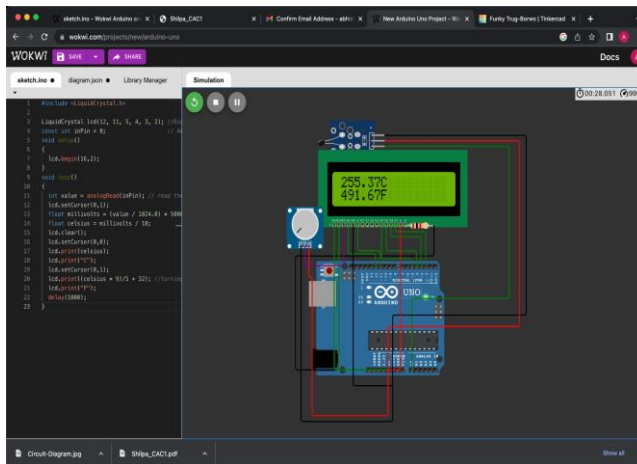
Micropython is now supported by WokwiArduino as well.

Advantage

- It is user friendly
- It is open-source software
- Consist of various sensor and boards
- It also support ESP32 board

Disadvantage

- It does not contain Pulse sensor
- It is difficult to use as compared toTinkercad



3. Arduino On Cloud

Arduino On Cloud is also a open-source IoT Simulator software powered by Arduino. This software have several controllers and sensors suchas Arduino UNO, Mega, and Nano. Keypads, LEDs, shift registers, buzzers, ultrasonic, temperature, humidity, and other sensors. In this software all the controllers and sensor categorizedin different block such as general, Controllers, Output, Input, Sources, Drivers and Miscellaneous. So the user can easily collect your recruitments on that specific block.

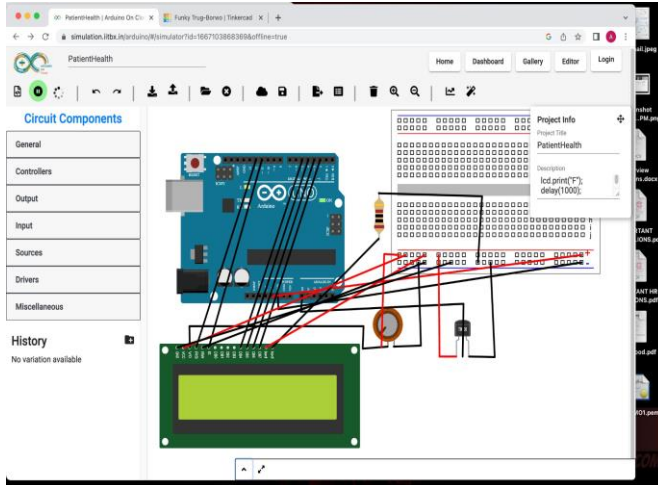
Advantage

- It is user friendly
- It is open-source software

- Consist of various sensor
- All the components are specified on aspecific block.

Disadvantage

- It does not contain Pulse sensor
- It is difficult to find a simulator firsttime.



Conclusion

This paper directly says that before applying concept on the hardware things first we need to use simulators then the developer can easily understand and implement without using hardware and also make it cost efficient and more powerful. This also says that each simulator has contain different component so the user can choose any of the best simulators for their own project and execute it.

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REFERENCES

- [1] https://www.apac-comms.axis.com/L/981772/2022-05-30/8rk33?gclid=Cj0KCQJWNBMAbHD-ARIsAGTPCfUEIZf8X_AYjFXrRGi_wYncJhBNWu56h9GDEMUEHEXyA_T6Yr7KRB7MAANHUEALw_wcB
- [2] <https://www.tinkercad.com/things/ALtJZF5MUaw-AUTOMATIC-STREET-LIGHT-WITH-LDR-/edit>
- [3] <https://how2electronics.com/iot-patient-health-monitoring-system-esp8266/>
- [4] <https://wokwi.com/projects/345557470398120531>
- [5] Arduino on cloud

J*P-IRRESOLUTE FUNCTIONS IN TOPOLOGICAL SPACES

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ABSTRACT:

The aim of this paper is to introduce some new class of functions called J*P-irresolute functions by using J*P-closed sets. The properties of J*P-irresolute functions are discussed. Different kinds of irresolute functions are introduced and characterized. Their interrelating properties are also obtained.

Keywords: J*P-irresolute, g-irresolute, J*P-closed, J*P-open, irresolute, δ g-irresolute, Contra J*P-irresolute.

INTRODUCTION:

Stone⁵³ (1937) defined the notion of regular open sets in his novel paper which related the theory of Boolean rings to General Topology. Mashhour et al³⁷ (1982) first studied the notion of pre open sets in topological spaces and obtained various properties. Levine³⁰ (1970) initiated the study of generalized closed sets in order to extend many of the important properties of closed sets to a larger family. Dunham¹⁸ (1982) has established a generalized closure using Levine's generalized closed sets as Cl^* . In 2016, Annalakshmi⁴ has introduced regular*-open (r^* -open sets) using Cl^* . Later in 2016, Meenakshi P L³⁸ has introduced a class of new sets namely η^* -open sets, a union of r^* -open sets, which is placed between δ -open set and open set. Meenakshi P L (2021) also introduced J-closed sets, J^* -closed sets, J^{**} -closed sets and J-irresolute functions. Its properties and characterization were established. Later, Malini R³⁶ (2022) has introduced J^*P -closed sets and their properties are studied. In this paper, J^*P -irresolute functions are introduced.

1. PRELIMINARIES

Definition 1.1

Let (L, ρ) be a topological space. If D is a non-empty subset of (L, ρ) then the intersection of all closed sets containing D is called closure of D and is denoted by $Cl(D)$.

The union of all open sets contained in D is called interior of D and is denoted by $int(D)$.

Definition 1.2

Let (L, ρ) be a topological space. A subset D of space (L, ρ) is called

- **regular closed set** (Stone, 1937) if $D = Cl(int(D))$
- **semi-closed set** (Levine, 1963) if $int(Cl(D)) \subseteq D$
- **α -closed set** (Njastad, 1965) if $Cl(int(Cl(D))) \subseteq D$
- **π -closed set** (Zaitsav, 1968) if it is the finite union of regular closed sets
- **pre-closed set** (Mashhour et al., 1982) if $Cl(int(D)) \subseteq D$
- **semi pre-closed set** (Andrijevic, 1986) if $int(Cl(int(D))) \subseteq D$

The complements of the above-mentioned sets are called **regular open, semi-open, α -open, π -open pre-open and semi pre-open sets** respectively.

The intersection of all **regular closed (resp. semi-closed, α -closed, π -closed, pre-closed and semi pre-closed)** subsets of (L, ρ) containing D is called the **regular closure (resp. Semi-closure, α -closure, π -closure, preclosure and semi pre-closure)** of D and is denoted by $rCl(D)$ (resp. $sCl(D)$, $\alpha Cl(D)$, $\pi Cl(D)$, $pCl(D)$ and $spCl(D)$).

Definition 1.3

The δ -interior (Velicko, 1968) of a subset D of L is the union of all regular open sets of L contained in D and is denoted by $\text{ints}(D)$. The subset D is called **δ -open** if $D = \text{ints}(D)$, i.e., a set is δ -open if it is the union of regular open sets, the complement of δ -open is called **δ -closed**.

Alternatively, a set $D \subseteq L$ is δ -closed if $D = \delta\text{Cl}(D)$, where $\delta\text{Cl}(D)$ is the intersection of all regular closed sets of (L, ρ) containing D .

Definition 1.4

A subset D of a topological space (L, ρ) is called **generalized Closed** (briefly **g-closed**) (Levine, 1970) if $\text{Cl}(D) \subseteq M$ whenever $D \subseteq M$ and M is open in (L, ρ) . The complement of g-closed is a **g-open set**.

Definition 1.5

[Pious Annalakshmi, 2016]: Let (L, ρ) be a topological space. A subset D of (L, ρ) is called **regular*-open (or r*-open)** if $D = \text{int}(\text{Cl}^*(D))$. The complement of regular*-open set is called **regular*-closed set**. The union of all regular*-open sets of L contained in D is called **regular*-interior** and is denoted by $r^*\text{int}(D)$. The intersection of all regular*-closed sets of L containing D is called **regular*-closure** is denoted by $r^*\text{Cl}(D)$.

Definition 1.6

[Meenakshi PL, 2019]: A subset D of a topological space (L, ρ) is called **η^* -open set** if it is a union of regular*-open sets (r^* -open sets). The complement of a η^* -open set is called a **η^* -closed set**. A subset D of a topological space (L, ρ) is called **η^* -Interior** of D is the union of all η^* -open sets of L contained in D . We denote the symbol by $\eta^*\text{-Int}(D)$. The intersection of all η^* -closed sets of L containing D is called **η^* -closure** and denoted by $\eta^*\text{-Cl}(D)$.

Definition 1.7

A subset D of a topological space (L, ρ) is called

1. **generalized semi-closed** (briefly **gs-closed**) (Arya et al., 1990) if $s\text{Cl}(D) \subseteq M$ whenever $D \subseteq M$ and M is open in (L, ρ) .
2. **regular generalized closed** (briefly **rg-closed**) (Palaniappan, et. al., 1993) if $\text{Cl}(D) \subseteq M$ whenever $D \subseteq M$ and M is regular open in (L, ρ) .
3. **regular weakly generalized closed** (briefly **rwg-closed**) (Nagaveni, 1999) if $\text{Cl}(\text{int}(D)) \subseteq M$ whenever $D \subseteq M$ and M is regular open in (L, ρ) .
4. **π -generalized closed** (briefly **π g-closed**) (Dontchev et.al., 2000) if $\text{Cl}(D) \subseteq M$ whenever $D \subseteq M$ and M is π -open in (L, ρ) .

5. **generalized δ -closed** (briefly **$g\delta$ -closed**) (Dontchev, 2000) if $sCl(D) \subseteq M$ whenever $D \subseteq M$ and M is δ -open in (L, ρ) .
6. **π -generalized semi-closed** (briefly **πgs -closed**) (Aslim et.al.,2006) if $sCl(D) \subseteq M$ whenever $D \subseteq M$ and M is π -open in (L, ρ) .
7. **π -generalized pre-closed** (briefly **πgp -closed**) (Park, 2006) if $pCl(D) \subseteq M$ whenever $D \subseteq M$ and M is π -open in (L, ρ) .
8. **π -generalized α -closed** (briefly **$\pi g\alpha$ -closed**) (Janaki, 2009) if $\alpha Cl(D) \subseteq M$ whenever $D \subseteq M$ and M is π -open in (L, ρ) .
9. **π -generalized semi pre-closed** (briefly **πgsp -closed**) (Sarsak,2010) if $spCl(D) \subseteq M$ whenever $D \subseteq M$ and M is π -open in (L, ρ) .
10. **generalized semi pre regular-closed** (briefly **$gspr$ -closed**) (Sarsak et.al.,2010) if $spCl(D) \subseteq M$ whenever $D \subseteq M$ and M is regular open in (L, ρ) .
11. **generalized pre regular-closed** (briefly **gpr -closed**) (Gnanambal, 1998) if $pCl(D) \subseteq M$ whenever $D \subseteq M$ and M is regular open in (L, ρ) .
12. **J-closed** [Meenakshi PL,2021] if $Cl(D) \subseteq M$ whenever $D \subseteq M$ and M is η^* -open in (L, ρ) .
13. **δ generalized -closed** (briefly **δg -closed**) (Dontchev, 1996) if $\delta Cl(D) \subseteq M$ whenever $D \subseteq M$ and M is open in (L, ρ) .
14. **δ generalized star -closed** (briefly **δg^* -closed**) (Sudha, 2014) if $\delta Cl(D) \subseteq M$ whenever $D \subseteq M$ and M is g -open in (L, ρ) .
15. **g^*s -closed** (Pushpalatha et al., 2000) if $Cl(D) \subseteq M$ whenever $D \subseteq M$ and M is gs -open in (L, ρ) .
16. **J^* -closed** [Meenakshi PL,2021] if $\eta^*Cl(D) \subseteq M$ whenever $D \subseteq M$ and M is η^* -open in (L, ρ) .
17. **J^{**} -closed** [Meenakshi PL,2021] if $\eta^*Cl(D) \subseteq M$ whenever $D \subseteq M$ and M is η^* -open in (L, ρ) .

The complements of the above-mentioned sets are called their respective open sets.

Remark 1.8

A topological space (L, ρ) is said to be a

1. **T_δ -space** (Dontchev, 2000) if every $g\delta$ -closed subset of (L, ρ) is δ -closed in (L, ρ) .
2. **$J^*P T_\delta$ -space** (Malini R,2022) when each J^*P - closed set is δ -closed in (L, ρ) .
3. **$g J^*P$ -space** (Malini R,2022) when each g - closed set is J^*P -closed in (L, ρ) .

4. $\alpha_g T_{J^*P}$ -space (Malini R,2022) when each α_g -closed set is J^*P -closed in (L,ρ) .
5. $g\delta T_{J^*P}$ -space (Malini R,2022) when each $g\delta$ -closed set is J^*P -closed in (L,ρ) .
6. $g_s T_{J^*P}$ -space (Malini R,2022) when each g_s -closed set is J^*P -closed in (L,ρ) .

Remark 1.9 [Meenakshi PL, 2019]:

- i. π -closed(open) \rightarrow regular closed (open) \rightarrow δ -closed (open) \rightarrow η^* -closed (open) \rightarrow closed(open) \rightarrow semi-closed(open) \rightarrow semi preclosed (open).
- ii. π -closed(open) \rightarrow regular closed(open) \rightarrow δ -closed(open) \rightarrow η^* -closed(open) \rightarrow closed(open) \rightarrow closed(open) \rightarrow α -closed(open).
- iii. π -closed(open) \rightarrow regular closed(open) \rightarrow δ -closed(open) \rightarrow η^* -closed(open) \rightarrow closed(open) \rightarrow g -closed(open).
- iv. π -closed(open) \rightarrow regular closed(open) \rightarrow δ -closed(open) \rightarrow η^* -closed(open) \rightarrow closed(open) \rightarrow pre-closed(open).

Definition 1.10

A subset D is said to be J^*P -closed if $\eta^*Cl(D) \subseteq M$, whenever $D \subseteq M$ and M is preopen in (L,ρ) .

Definition 1.11

A function $f: (L, \rho) \rightarrow (T, \sigma)$ is said to be

1. **strongly continuous** (Levine,1960) if the inverse image of every subset of (T,σ) is clopen in (L,ρ) .
2. **Continuous** (Levine,1970) if the inverse image of every closed set of (T,σ) is closed in (L,ρ) .
3. **J-continuous** (Meenakshi PL,2021) if the inverse image of every closed set of (T,σ) is J -closed in (L,ρ) .
4. **δ -continuous** (Noiri,1980) if for every δ -closed set V of (T,σ) , $f^{-1}(V)$ is a δ -closed set of (L,ρ) .
5. **totally continuous** (Jain,1980) if the inverse image of every open set of (T,σ) is clopen in (L,ρ) .
6. **Super continuous** (Munshi,1982) if for every closed set V of (T, σ) , $f^{-1}(V)$ is a δ -closed set of (L,ρ) .
7. **g -continuous** (Balachandran et al.,) if for every closed set V in (T,σ) , $f^{-1}(V)$ is a g -closed set in (L,ρ) .
8. **rg -continuous** (Palaniappan,et.al.,) if $f^{-1}(V)$ is a rg -closed set in (L,ρ) for every closed set V in (T, σ) .

9. **gs-continuous** (Devi et.al., 1993) if $f^{-1}(V)$ is a gs-closed set in (L, ρ) for every closed set V in (T, σ) .
10. **Contra continuous** (Dontchev, 1996) if the inverse image of every closed set of (T, σ) is an open set in (L, ρ) .
11. **δg -continuous** (Dontchev, 1996) if $f^{-1}(V)$ is a δg -closed set in (L, ρ) for every closed set V in (T, σ) .
12. **gpr-continuous** (Gnanambal, 1997) if $f^{-1}(V)$ is a gpr-closed set in (L, ρ) for every closed set V in (T, σ) .
13. **rwg-continuous** (Nagaveni, 1999) if $f^{-1}(V)$ is a rwg-closed set in (L, ρ) for every closed set V in (T, σ) .
14. **$g\delta$ -continuous** (Dontchev, 2000) if $f^{-1}(V)$ is a $g\delta$ -closed set in (L, ρ) for every closed set V in (T, σ) .
15. **\hat{g} -continuous** (Veerakumar, 2003) if $f^{-1}(V)$ is a \hat{g} -open set in (L, ρ) for every open set V in (T, σ) .
16. **πgp -continuous** (Park, 2004) if $f^{-1}(V)$ is a πgp -closed set in (L, ρ) for every closed set V in (T, σ) .
17. **πgs -continuous** (Aslim, 2006) if $f^{-1}(V)$ is a πgs -closed set in (L, ρ) for every closed set V in (T, σ) .
18. **$\pi g\alpha$ -continuous** (Park, 2004) if $f^{-1}(V)$ is a $\pi g\alpha$ -closed set in (L, ρ) for every closed set V in (T, σ) .
19. **πg -continuous** (Ekici et.al., 2007) if $f^{-1}(V)$ is a πg -closed set in (L, ρ) for every closed set V in (T, σ) .
20. **πgsp -continuous** (Park, 2004) if $f^{-1}(V)$ is a πgsp -closed set in (L, ρ) for every closed set V in (T, σ) .
21. **gspr-continuous** (Devi et.al., 1993) if $f^{-1}(V)$ is a gspr-closed set in (L, ρ) for every closed set V in (T, σ) .
22. **g^*s -continuous** (Pushpalatha et.al.,) if $f^{-1}(V)$ is a g^*s -closed set in (L, ρ) for every closed set V in (T, σ) .
23. **δg^* -continuous** (Pushpalatha et.al.,) if $f^{-1}(V)$ is a δg^* -closed set in (L, ρ) for every closed set V in (T, σ) .

Definition 1.12

A function $f: (L, \rho) \rightarrow (T, \sigma)$ is said to be

1. **irresolute** (Crossley, 1972) if for every semi-open set V in (T, σ) , $f^{-1}(V)$ is a semi-open set in (L, ρ) .
2. **g-irresolute** (Balachandran, 1991) if for every g-open set V in (T, σ) , $f^{-1}(V)$ is a g-open set in (L, ρ) .
3. **gs-irresolute** (Devi, 1995) if for every gs-open set V in (T, σ) , $f^{-1}(V)$ is a gs-open set in (L, ρ) .
4. **δ g-irresolute** (Dontchev, 1996) if for every δ g-open set V in (T, σ) , $f^{-1}(V)$ is a δ g-open set in (L, ρ) .
5. **contra irresolute** (Miguel Caldas Cueva, 2000) if for each semi-open set V in (T, σ) , $f^{-1}(V)$ is a semi-closed set in (L, ρ) .
6. **$g\delta$ -irresolute** (Dontchev, 2000) if for every $g\delta$ -open set V in (T, σ) , $f^{-1}(V)$ is a $g\delta$ -open set in (L, ρ) .
7. **g^*s -irresolute** (Pushpalatha, 2011) if for every g^*s -open set V in (T, σ) , $f^{-1}(V)$ is a g^*s -open set in (L, ρ) .
8. **δg^* -irresolute** (Sudha, 2014) if for every δg^* -open set V in (T, σ) , $f^{-1}(V)$ is a δg^* -open set in (L, ρ) .

2.J*P-IRRESOLUTE FUNCTIONS IN TOPOLOGICAL SPACES

2.1 Introduction

Crossley and Hildebrand introduced the concepts pre semi open and irresolute functions using semi open sets. Every continuous, open function is irresolute as well as pre semi open but not conversely. In 2021, Meenakshi PL has introduced J-irresolute functions. In this chapter, the concepts of a new type of functions namely J*P-irresolute functions are introduced. The study of independency and dependency of the J*P-irresolute functions with other existing functions in the literature is done. Furthermore, contra J*P -irresolute functions are introduced and the properties under composition of functions are analysed.

2.2 J*P-Irresolute Functions

The J*P-irresolute functions are studied and investigated here.

Definition 2.2.1

A function $f: (L, \rho) \rightarrow (T, \sigma)$ is said to be J*P-irresolute function if the inverse image of every J*P-open set in (T, σ) is J*P-open in (L, ρ) .

Example 2.2.2

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{a, b\}\}$. We have $J^*PO(L, \rho)= \{L, \emptyset, \{a\}\}$ and $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}\}$. Then f is J^*P -irresolute function.

Proposition 2.2.3

A J^*P -continuous function $f:(L, \rho) \rightarrow (T, \sigma)$ is a J^*P - irresolute function but not conversely.

Proof:

Given that $f:(L, \rho) \rightarrow (T, \sigma)$ is a J^*P -continuous function. Let V be any open set in (T, σ) , Which implies that V is J^*P -open in (T, σ) . since f is J^*P -continuous function, $f^{-1}(V)$ is J^*P -open in (L, ρ) . Hence f is J^*P - irresolute function.

Counter Example 2.2.4

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{a,b\}, \{a,c\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{a, b\}\}$. We have $J^*PO(L, \rho)= \{L, \emptyset, \{a\}\}$ and $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}\}$. Then f is J^*P -irresolute but not J^*P -continuous function.

Proposition 2.2.5

A totally J^*P -continuous function $f:(L, \rho) \rightarrow (T, \sigma)$ is a J^*P -irresolute function but not conversely.

Proof:

Given $f:(L, \rho) \rightarrow (T, \sigma)$ is a totally J^*P -continuous function. Let V be any open set in (T, σ) , Which implies that V is J^*P -open in (T, σ) . since f is a totally J^*P -continuous function, $f^{-1}(V)$ is J^*P -clopen in (L, ρ) . Then $f^{-1}(V)$ is J^*P -open in (L, ρ) . Hence f is J^*P -irresolute function.

Counter Example 2.2.6

In the **Example 2.2.2**, f is a J^*P -irresolute function but not totally J^*P -continuous function. Because for the open set $\{a\}$ in (T, σ) , its inverse image is not J^*P -clopen in (L, ρ) .

Proposition 2.2.7

A strongly J^*P -continuous function $f:(L, \rho) \rightarrow (T, \sigma)$ is a J^*P -irresolute function but not conversely.

Proof:

Given $f:(L, \rho) \rightarrow (T, \sigma)$ is a strongly J^*P -continuous function. Let V be a J^*P -open set in (T, σ) . since f is a strongly J^*P -continuous function, $f^{-1}(V)$ is J^*P -clopen in (L, ρ) . Then $f^{-1}(V)$ is J^*P -open in (L, ρ) . Hence f is J^*P -irresolute function.

Remark 2.2.8

The converse of the above Proposition 2.2.7 is not true. Let us see in the following Counter Example.

Counter Example 2.2.9

In the **Example 2.2.2**, f is a J^*P -irresolute function but not strongly J^*P -continuous function. Because for the subset $\{a\}$ in (T, σ) , its inverse image is not J^*P -clopen in (L, ρ) .

Proposition 2.2.10

A quasi totally J^*P -continuous function $f: (L, \rho) \rightarrow (T, \sigma)$ is a J^*P -irresolute function but not conversely.

Proof:

Given $f: (L, \rho) \rightarrow (T, \sigma)$ is a quasi totally J^*P -continuous function. Let V be any J^*P -open set in (T, σ) . since f is a quasi totally J^*P -continuous function, $f^{-1}(V)$ is clopen in (L, ρ) which implies that $f^{-1}(V)$ is J^*P -open in (L, ρ) . Hence f is J^*P -irresolute function.

Remark 3.2.11

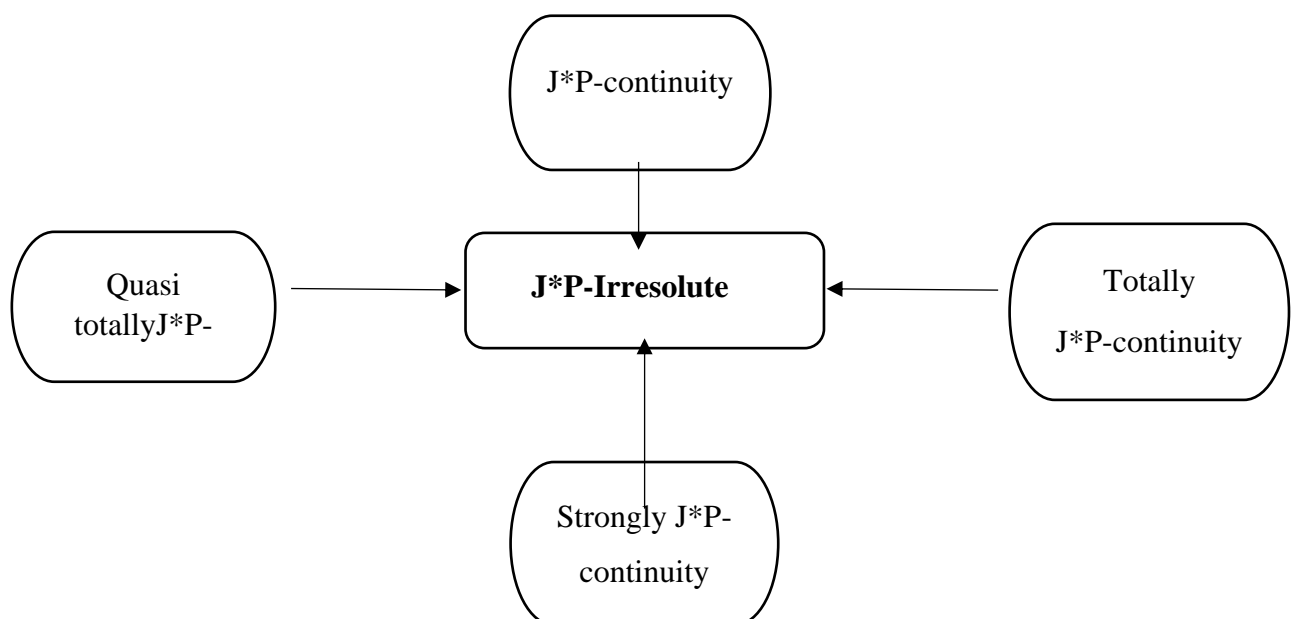
The converse of the above **Proposition 2.2.10** is not true. Let us see in the following Counter Example

Counter Example 2.2.12

In the **Example 2.2.2**, f is a J^*P -irresolute function but not quasi totally J^*P -continuous function. Because for the J^*P -open set $\{a\}$ in (T, σ) , its inverse image is not clopen in (L, ρ) .

Result 2.2.13

From the above discussion, we get the following diagram:



Note 2.2.14

In general J^*P -irresolute functions and irresolute functions are independent. It can be shown in the following Counter Examples.

Counter Example 2.2.15

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{b,c\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{a,b\}, \{a,c\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}, \{b,c\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}\}$, $sO(L, \rho)=\{L, \emptyset, \{a\}, \{b,c\}\}$ and $sO(T, \sigma)=\{T, \emptyset, \{a\}, \{a,b\}, \{a,c\}\}$. Then f is J^*P -irresolute function but not irresolute function. Because for the semi-open sets $\{a,b\}$ and $\{a,c\}$ in (T, σ) , its inverse images are not semi-open in (L, ρ) .

Counter Example 2.2.16

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $\sigma=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$, $sO(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}, \{b,c\}\}$ and $sO(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$. Then f is irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{a,c\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Remark 2.2.17

The following Counter Examples shows that g -irresolute functions and J^*P -irresolute functions are independent.

Counter Example 2.2.18

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{a,b\}\}$ and $\sigma=\{T, \emptyset, \{a\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}\}$, $gO(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $gO(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{c\}, \{a,b\}, \{a,c\}\}$. Then f is J^*P -irresolute function but not g -irresolute function. Because for the g -open set $\{c\}$ in (T, σ) , its inverse image is not g -open in (L, ρ) .

Counter Example 2.2.19

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{a,b\}\}$ and $\sigma=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$, $gO(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $gO(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$. Then f is g -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{b\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Remark 2.2.20

The following Counter Examples shows that δg -irresolute functions and J^*P -irresolute functions are independent.

Counter Example 2.2.21

Consider the **Counter Example 3.2.18**, $\delta gO(L, \rho) = \{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $\delta gO(T, \sigma) = \{T, \emptyset, \{a\}, \{b\}, \{c\}, \{a,b\}, \{a,c\}\}$. Then f is J^*P -irresolute function but not δg -irresolute function. Because for the δg -open set $\{c\}$ in (T, σ) , its inverse image is not δg -open in (L, ρ) .

Counter Example 2.2.22

Consider the **Counter Example 3.2.19**, $\delta gO(L, \rho) = \{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $\delta gO(T, \sigma) = \{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$. Then f is δg -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{b\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Remark 2.2.23

The following Counter Examples shows that δg^* -irresolute functions and J^*P -irresolute functions are independent.

Counter Example 2.2.24

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho = \{L, \emptyset, \{a\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{a,b\}\}$. We have $J^*PO(L, \rho) = \{L, \emptyset, \{a\}\}$, $J^*PO(T, \sigma) = \{T, \emptyset, \{a\}\}$, $\delta g^*O(L, \rho) = \{L, \emptyset, \{a\}\}$ and $\delta g^*O(T, \sigma) = \{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$. Then f is J^*P -irresolute function but not δg^* -irresolute function. Because for the δg^* -open set $\{b\}$ in (T, σ) , its inverse image is not δg^* -open in (L, ρ) .

Counter Example 2.2.25

Consider the **Counter Example 3.2.19**, $\delta g^*O(L, \rho) = \{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $\delta g^*O(T, \sigma) = \{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$. Then f is δg^* -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{b\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Remark 2.2.26

The following Counter Examples shows that $g\delta$ -irresolute functions and J^*P -irresolute functions are independent.

Counter Example 2.2.27

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $\sigma=\{T, \emptyset, \{a\}\}$. We have $J^*PO(L, \rho)=\rho$, $J^*PO(T, \sigma)=\sigma$, $g\delta O(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}\}$ and $g\delta O(T, \sigma)=P(T)$. Then f is J^*P -irresolute function but not $g\delta$ -irresolute function. Because for the $g\delta$ -open set $\{c\}$ in (T, σ) , its inverse image is not $g\delta$ -open in (L, ρ) .

Counter Example 2.2.28

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}\}$ and $\sigma=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$, $g\delta O(L, \rho)=P(L)$ and $g\delta O(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}\}$. Then f is $g\delta$ -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{b\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Remark 2.2.29

The following Counter Examples shows that g_s -irresolute functions and J^*P -irresolute functions are independent.

Counter Example 2.2.30

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{a,b\}\}$ and $\sigma=\{T, \emptyset, \{a\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}\}$, $g_s O(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$ and $g_s O(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{c\}, \{a,b\}, \{a,c\}\}$. Then f is J^*P -irresolute function but not g_s -irresolute function. Because for the g_s -open set $\{c\}$ in (T, σ) , its inverse image is not g_s -open in (L, ρ) .

Counter Example 2.2.31

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{a,b\}\}$ and $\sigma=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$, $g_s O(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$ and $g_s O(T, \sigma)=\{T, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$. Then f is g_s -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{b\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Remark 2.2.32

The following Counter Examples shows that g^*s -irresolute functions and J^*P -irresolute functions are independent.

Counter Example 2.2.33

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{b,c\}\}$ and $\sigma=\{T, \emptyset, \{a\}, \{a,b\}, \{a,c\}\}$. We have $J^*PO(L, \rho)=\{L, \emptyset, \{a\}, \{b,c\}\}$, $J^*PO(T, \sigma)=\{T, \emptyset, \{a\}\}$,

$g^*sO(L, \rho) = \{L, \emptyset, \{a\}, \{b, c\}\}$ and $g^*sO(T, \sigma) = \{T, \emptyset, \{a\}, \{a, b\}, \{a, c\}\}$. Then f is J^*P -irresolute function but not g^*s -irresolute function. Because for the g^*s -open set $\{a, b\}$ in (T, σ) , its inverse image is not g^*s -open in (L, ρ) .

Counter Example 2.2.34

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a, b, c\}$ with $\rho = \{L, \emptyset, \{a\}, \{b\}, \{a, b\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{b, c\}\}$. We have $J^*PO(L, \rho) = \{L, \emptyset, \{a\}, \{b\}, \{a, b\}\}$, $J^*PO(T, \sigma) = \{T, \emptyset, \{a\}, \{b, c\}\}$, $g^*sO(L, \rho) = \{L, \emptyset, \{a\}, \{b\}, \{a, b\}, \{a, c\}, \{b, c\}\}$ and $g^*sO(T, \sigma) = \{T, \emptyset, \{a\}, \{b, c\}\}$. Then f is g^*s -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{b, c\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Remark 2.2.35

The following Counter Examples shows that rg -irresolute functions and J^*P -irresolute functions are independent.

Counter Example 2.2.36

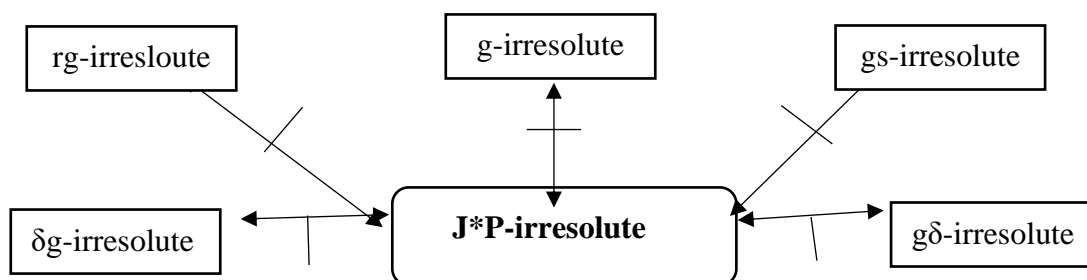
Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a, b, c\}$ with $\rho = \{L, \emptyset, \{a\}, \{b\}, \{a, b\}\}$ and $\sigma = \{T, \emptyset, \{a\}\}$. We have $J^*PO(L, \rho) = \{L, \emptyset, \{a\}, \{b\}, \{a, b\}\}$, $J^*PO(T, \sigma) = \{T, \emptyset, \{a\}\}$, $rgO(L, \rho) = \{L, \emptyset, \{a\}, \{b\}, \{c\}, \{a, b\}\}$ and $rgO(T, \sigma) = P(T)$. Then f is J^*P -irresolute function but not rg -irresolute function. Because for the rg -open set $\{a, c\}$ in (T, σ) , its inverse image is not rg -open in (L, ρ) .

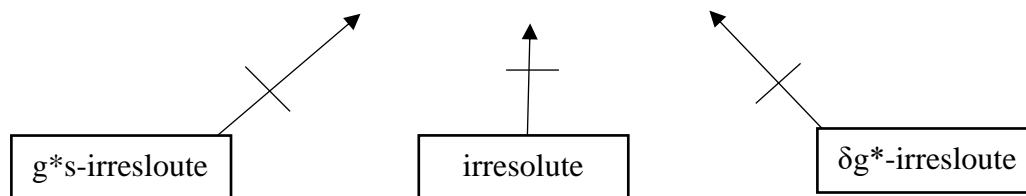
Counter Example 2.2.37

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a, b, c\}$ with $\rho = \{L, \emptyset, \{a\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{b\}, \{a, b\}\}$. We have $J^*PO(L, \rho) = \{L, \emptyset, \{a\}\}$, $J^*PO(T, \sigma) = \{T, \emptyset, \{a\}, \{b\}, \{a, b\}\}$, $rgO(L, \rho) = P(L)$ and $rgO(T, \sigma) = \{T, \emptyset, \{a\}, \{b\}, \{c\}, \{a, b\}\}$. Then f is rg -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{b\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Result 2.2.38

From the above discussion, we get the following diagram:





2.3 Contra J*P-Irresolute Functions

Definition 2.3.1

A function $f:(L, \rho) \rightarrow (T, \sigma)$ is said to be contra J*P-irresolute function if the inverse image of every J*P-closed set in (T, σ) is J*P-open in (L, ρ) .

Example 2.3.2

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the bijective function defined by $f(a)=b$, $f(b)=a$ and $f(c)=c$. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{b, c\}\}$. We have $J^*PO(L, \rho)=\rho$ and $J^*PC(T, \sigma)=\sigma$. Then f is contra J*P-irresolute function.

Proposition 2.3.3

A strongly J*P-continuous function $f:(L, \rho) \rightarrow (T, \sigma)$ is a contra J*P-irresolute function but not conversely.

Proof:

Given $f:(L, \rho) \rightarrow (T, \sigma)$ is a strongly J*P-continuous function. Let V be a J*P-closed set in (T, σ) . since f is a strongly J*P-continuous function, $f^{-1}(V)$ is J*P-clopen in (L, ρ) which implies that $f^{-1}(V)$ is J*P-open in (L, ρ) . Hence f is contra J*P-irresolute function.

Counter Example 2.3.4

Let $f:(L, \rho) \rightarrow (T, \sigma)$ be the function defined by $f(a)=c$, $f(b)=b$ and $f(c)=a$. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$ and $\sigma = \{T, \emptyset, \{a\}, \{b\}, \{a, b\}\}$. We have $J^*PC(L, \rho)=\{L, \emptyset, \{b\}, \{c\}, \{a,c\}, \{b,c\}\}$, $J^*PO(L, \rho)=\{L, \emptyset, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$ and $J^*PC(T, \sigma)=\{T, \emptyset, \{c\}, \{b,c\}, \{a,c\}\}$. Then f is contra J*P-irresolute function but not strongly J*P-continuous function. Because for the subset $\{b,c\}$ in (T, σ) , the inverse image $\{a,b\}$ is not J*P-clopen in (L, ρ) .

Remark 2.3.5

The following Counter Examples shows that J*P-irresolute functions and contra J*P-irresolute functions are independent.

Counter Example 2.3.6

Consider the **Example 3.2.2**, f is a J^*P -irresolute function but not a contra J^*P -irresolute function. Because for the J^*P -closed set $\{b,c\}$ in (T,σ) , the inverse image is not J^*P -open in (L,ρ) .

Counter Example 2.3.7

Consider the **Counter Example 3.3.4**, we have $J^*PO(T,\sigma)=\{T,\emptyset,\{a\},\{b\},\{a,b\}\}$. Then f is contra J^*P -irresolute function but not J^*P -irresolute function. Because for the J^*P -open set $\{a\}$ in (T,σ) , the inverse image $\{c\}$ is not J^*P -open in (L,ρ) .

Proposition 2.3.8

A function $f:(L,\rho) \rightarrow (T,\sigma)$ is a contra J^*P -irresolute function if and only if inverse image of every J^*P -open set in (T,σ) is J^*P -closed in (L,ρ) .

Proof:

It is true from the **Definition 2.3.1**.

Proposition 2.3.9

A totally J^*P -continuous function $f:(L,\rho) \rightarrow (T,\sigma)$ is a contra J^*P -irresolute function but not conversely.

Proof:

Given $f:(L,\rho) \rightarrow (T,\sigma)$ is a totally J^*P -continuous function. Let V be a J^*P -closed set in (T,σ) . since f is a totally J^*P -continuous function, $f^{-1}(V)$ is J^*P -clopen in (L,ρ) which implies that $f^{-1}(V)$ is J^*P -open in (L,ρ) . Hence f is contra J^*P -irresolute function.

Counter Example 2.3.10

Consider the Counter Example 2.3.4, f is contra J^*P -irresolute function but not totally J^*P -continuous function. Because for the subset $\{b,c\}$ in (T,σ) , the inverse image $\{a,b\}$ is not J^*P -clopen in (L,ρ) .

Proposition 2.3.11

A quasi totally J^*P -continuous function $f:(L,\rho) \rightarrow (T,\sigma)$ is a contra J^*P -irresolute function but not conversely.

Proof:

Given $f:(L,\rho) \rightarrow (T,\sigma)$ is a quasi totally J^*P -continuous function. Let V be any J^*P -open set in (T,σ) . since f is a quasi totally J^*P -continuous function, $f^{-1}(V)$ is clopen in (L,ρ) which implies that $f^{-1}(V)$ is J^*P -closed in (L,ρ) . Hence f is contra J^*P -irresolute function.

Remark 2.3.12

The converse of the above proposition is shown in the following Counter Example.

Counter Example 2.3.13

Consider the **Counter Example 2.3.4**, f is contra J^*P -irresolute function but not quasi totally J^*P -continuous function. Because for the J^*P -open set $\{a\}$ in (T, σ) , the inverse image $\{c\}$ is not clopen in (L, ρ) .

Remark 2.3.14

The following Counter Examples shows that J^*P -continuous functions and contra J^*P -irresolute functions are independent.

Counter Example 2.3.15

Let $f: (L, \rho) \rightarrow (T, \sigma)$ be the identity function. consider $L=T=\{a,b,c\}$ with $\rho=\{L, \emptyset, \{a\}, \{a,b\}\}$ and $\sigma=\{T, \emptyset, \{a\}\}$. We have $\sigma^c=\{T, \emptyset, \{b,c\}\}$, $J^*PC(L, \rho)=\{L, \emptyset, \{b,c\}\}$, $J^*PC(T, \sigma)=\{T, \emptyset, \{b,c\}\}$ and $J^*PO(L, \rho)=\{L, \emptyset, \{a\}\}$. Then f is J^*P -continuous function but not contra J^*P -irresolute function. Because for the J^*P -closed set $\{b,c\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Counter Example 2.3.16

Consider the Counter Example 2.3.4, f is contra J^*P -irresolute function but not J^*P -continuous function. Because for the closed set $\{c\}$ in (T, σ) , the inverse image is not J^*P -closed in (L, ρ) .

Remark 2.3.17

The following Counter Examples shows that quasi J^*P -continuous functions and contra J^*P -irresolute functions are independent.

Counter Example 2.3.18

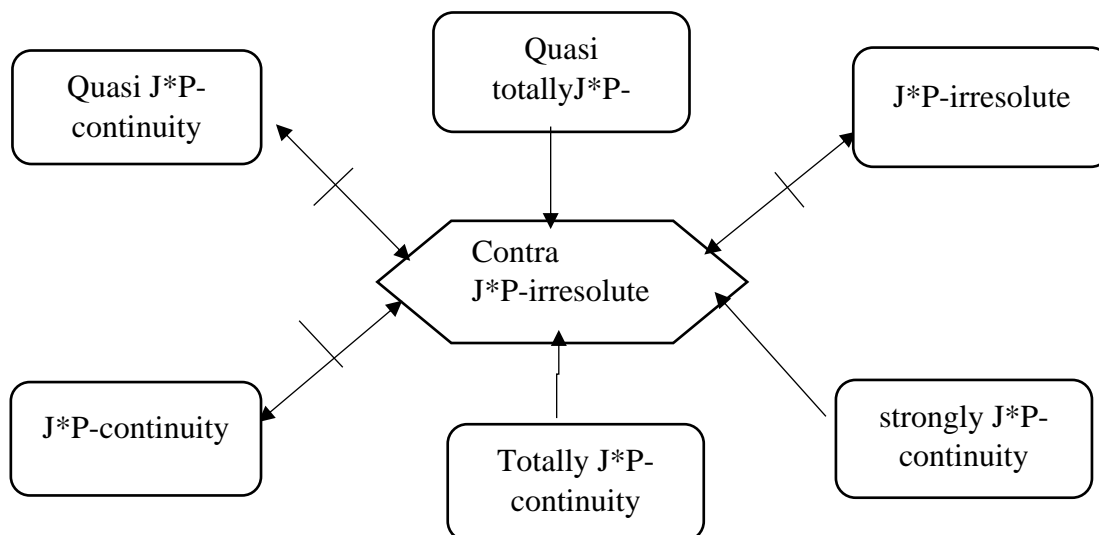
Consider the **Counter Example:2.3.15**, we $\rho^c=\{L, \emptyset, \{c\}, \{b,c\}\}$ and $J^*PC(T, \sigma)=\{T, \emptyset, \{b,c\}\}$. Then f is quasi J^*P -continuous function but not contra J^*P -irresolute function. Because for the J^*P -closed set $\{b,c\}$ in (T, σ) , its inverse image is not J^*P -open in (L, ρ) .

Counter Example 2.3.19

Consider the **Counter Example 2.3.4**, f is contra J^*P -irresolute function but not quasi J^*P -continuous function. Because for the J^*P -closed set $\{c\}$ in (T, σ) , the inverse image $\{a\}$ is not closed in (L, ρ) .

Result 2.3.20

From the above discussion, we get the following diagram:



Composition of Contra J*P-Irresolute Functions

Proposition 2.3.21

If $f:(L, \rho) \rightarrow (T, \sigma)$ is a contra J*P-irresolute function and $h:(T, \sigma) \rightarrow (Q, \mu)$ is a contra J*P-irresolute function, then their composition $h \circ f:(L, \rho) \rightarrow (Q, \mu)$ is a J*P-irresolute function.

Proof:

Let V be any J*P-closed set in (Q, μ) . Since h is contra J*P-irresolute, $h^{-1}(V)$ is J*P-open in (T, σ) . Since f is contra J*P-irresolute, $f^{-1}(h^{-1}(V))$ is J*P-closed in (L, ρ) . Hence $(h \circ f)^{-1}(V) = f^{-1}(h^{-1}(V))$ is J*P-closed in (L, ρ) . Therefore $h \circ f$ is a J*P-irresolute function.

Proposition 2.3.22

If $f:(L, \rho) \rightarrow (T, \sigma)$ is a J*P-irresolute function and $h:(T, \sigma) \rightarrow (Q, \mu)$ is a contra J*P-irresolute function, then their composition $h \circ f:(L, \rho) \rightarrow (Q, \mu)$ is a contra J*P-irresolute function.

Proof:

Let V be any J*P-closed set in (Q, μ) . Since h is contra J*P-irresolute, $h^{-1}(V)$ is J*P-open in (T, σ) . Since f is J*P-irresolute, $f^{-1}(h^{-1}(V))$ is J*P-open in (L, ρ) . Hence $(h \circ f)^{-1}(V) = f^{-1}(h^{-1}(V))$ is J*P-open in (L, ρ) . Therefore $h \circ f$ is a contra J*P-irresolute function.

Proposition 2.3.23

If $f:(L, \rho) \rightarrow (T, \sigma)$ is a contra J^*P -irresolute function and $h:(T, \sigma) \rightarrow (Q, \mu)$ is a J^*P -irresolute function, then their composition $h \circ f:(L, \rho) \rightarrow (Q, \mu)$ is a contra J^*P -irresolute function.

Proof:

Let V be any J^*P -closed set in (Q, μ) . Since h is J^*P -irresolute, $h^{-1}(V)$ is J^*P -closed in (T, σ) . Since f is contra J^*P -irresolute, $f^{-1}(h^{-1}(V))$ is J^*P -open in (L, ρ) . Hence $(h \circ f)^{-1}(V) = f^{-1}(h^{-1}(V))$ is J^*P -open in (L, ρ) . Therefore $h \circ f$ is a contra J^*P -irresolute function.

Proposition 2.3.24

If $f:(L, \rho) \rightarrow (T, \sigma)$ is a quasi totally J^*P -continuous function and $h:(T, \sigma) \rightarrow (Q, \mu)$ is a contra J^*P -irresolute function, then their composition $h \circ f:(L, \rho) \rightarrow (Q, \mu)$ is a quasi totally J^*P -continuous function.

Proof:

Let V be any J^*P -open set in (Q, μ) . Since h is contra J^*P -irresolute, $h^{-1}(V)$ is J^*P -closed in (T, σ) . Since f is quasi totally J^*P -continuous function, $f^{-1}(h^{-1}(V))$ is clopen in (L, ρ) . Hence $(h \circ f)^{-1}(V) = f^{-1}(h^{-1}(V))$ is clopen in (L, ρ) . Therefore $h \circ f$ is a quasi totally J^*P -continuous function.

SUMMARY AND CONCLUSION

A new type of g -closed set called J^*P -closed set is started using the ideas of n^* -closure and preopen set. J^*P -closed sets are demonstrated to be stronger than J^{**} -closed sets and weaker than δ -closed sets. The concept of J^*P -closed sets are studied for continuity and irresoluteness. Five new spaces are constructed using J^*P -closed sets, and their connections to other existing spaces are examined. The interrelations between J^*P -continuous function and other existing continuous functions are investigated. Furthermore, the relations between J^*P -Irresolute function and other existing functions are studied.

The following concerns are recommended for more research:

- It is possible to investigate homeomorphisms in topological spaces in the context of J^*P -closed sets.
- Fuzzy topological spaces and bitopological spaces can be related to J^*P -closed set concepts.
- For biminimal structures, ideal topological spaces, supra topological spaces, and nano topological spaces, the concepts of J^*P -closed sets can be characterised, and their applications may be learned.

- It is possible to examine J*P-closed sets in digital plane and digital n-space.
- J*P-closed sets are a useful tool for studying the operation.

REFERENCES

1. Abd, M.E., Monsef, E.L., EI-Deeb, S.N. and Mohmoud, R.A. (1983). β -open sets and β -continuous mappings, Bull. Fac. Sci. Assiut Univ., 12, 77-90.
2. Akdag, M. and Ozkan, A. (2014) Soft α -open sets and soft α continuous functions, Abstr. Anal. Appl. Art ID 891341, 1-7.
3. Andrijevic, D. (1986) Semi-preopen sets, Mat. Vesnik., 38(1), 24-32.
4. Annalakshmi, M. and Pious Missier, S. (2016) Between Regular Open Sets and Open Sets, IJMA, 7, 128-133.
5. Arya, S.P. and Nour, T.M. (1990) Characterizations of s-normal spaces, Indian J. Pure. Appl. Math., 21 (8), 717-719.
6. Aslim, G., CaksuGuler, A. and Noiri, T. (2006) On π gs -closed sets in topological spaces, Acta. Math Hungar., 112 (4), 275-283.
7. Balachandran, K., Sundaram, P. and Maki, H. (1991) On generalized continuous maps in topological spaces, Mem.Fac.Sci.Kochi.Univ.Ser.A.Math., 12, 5-13.
8. Bhattacharya, P. and Lahiri, B.K. (1987) Semi-generalized closed sets in topology, Indian J.Math., 29(3), 375-382.
9. Caldas, M., (1993) On g-closed sets and g-continuous Mappings, Kyungpook Math. J., 33(2), 205-209.
10. Caldas, M. and Jafari, S. (2005) On rarely g-continuous functions, Glasnik Mat, 40(60), 317-322.
11. Chawalit, B., (2003a) Generalized continuous functions from any topological space into product, Naresuan Univ. J., 11(2), 93-98.
12. Devi, R. Maki, H. and Balachandran, K. (1993), Semi-generalized closed maps and generalized semi-closed maps. Mem. Fac. Sci. Kochi Univ. Ser. A. Math, 14, 41-54.
13. Devi, R., Balachandran, K. and Maki, H. (1998), Generalized α -closed maps and α -generalized closed maps, Indian J. Pure Appl. Math., 29, 37-49.
14. Dontchev, J. (1995) On generalizing semi-pre-open sets. Mem. Fac. Sci. Kochi Univ, ser.A.Math, 16, 35-48.
15. Dontchev, J. (1996) Contra continuous functions and strongly S-closed spaces, International Journal of Mathematics and Mathematical Sciences, 19, 303-310.
16. Dontchev, J., Arokiarani, L. and Krishnan Balachandran (2000) On generalised δ -closed sets and almost weakly Hausdorff spaces, Q and A in General Topology. 18, 17- 30.
17. Dontchev, J. and Ganster, M. (1996) On δ -generalised closed sets and $T_{3/4}$ spaces, Mem. Fac. Sci. Kochi Univ. (Math.), 17, 15-31.
18. Dunham. W., (1977) $T_{1/2}$ -spaces, Kyungpook Math. J. 17, 161-169.
19. Dunham. W., (1982) A New Closure Operator for Non-TI Topologies, Kyungpook Mathematical Journal, 22(1), 55-60.
20. Ekici, E. and Baker, C. W. (2007), On π g-closed sets and continuity. Kochi. J. of Mathematics, 2, 35-42.
21. Geethagnanaselvi, B. and Sivakamasundari, K. (2017) δ sg* - Continuity in Topological Spaces, Advances in Fuzzy Mathematics, 12(3), 361-370.
22. Gnanambal, Y. (1998) Studies on generalized pre-regular closed sets and generalizations of locally closed sets, Ph.D., Thesis, Bharathiar University, Coimbatore, TamilNadu.
23. Halgwrddarwesh, Sarhad F Namiq (2018), Some properties of Preopen set in Closure Spaces, University of Sulaiman, University of Garmina, 229-230.

24. Jafari, S., (1995) A note on rarely continuous functions, Univ. Bacâu, Stud. Cerc. St. Ser. Mat., 5,29-34.
25. Jafari, S., (1997) On some properties of rarely continuous Functions, Univ. Bacâu. Cerc. St. Ser. Mat., 7,65-73.
26. Janaki, C. (2009) Studies on $\pi g\alpha$ -closed sets in topology, Ph.D. Thesis, Bharathiar University, Coimbatore, India.
27. Jankovic, D. and Reilly.I.L. (1985), On semi separation properties, Indian I.PureandAppl. Math., 16, 957-964.
28. Khalimsky, E.D., Kooperman, R. and Meyer, P.R. (1990), Computer graphics and connected topologies on finite ordered sets, Topology and its Appl. 36, 1-17.
29. Kovalevsky.V., Kooperman, R. (1994), Some-topology based image processing algorithms, Annals of the New York Academy of Sciences, 728, 174-182.
30. Levine, N. (1960) Strong continuity in topological spaces. Amer. Math. Monthly, 67, 269-275.
31. Levine, N. (1963) Semi-open sets and semi-continuity in topological spaces, Amer Math Monthly, 70, 36-41.
32. Levine, N. (1970) Generalized closed sets in topology, Rend. Circ. Mat. Palermo, 19(2),89-96.
33. Long, P.E. and Herrington, L.L. (1982) Properties of rarely continuous functions, Glasnik Mat. Ser. III, 17(37),147-153.
34. Maheshwari,S.N. and Prasad.R.,(1975) Some new separation axioms, Ann.Soc.Sci.Bruxelles, 89.395-402.
35. Maki, H. Devi, R. and Balachandran, K. (1994) Associated topologies of generalized α -closed sets and α -generalized closed sets, Mem. Fac. Sci. Kochi Univ. Math.,15, 51-63.
36. Malini, R. (2022), J*P-Closed sets in topological spaces, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore.
37. Mashhour, A.S. et.al., (1982) On pre continuous and weak pre continuous functions. Proc. Math. Phys. Soc. Egypt, 53, 47-53.
38. Meenakshi, PL. (2019) Unification of regular star open sets, International journal of research and analytical reviews, (Accepted).
39. Meenakshi, PL. (2020), J** α -closed sets in topological spaces, Malaya Journal of Matematik, Vol. 5, No. 1, 206-213, 2020.
40. Meenakshi, PL. (2021), Characterization of J, J*, J** α - closed sets in Topological spaces, 245-264.
41. Miguel Caldas Cueva, (2000) Weak and Strong forms of Irresolute Maps, Internat. J. Math. & Math Sci. 23 (4), 253-259.
42. Nagaveni, N. (1999), Studies on generalization of homeomorphisms in topological spaces, Ph.D. Thesis, Bharathiar University, Coimbatore.
43. Navalagi, G., Chandrashekharappa, A. S. and Gurushantanavar, S. V. (2010) On $g\alpha$ -closed sets in topological spaces, International Journal of Mathematics and Computer Applications, 2(1-2), 51-58.
44. Njastad, O., (1965) On some classes of nearly open sets, Pacific J. Mathematics, 15(3),961-970.
45. Noiri, T., (1980) On δ -continuous functions. J Koman Math. Soc., 16, 161-166.
46. Palaniappan, N, and Rao, K.C. (1993), Regular generalized closed sets, Kyungpook Math J., 33 (2), 211-219.
47. Park, J. H. (2006) On πgp -closed sets in topological spaces, Indian J, Pure Appl. Math., 112(4), 257-283.

48. Pushpalatha, A. and Anitha, K. (2011) g^*s -closed sets in topological spaces, *Int. J. Contemp. Math. Sciences*, 6(19), 917-929.
49. Popa, V. (1979) Sur certain decomposition de la continuite dans les espace topologiques, *Glasnik Mat. Ser. III*, 14(34), 359-362.
50. Rajesh, N. (2012) Two new types of irresolute functions via b-open sets, *Acta. Math. Hungers*, 27, 287-297.
51. Sathyapriya, S. Kousalya, M. and Kamali, S. (2019) On Strongly αg^*p -Irresolute Functions in Topological Spaces, *IJEDR*, 7(1), 225-231.
52. Sarsak, M.S. and Rajesh, N. (2010) π -generalized semi-pre-closed sets, *International Mathematical Forum*, 5(12), 573-578.
53. Stone, M. (1937), Application of the theory of Boolean rings to general topology, *Trans. Amer. Math. Soc.*, 41, 374-481.
54. Sudha, R. (2014) A study on some generalizations of δ -closed sets in topological spaces, Ph.D. Thesis, Avinashilingam University, Coimbatore, India.
55. Sundarm, P. and N. Nagaveni. (1998) On weakly generalized continuous maps, weakly generalized closed maps and weakly generalized irresolute maps in topological spaces, *Far East J. Math. Sci.*, 6, 903-912.

THE IMPACT OF CHATGPT ON HUMAN RESOURCE MANAGEMENT

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Abstract

The most precious asset in a company is its people. With the help of ChatGPT, an AI-powered natural language processing tool, can communicate with the chatbot in a variety of human-like ways. The language model can provide information and support for tasks like writing emails, articles, and code. OpenAI, a corporation that conducts research in artificial intelligence, developed ChatGPT. ChatGPT was introduced on November 30, 2022, by the research company. By responding to inquiries from candidates regarding the job specifications, corporate culture, and application procedure, Chat GPT can be used to automate the hiring process. In addition to making sure that candidates have timely and correct information, this can free up HR workers to concentrate on other activities. The GPT-4 Chat has a huge impact on human resource specialists. It may help cut down on the time and effort required to complete typical HR duties, allowing HR employees to concentrate on more important projects. Additionally, it can give workers a more tailored experience, which can boost engagement and productivity. This study gathered data based on a survey of the literature and secondary sources for statistical information. Writing policies and procedures could be aided by ChatGPT. Again, even if this could be very helpful, nothing can replace years of experience or some of the subtleties that go into developing an HR policy and can only be understood by having actually done it. In conclusion, ChatGPT can be a useful tool for HR departments, offering a variety of advantages like improved applicant and employee experiences, increased efficiency, and streamlined operations. HR professionals may anticipate seeing additional opportunities as AI technology develops to use language models like ChatGPT to streamline their processes and propel corporate success.

Keywords: ChatGPT, openAI, human resource management, HR professionals, technology

Introduction

The impact of Artificial Intelligence (AI) on numerous businesses is growing increasingly pronounced as the world continues to adopt it. The GPT-4 Chat is a key AI development that has the potential to completely change the HR sector. The GPT-4 Chat is a conversational agent powered by AI that can mimic human conversations. This technology is intended to comprehend natural language, pick up knowledge from human encounters, and offer tailored responses. The GPT-4 Chat can be used by HR professionals to streamline a number of processes, including hiring, onboarding, training, and employee engagement.

The GPT-4 Chat has a huge effect on HR workers. It may assist cut down on the time and effort required to complete typical HR duties, allowing HR employees to concentrate on more important projects. Additionally, it can give workers a more tailored experience, which can boost engagement and productivity. Nevertheless, there might be drawbacks to using GPT-4 Chat in HR. The possibility of bias in the AI's decision-making process is one cause for concern. The GPT-4 Chat may produce biased results and engage in discriminatory HR practices if the data used to train the AI is biased. As a result, HR personnel need to make sure that the data being used to train the GPT-4 Chat is representative and diverse. The potential loss of the personal touch in HR is another issue. The sensitivity and emotional intelligence of a human HR expert cannot be replaced by the GPT-4 Chat, despite the fact that it may offer personalized responses. In order to keep a human touch in their contacts with employees while employing AI to expedite operations, HR professionals must strike a balance.

ChatGPT's unethical issues like considering that ChatGPT can produce conversational text, there are ethical questions about the likelihood that it won't produce false or misleading information. Serious consequences could result from this, including damage to reputations, the dissemination of untrue information, or even the incitement of violence. For those working in human resources, ChatGPT may change the rules of the game. Businesses can utilize ChatGPT to streamline activities, increase productivity, and enhance the entire work experience as the need for efficiency in the workplace grows.

Review of Literature

Yogesh K. Dwivedi et al. (2023), entitled "So what if ChatGPT wrote it? Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy, Transformative artificially intelligent tools, such as ChatGPT, designed to generate sophisticated text indistinguishable from that produced by a human, are applicable across a wide range of contexts." The technology offers advantages as well as

frequent moral and legal difficulties, and it has the ability to have both good and bad effects on organizations, society, and individuals. Identifying the knowledge, tools, and resources required to handle generative AI; examining the biases of generative AI attributable to training datasets and processes; investigating business and societal contexts best suited for generative AI implementation; figuring out the best combinations of humans and generative AI for various tasks; figuring out how to assess the accuracy of text produced by generative AI; and discovering the ethical and legal implications.

Viriya Taecharungroj (2023). Titled “What Can ChatGPT Do? Analyzing Early Reactions to the Innovative AI Chatbot on Twitter”, the investigation also revealed that ChatGPT has the capacity to have both positive and bad effects on both technology and people. The quest for artificial general intelligence, the evolution of occupations, a new technical landscape, and the progress-ethics problem are the four major concerns that the author identifies as needing to be addressed while a outcome of this AI advancement.

Tufan. Adiguzel, et al. (2023) in this research “Revolutionizing education with AI: Exploring the transformative potential of ChatGPT” In the educational setting, artificial intelligence (AI) brings new tools that have the potential to revolutionize the way that lessons are taught and learned. This paper provides a thorough overview of AI technology, including possible uses in education and associated challenges. We cover chatbots and associated algorithms that can mimic human interactions and produce text that appears human, depending on input from natural language. Modern chatbots like ChatGPT have many benefits, but they also present significant ethical and practical problems when used in education. In order to assist instructors and students and to advance responsible and ethical use, the authors hope to offer valuable information on how AI may be successfully introduced into the educational environment.

ChatGPT

'Artificial Intelligence Chatbot' ChatGPT was created by OpenAI, a research facility that specializes in 'AI' research. It builds on the GPT 3.5 model from OpenAI by using a 'large language model' that has been improved through supervised reinforcement-based training. The GPT, or "Generative Pre-trained Transformer," offers thorough responses to user inquiries. The responses might not always be factually accurate, but they always offer thorough explanations, and they can even recall what they previously said and make corrections if necessary.

Impact of ChatGPT on Human Resource Management

Technology professionals have been in awe of ChatGPT ever since it was released. It makes sense why the clever chatbot has evolved into a sort of demi-god among digital applications because its skills are so all-encompassing. As technology has recently become more important to human resources, chatGPT is prepared to take over this division as well. However, it remains to be seen whether the AI chatbot can actually produce results given that human volition and judgement are needed in human resources to select the best candidate or interact with them for the advancement of the business and the individual as well. Because chatGPT makes it simple for HR professionals to quickly generate texts, create effective responses, and analyse user data to derive insightful conclusions, it is vital to consider the other side of the coin as well. Beyond what is apparent, chatGPT's effects on HR are possible.

Advantages of using chatGPT

- **Effectiveness:** It is clear that chatGPT can handle tedious and routine HR operations like scheduling interviews and composing mass emails, allowing users to concentrate on things that create value.
- **Efficiency:** By offering feedback and filling out the appraisal forms with candidate information, it helps hasten the process and allows management to make judgments more quickly.
- **Better communication:** ChatGPT can assist HR leaders in honing their communication tactics. The software serves as a knowledge base and trustworthy human-like Wikipedia.
- **Improved data management:** ChatGPT's real-time updates and insights will significantly relieve HR of their workload. It can carry out all the labor-intensive tasks in data-driven processes that enhance HR operations.

Cons of using chatGPT

- **Limitations in difficult situations:** While chatGPT continues to struggle to offer accurate factual information, there is little hope for helping HR executives in circumstances when empathy and judgement are needed.
- **Privacy compromised:** There is a good probability that AI programmes may act erratically. Saving private employee data in that situation is virtually impossible.

- **Technology dependence:** ChatGPT is so compulsive that HR recruiters rely on it a lot. As a result, the entire reason the department exists—the human touch—may be lost in HR operations. The USP of HR leaders, the ability to balance, will be lost in the race to be agile.

Relevance of ChatGPT for the HR Department

As a general-purpose AI chatbot, ChatGPT has a variety of applications. Because it is interactive, it can quickly offer top-notch employee support. The chatbot can therefore address the majority of employee inquiries, relieving HR personnel from having to continuously respond to the same queries. Using ChatGPT to resolve queries can also cut down on the expense, time, and effort needed to maintain employee engagement. The AI chatbot can quickly and intelligently respond to staff questions. It might even offer insightful conclusions that boost business productivity. Because of its adaptability, ChatGPT can be utilized in a variety of circumstances. Therefore, ChatGPT can be applied in a number of ways to help the HR department perform its duties.

Advantages of ChatGPT for the HR Department

ChatGPT deployment has a number of benefits, including increased cost-effectiveness, employee engagement, simpler management, improved insights, and more. So let's go into detail about the various benefits of implementing ChatGPT for the HR department.

❖ Simplified Query Resolution

Because ChatGPT is so adept at demystifying complicated ideas, it is the ideal chatbot for answering these kinds of questions. Given that the employee won't have to remember complicated menu paths, it will speed up the query resolution process.

❖ Improved Employer Branding

It guarantees that the staff members are happy with their work and actively support the business. Having a chatbot also aids in recruiting because candidates get to interact with an AI-based chatbot and learn something new and exciting. The aforementioned factors aid in motivating workers effectively, which in turn raises the calibre of their output. As a result, the company's goods and services are of much higher quality, which boosts both its employer brand and its own brand.

❖ AI-based Analytics

The personnel database can be examined using ChatGPT to draw insightful results. Additionally, AI-based analytics can assist in comprehending minute details that affect an organization success. It can, for instance, assist you in understanding the patterns of employee

absence, attendance, and breaks and alert you to any instances of workplace laziness. These in-depth insights can assist you in streamlining your operations by retaining your workforce and improving their job performance.

How to reduce bias in the Chat GPT-4 results with AI and equality in HR: To guarantee that the technology is applied fairly and ethically, it is critical to reducing bias in the findings produced by the Chat GPT-4 in Human Resources. The following actions can be taken by HR professionals to lessen bias in the outcomes produced by the Chat GPT-4.

- ❖ **Ensure diverse training data:** HR professionals should make sure that the training data used to teach the AI is diverse and representative in order to reduce bias in the Chat GPT-4. To eliminate biases based on gender, race, ethnicity, or any other demographic aspect, the training data should represent a diverse spectrum of voices, opinions, and experiences.
- ❖ **Continually audit and update training data:** HR professionals should continuously review and update the training data used to train the Chat GPT-4. By doing this, any biases in the training data will be discovered and swiftly fixed.
- ❖ **Utilized numerous data sources:** When training the Chat GPT-4, HR professionals should make use of multiple data sources to lessen the potential for bias. Using a wider variety of data sources, will ensure that any specific biases or flaws in one dataset are balanced out.
- ❖ **Track findings:** To spot any biases or inaccuracies, HR professionals should constantly track and assess the results produced by the Chat GPT-4. By doing so, they will be able to fix any problems and raise the fairness and accuracy of the conclusions drawn.
- ❖ **Take into account various viewpoints:** When using the Chat GPT-4, HR professionals should take various viewpoints from various stakeholders into account. To make sure that the technology is utilized in a fair and equitable manner, this includes requesting feedback from staff members, managers, and other stakeholders.

These actions can be taken by HR professionals to ensure that the technology is applied fairly and ethically in the human resources sector and to help reduce bias in the results produced by the Chat GPT-4.

Conclusion

This article, discuss how the GPT-4 Chat has the ability to transform the HR sector by reducing processes and giving workers individualized experiences. However, when

interacting with employees, HR professionals need to keep a human touch and be aware of any potential biases. HR executives may maximize the advantages of the GPT-4 Chat while ensuring fair and compassionate treatment of employees by finding a balance between AI and human contact. Effective employee engagement ensures devoted staff members who actively work to lead the business toward success. Finally, OpenAI's ChatGPT, one of the most sophisticated publicly available chatbots, will be ideal for assisting the HR team in taking care of the employees.

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Reference

1. Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology, 15*(3), ep429. <https://doi.org/10.30935/cedtech/13152>
2. Chavez, M. R., Butler, T. S., Rekawek, P., Heo, H., & Kinzler, W. L. (2023). ChatGPT(Generative Pre-trained Transformer): Why we should embrace this technology. *American Journal of Obstetrics and Gynecology*. <https://doi.org/10.1016/j.ajog.2023.03.010>
3. Deng, J., & Lin, Y. (2023). The Benefits and Challenges of ChatGPT: An Overview. *Frontiers in Computing and Intelligent Systems, 2*(2), 81–83. <https://doi.org/10.54097/fcis.v2i2.4465>
4. Gabbiadini, A., Dimitri, O., Baldissarri, C., & Manfredi, A. (2023). Does ChatGPT Pose a Threat to Human Identity? *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4377900>
5. Viriya Taecharungroj (2023). “What Can ChatGPT Do? Analyzing Early Reactions to the Innovative AI Chatbot on Twitter”, *Big Data Cognitive Computing, 7*(1), 35. <https://doi.org/10.3390/bdcc7010035>

6. Yogesh K. Dwivedi et al. (2023), entitled that “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy, *International Journal of Information Management*, 71 (2023) 102642.

REGIONLARDA TURİZMİN İNKİŞAFININ MÜASİR VƏZİYYƏTİNİN QIYMƏTLƏNDİRİLMƏSİ

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Xülasə:Məlum olduğu kimi hazırda ölkədə dövlətin apardığı siyasətin əsasını neft-qaz sektorundan gələn gəlirlərin qeyri neft sektorunun inkişafına yönəltməkdir.Qeyri neft sektoruna daxil olan sahələrin əsası da turizm sektorudur. Digər xidmət sahələri kimi, turizm sferasının inkişafı, ölkədə digər sahələrin inkişafına da stimül verir. Bu biznes əsasən sahibkarları turist

xidmətlərinə günü-gündən artan tələbat, yüksək rentabellilik, xərclərin qısa zaman kəsiyində ödənilməsi kimi xüsusiyyətləri ilə özünə cəlb edir.

Azərbaycanda turizmin inkişafı dövlət siyasətidir. Ölkəmizdə turizmin inkişafı təkcə mərkəzi şəhərlərə turistlərin cəlb edilməsi ilə məhdudlaşmayıb. Regionların turizm potensialından maksimum istifadə də dövlətin prioritetlərindəndir. Ümummilli liderin siyasi kursunun layiqli davamçısı Prezident İlham Əliyevin 2004-cü ildən ardıcıl olaraq imzaladığı "Azərbaycan Respublikası regionlarının sosial-iqtisadi inkişafı Dövlət Proqramı haqqında" Sərəncamlar (2004-2008, 2009-2013, 2014-2018, 2019-2023-cü illər) ölkə iqtisadiyyatının, o cümlədən regionlarda turizmin inkişafı istiqamətində mühüm addımlar oldu. Azərbaycan Respublikası regionlarının inkişafı ölkədə uğurla həyata keçirilən davamlı sosial-iqtisadi inkişaf strategiyasının mühüm tərkib hissəsidir.

Bu proqramların icrası nəticəsində regionlarda ardıcıl bir neçə beynəlxalq standartlara cavab verən kurort-sanatoriya, otel və istirahət mərkəzləri yaradıldı. 44 günlük müharibədən sonra, torpaqlarımızın düşmən tapdaqları altından azad edilməsi nəticəsində həmin regionların turizm potensialından maksimum yararlanması üçün ölkədə sürətli yenidənqurma işləri gedir.

Bu baxımdan da tədqiq olunan mövzu mövcud şəraitdə çox aktualıq kəsb edir. Məqalədə ölkədə regionlarda, xüsusilə azad edilmiş ərazilərdə turizmin inkişaf səviyyəsi təhlil edilmiş, onun postpandemiya dövründə mövcud və həlli yolları müəyyənləşdirilmişdir.

Açar sözlər: Turizm sektoru, turizmin inkişafı regional turizm, regional inkişaf.

Assessment of The Current State Of Tourism Development In The Regions

Summary: As it is known, the basis of the state's policy in the country is to direct the revenues from the oil and gas sector to the development of the non-oil sector. The basis of the areas included in the non-oil sector is the tourism sector. Like other service areas, the development of the tourism sphere stimulates the development of other areas in the country. This business mainly attracts entrepreneurs with its features such as daily increasing demand for tourist services, high profitability, and payment of expenses in a short period of time. The development of tourism in Azerbaijan is a state policy. The development of tourism in our country is not limited to the attraction of tourists to the central cities. The maximum use of the tourism potential of the regions is one of the state's priorities. The Decrees "On the State Program for the Socio-Economic Development of the Regions of the Republic of Azerbaijan" signed by President

Ilham Aliyev, a worthy follower of the national leader's political course, have been signed since 2004. (2004-2008, 2009-2013, 2014-2018, 2019-2023 years) were important steps towards the development of the country's economy, including tourism in the regions. The development of the regions of the Republic of Azerbaijan is an important component of the sustainable socio-economic development strategy successfully implemented in the country.

As a result of the implementation of these programs, several resorts-sanatoria, hotels and recreation centers that meet international standards were created in the regions. After the 44-day war, as a result of the liberation of our lands from the enemy, rapid reconstruction is underway in the country in order to make the most of the tourism potential of those regions.

From this point of view, the researched topic is very relevant in the current conditions. In the article, the level of development of tourism in the regions of the country, especially in the liberated areas, is analyzed, and the existing and solutions for it in the post-pandemic period are determined.

Keywords: Tourism sector, tourism development, regional tourism, regional development.

Azərbaycanda qeyri-neft sektorunun əsas sahələrindən biri olan turizm sahəsinin inkişafı İlham Əliyev prezident seçildikdən sonra yeni müstəviyə qədəm qoydu. Belə ki, ölkədə, o cümlədən regionlarda turizmin inkişafı üçün müxtəlif Dövlət proqramları, strateji yol xəritəsi və s normativ hüquqi aktlar qəbul edilmişdir. Təməlu ulu öndər tərəfindən qoyulan bu inkişafı İlham Əliyev fəaliyyətə başladığı gündən indiyədək imzaladığı dörd regionların sosial-iqtisadi inkişafı ilə əlaqədar Dövlət Proqramları (2003-2008, 2009-2013, 2014-2018, 2019-2023-cü illər) regionlarda turizmin inkişafına böyük təkan verdi.

2009-cu ildə Kurortların inkişafına dair 2009-2018-ci illər üçün Dövlət Proqramı, , 2010-cu ildə Turizmin inkişafına dair 2010-2014-cü illər üçün Dövlət Proqramı qəbul edilmişdi.

Bundan əlavə 2011-ci il turizm ili elan edildi. Bununla da ölkəmizdə turizmin inkişafı üçün lazım olan sosial-iqtisadi və hüquqi baza yaradıldı.

Qəbul edilən proqramların əsas məqsədi, sənaye və dünya turizminin infrastrukturuna inteqrasiya, yüksək səviyyəli turizm xidməti göstərmək və milli turizm modelinin yaradılmasına yönəldilmişdir.

Bu proqramların əsas məqsədləri bunlardır:

- ❖ turizmin inkişafındakı nailiyyətlər;
- ❖ turizm sahəsində kiçik və orta sahibkarlığın inkişafı;
- ❖ rəqabətə davamlı turizm bazarının yaradılması;
- ❖ turistlərə göstərilən xidmətlərin keyfiyyətinin yaxşılaşdırılmasının təmin edilməsi;
- ❖ kurort müəssisələrinin planlı şəkildə inkişafı və təmin edilməsi onların effektiv istifadəsi.

Dövlətin inkişaf istiqamətində apardığı məqsədyönlü siyasət nəticəsində Azərbaycanın bölgələrindəki turizm böyüməsi bu sahədəki iqtisadi göstəricilərin inkişafından açıqca görünür. Otel infrastrukturunda iqtisadi göstəriciləri aşağıdakı cədvələ əsasən təhlil edək;

Cədvəl 1

Azərbaycan Respublikasında otellərin, motellərin və ümumi iqtisadi göstəriciləri bölgələrə görə turistlərin digər yerləşmə yerləri

Turizm bölgəsi	Köhnə otaqlar		Yeni otaqlar	
	2016	2017	2018	2019
1. Abşeron	11843	11866	1004422	1107625
2. Gəncə-Qazax	2842	3080	82231	31113
3. Şəki-	2203	2374	62751	64871
4. Yuxarı Qarabağ	2153	2245	31655	45286
5. Quba-	8119	8703	279439	194871
6. Kəlbəcər-	1130	1320	67423	8361
7. Dağlıq	1139	1321	18376	19315
8. Lənkaran	2783	2884	76855	67637
9. Naxçıvan	1522	1448	84420	85897
10. Ümumi	31465	32600	1621813	1597300

Mənbə: <https://aw.s tat, gov. az/>

Cədvəldən görüldüyü kimi, hesablamalar göstərir ki, ümumi iqtisadi göstəricilərin dinamikasında, otaq sayı və yataq sayı habelə, otellər, motellər və s. ən böyük pay Abşeron iqtisadi rayonuna düşür. Belə ki, 2016-2017-ci ilin müqayisəsində otaq sayı turizm bölgəsi üzrə ən böyük göstərici Abşeron, Gəncə-Qazax, Şəki-Zaqatala iqtisadi rayonlarının payına düşür və ümumi göstərici bu illər üzrə 1.135 dəfə artmışdır. 2017-2018-ci illərin müqayisəsində bölgələr üzrə turizmin yerləşmə yeri 1.589 dəfə artmışdır. 2018-2019-cu illər üzrə artım təmomi isə 2.454 dəfə artmışdır. Ümumi olaraq 2017-ci ildən 2019-cu ilə qədər isə 1.565 dəfə artmışdır. Belə ki, iqtisadi bölgə olaraq sırasıyla 2017-ci ilə əsasən, 36.4% və yəzdə 69.3% təşkil edir. Abşeron bölgəsinin belə bir hakim mövqeyi sahənin təmsil etdiyi böyük maraqla izah edilə bilər. Turistlər üçün, yəni: memarlıq və tarixi zəngin abidələr, bölgənin Xəzər dənizinin sahilindəki yeri, mərkəz və dünyanın hər yerindən iş adamlarını cəlb etmək və s. bütün bu amillər lazımi yerləşmə qurumlarının meydana gəlməsinə və eləcə də müəyyən bir iqtisadi bölgədə turizmin inkişafına zəmin yaradır. Daxili turizm müxtəlif bölgələrdə inkişaf etdikcə Azərbaycanda istirahət üçün lazım olan infrastruktur yaradılır.

Amma rekreasiya zonalarının yaranma prosesi qeyri-bərabər paylanmışdır. Ölkəmizin bəzi mənzərəli guşələri hələ unudulmaqda qalır, digərləri isə əksinə, turizmin inkişafı müşahidə olunur. Bu zonalara dəniz kənarı, xüsusən Quba-Xaçmaz iqtisadi rayonun bir hissəsi olan Nabran bölgəsi ümumi iqtisadi dinamikasında ikinci sırada turistlərin yerləşməsi üçün müvafiq olaraq 26,7% və 12,2% olan göstəricilər iştirak etdi. Hələ 80-ci illərdə bu yerlərin dövlət əhəmiyyətli bir turizm zonası kurortuna çevrilməsi lazım idi. Ancaq bu proyektə, əhəmiyyətli səbəblərdən investisiya yatırımı həyata keçirilmədi. İndi suverenliyin əldə edilməsi və bazar münasibətlərinin inkişafı ilə, yerli iş adamları, xüsusi şirkətləri məmnun etməyə çalışır.

Regionlarda turizmin sürətli inkişafı digər sosial-iqtisadi göstəricilərə də, böyük müsbət təsirini göstərmişdir. Bunları ayrı-ayrılıqda aşağıdakı cədvəldə aydın şəkildə izah edək.

Cədvəl 2

**Azərbaycan Respublikasının regionlarda turizmin sürətli inkişafına təsir
 edən digər sosial-iqtisadi göstəricilər (min.manat)**

Göstəricilər	2010	2015	2016	2017	2018	2019
Əhalinin xərcləri, milyon manat	19251,5	30799,6	34963,4	39775,0	44498,4	47370,5
Muzdlu işçilərin orta aylıq nominal əmək	331,5	444,5	466,9	499,8	528,5	544,6
Balans dəyəri ilə iqtisadiyyatda əsas fondlar (ilin sonuna),	66659,5	110677,9	124008,4	169120,3	182788,5	193491,0
Ümumi daxili məhsul:						
cəmi, milyon manat	42465,0	59014,1	54380,0	60425,2	70337,8	79797,3
əhalinin hər nəfərinə, manat	4753,0	6268,0	5706,6	6269,6	7226,0	8126,2
Faktiki son istehlak, milyon manat	21336,1	33238,8	37575,7	43228,5	48482,2	50552,9
Ümumi yığım, milyon manat	7669,0	16234,8	15179,4	15518,1	17147,6	16019,6
Sənaye məhsulu, milyon manat	27978,2	32110,3	26369,4	32300,2	39892,5	47677,0
Kənd, meşə və balıqçılıq təsərrüfatı məhsulu,	3968,1	5431,7	5836,8	5874,3	6853,5	7274,5
Əsas fondların istifadəyə verilməsi, milyon manat	5961,3	9336,3	9933,3	10157,4	8617,4	12357,8
Əsas kapitala yönəldilmiş vəsaitlər, milyon manat	9905,7	17618,6	15957,0	15772,8	17430,3	17244,9

Mənbə: <https://stat.gov.az/>

1.Regionların sosial-iqtisadi inkişaf proqramı 2009-2013

2.Regionların sosial-iqtisadi inkişaf proqramı 2014-2018

3.Regionların sosial-iqtisadi inkişaf proqramı 2019-2021

Cədvəldən görüldüyü kimi, regionlarda turizmin inkişafına təsir edən sosial-iqtisadi göstəricilər əhalinin xərcləri, 2010-2015-ci illərin müqayisəsində 2.124 dəfə artım olmuşdur. Balans dəyəri ilə iqtisadiyyatda əsas fondlar (ilin sonuna) 2015-2016-cı illin müqayisəsində isə 8,936 dəfə artım müşahidə edilir. 2016-2017-ci illərin müqayisəsində 6.875 dəfə artım qeydə alınıb. Əsas kapitalla yönəldilmiş vəsaitlər 2017-2018-ci ilin müqayisəsində 4.475 dəfə artım qeyd olunur. Əsas fondların istifadəyə verilməsi 2018-2019-cu illərin müqayisəsində isə 3.688 dəfə artım müşahidə edilib. Ümumi olaraq regionlarda turizmin sürətli inkişafına təsir edən digər sosial-iqtisadi göstəricilər üzrə 2010- 2019-cu illər üzrə 2.737 dəfə artım qeydə alınıb.

Təsadüfi deyil ki, turizmin inkişafının əsas istiqamətləri hökumətin ümumi iqtisadi siyasətinin ayrılmaz hissəsi, yoxsulluğa və iqtisadi böyüməyə qarşı mübarizə proqramı, işsizlərin sayının azaldılması üçün bir fəaliyyət planı müəyyənləşdirir, böyük ölçüdə bu sənayedəki inkişafın sayəsində kiçik sahibkarlığın inkişafı və regional infrastrukturun yaxşılaşdırılmasını həyata keçirir. Öz növbəsində, bölgələrin sosial-iqtisadi inkişafı dövlət proqramı da turizm mərkəzləri, evlər və istirahət zonaları şəbəkəsinin inşasını stimullaşdırmaq, sanatoriyalar, xəstəxanalar və s. nəzərdə tutulmuşdur. Bir-birini qarşılıqlı şəkildə tamamlayan bütün bu tədbirlər nəticədə turizm biznesinin inkişafına təkan verən olmalıdır. Xarici təcrübənin də göstərdiyi kimi kənd turizmi onsuz da inkişaf edir və bir neçə onillik və xüsusilə son bir neçə ildə aktivdir.

Qeyd etmək lazımdır ki, Azərbaycanca kənd turizmi turizm sahələrindən biridir. Kəndin iqtisadi inkişaf yolları, əlavə imkanı sakinləri üçün qazandır. Hal hazırda Şəkiddə “ailə səyahəti birliyi” yaradılıb. Şirkət Göyçaya kiçik turist qruplarından mövcud olan və göndərilən turistlər burada yerləşən villada

istirahət edir. Bu cür qruplar üçün şirkət fərdi evlərdə tətillər təşkil edir (gündəlik səhər yeməyi və digər xidmətlər ilə adam başına dollar). Avropanın ucuz kənd təsərrüfatı təcrübəsini tətbiq edərsə və ekoloji turizm düzgün təşkil edildiyi təqdirdə, yeni iş yerləri açacaq və bununla da problemi həll edəcəkdir. Bundan əlavə fikrimizcə, Azərbaycan iqtisadiyyatı, xeyli fayda götürər. Regional məşğulluq və yoxsulluğun azaldılmasına da, müsbət təsir göstərəcək. Bu, şübhəsiz ki, yalnız yerli turistləri deyil, həm yalnız kənd istirahəti ilə, həm də, orijinal həyat tərziləri ilə kəndlərimizin həyat tərziləri və adətləri maraqlanan xariciləri cəlb edəcəkdir. Bununla yanaşı, ölkənin sənaye inkişafına baxmayaraq bir çox təbii mənzərələr orijinal görünüşünü və ekoloji təmizliyini qoruyub saxlamışdır. Son bir il yarımında qorunan təbiət zonalarının sahəsi 8-dən artırılmışdır. Azərbaycan ərazisinin 7% -ə qədər bir neçə milli park yaradılmışdır, ekoturizmin təşkili üçün böyük imkanlara malik olunmuşdur. Qeyd olunduğu kimi, 2009-cu ilin aprel konfransında "ölkəmizdə davamlı ekoturizm və milli parklar sistemi", ölkənin bunun üçün bütün imkanlarını yaratdı. Bunun təsdiqində bu günü dağlarda aktiv, sərgüzəştli bir sərvət, tətillər olduğunu orta hesabla da olsa bir ailə üçün olduqca əlverişli bir zövqdür. Tətillərini dağlarda mənzərəli yerlərdə keçirməyi sevənlər üçün Kiçik və Böyük Qafqazın yerləri, ərazidə istirahət zonaları var. Misal üçün, Quba, Zaqatala, Qax, Masallı, Şamaxı və Qusar rayonlarını göstərə bilərik. Əsasən bu istirahət zonaları yaxınlıqdadır və dağların ətəkləri turistlərə xidmətlər təklif edilir. Qusar rayonunda yerləşən turistik Ekstremal yüksək hündürlük 4 ildir fəaliyyət göstərir.

Gələcəkdə turizm biznesinin daha da inkişaf etdirilməsinin bütün istiqamətləri ilə eyni zamanda, kurort biznesinin inkişafı, otel biznesi, yeni turizm komplekslərinin yaradılması, ixtisaslı kadrların hazırlanması, infrastrukturun inkişafı, xüsusən otellərdə, mərkəzlər, tətillər evləri, sanatoriyalar, restoranlar, əyləncə mərkəzləri yerli əhalinin mədəniyyəti və yaşayış şəraiti

turistlərdə yüksək keyfiyyətli xidmət göstərilməsi ilə eyni vaxtda getməsi tamamilə aydındır. Ancaq müşahidələrimizə görə, müstəqillik illərində kurortlar nəinki ölkə iqtisadiyyatına ciddi bir töhfə vermiş, əksinə dövlətin subsidiyalarını alaraq aşağı gəlirliliklə fəaliyyət göstərirlər. Lakin cədvəllərdən də görüldüyü kimi, 2019-cu ildən bəri başlayan Covid-19 pandemiyası bütün dünyada o cümlədən Azərbaycanda turizm sahəsini iflic etdi. Artıq indi yavaş yavaş bu sahə özünə gəlməyə başlayır. Azərbaycanda isə turizmin inkişafı üçün yeni mərhələ başlayır. Belə ki, 44 günlük Vətən müharibəsi nəticəsində Ali Baş komandanın rəhbərliyi altında rəşadətli ordumuz uzun illər ermənilərin əsarəti altında olan torpaqlarımızı azad etdi. Hazırda orada böyük quruculuq işləri gedir. Məlum olduğu kimi Qarabağın turizm potensialı həddindən artıq çoxdur. Bu səbəbdən də qeyd olunanların hamısı və Qarabağ və Şərqi zəngəzur iqtisadi rayonlarında yenidən təşkil olunmalıdır:

- turizm məkanlarının çox hissəsinin özəlləşdirilməsini təşkil etmək;
- turizm məkanlarının iqtisadi və maliyyə müstəqilliyini təşkil etmək;
- turizm məkanlarında mülkiyyət növündən asılı olmayaraq turizm məkanlarını tam iqtisadi və maliyyə müstəqilliyi ilə təmin etmək;
- turizm məkanlarında mülkiyyət növündən asılı olmayaraq, göstərilən xidmətlər üçün müvafiq strukturların cəlb edilməsi ilə “Gənclər və İdman Nazirliyi” və Turizm Agentliyi tərəfindən hazırlanmalı olan keyfiyyət standartlarını tətbiq etmək;
- xarici investisiyaların cəlb edilməsi və kurort işinin yaxşılaşdırılması üçün istənilən mülkiyyət formasında birgə müəssisələr yaratmaq;
- İdarəetmənin demokratikləşməsi, müstəqilliyin daha da genişləndirilməsi, iqtisadi idarəetmə metodlarının dərinləşdirilməsi.

Ədəbiyyat siyahısı

1. Mərkəzi bankın statistik bülleteni. Noyabr 2019. 71 səh.

- 2."Turizm fəaliyyəti haqqında" Azərbaycan Respublikasının qanunu 2021
- 3.Ə.Q. Əlirzayev "Turizm iqtisadiyyatı və idarə edilməsi" Bakı-2010 494 səh
4. Azərbaycan Respublikasında ixtisaslaşmış turizm sənayesinin inkişafına dair strateji yol xəritəsi 2016-cı il
- 5.DSK-nın rəsmi bülleteni 2019-cu il.806 səh.
- 6.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2004-2008)
- 7.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2009-2013)
- 8.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2014-2018)
- 9.Regionlarda sosial-iqtisadi inkişaf dövlət proqramı.(2019-2023)
10. Azərbaycan Respublikası Dövlət Turizm Agentliyinin rəsmi internet sahifəsi.
- 11.ATMU-nun rəsmi internet sahifəsi.

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ÖZET

İnternetin ve internet platformlarının hayatımıza girmesi insanların yaşamında birçok kolaylık sağlamıştır. Dijitalleşme sosyal hayatımızın her köşesinde önemli bir olgu halindedir. Bu kadar kolaylaştırıcı ve fayda sağlamanın yanında derin bir bilinmezlik de barındırmaktadır. Dijital ortamda yaptığımız her faaliyet kayıt altına alınmakta ve bilgiler saklanmaktadır. Bazen bu bilgiler olumlu amaçlar için kullanılsa da kötü niyetli amaçlar için kullanılma ihtimali de olmaktadır. Bu kayıtları kullanıcıyı daha iyi tanıma ve analiz etmek amaçlı birçok kurum kullanmaktadır. Kayıt altına alınan bilgiler, kısaca internetteki her adım dijital ayak izi olarak adlandırılmaktadır. Dijital ayak izi; internet kullanırken gerçekleştirilen site ziyaretleri, e-postalar ve çevrim içi hizmetlere gönderilen tüm bilgileri içermektedir. Bu çalışmada dijital ayak izinin turizm faaliyetleri çerçevesinde bilinçli veya bilinçsiz bırakmış olduğumuz izlerin ne şekillerde bırakılabildiği bu bilgilerle turizm sektöründe bizlere geri dönüşlerin ne şekilde olduğu, bu dijital ayak izlerinin turizm için ne ifade ettiği ve dijital izlerimizin güvenliği için neler yapılması gerektiği hakkında literatürden toparlanan bilgilerle ve daha önce bu konu ile ilgili yazılmış belli başlı alan yazın çalışmalarının incelenmesi ile dijital ayak izinin anlamından bahsedilmiştir. Araştırmanın amacı turizm sektörü açısından dijital ayak izinin ne amaçla kullanıldığı sektördeki rolünün öneminin ne gibi temel sorular üzerinden oluştuğuna yüzeysel bir biçimde cevap vermektir. Sonuç olarak, yapılan çalışmalardan yola çıkarak geniş bir veri kütüphanesine sahip olan internet ağlarına kaydedilen adımlar turizm sektöründe oldukça önemlidir. Dijital ayak izinin turizmde büyük verileri kullanarak popüler destinasyonların, yerel yönetimlerin alt yapı yatırımlarının, işletme konseptlerinin ve hizmet beklentisinin belirlenmesin de ciddi rol aldığı görülmektedir. Tüketicilerin dijital ayak izi ile ilgili farkındalığın artırılmasına yönelik çalışmaların sayısının artırılması tavsiye edilmektedir.

Anahtar Kelimeler: Dijital Ayak İzi, Veri, Turizm, İnternet

DIGITAL FOOTPRINT IN TOURISM INDUSTRY

ABSTRACT

The existence of the Internet and Internet platforms in our lives has provided many conveniences in people's lives and digitalization is an important phenomenon in every aspect of our social lives. Despite the many benefits and conveniences that it provides, the Internet also has a profound obscurity. Every activity we carry out in the digital environment is recorded and stored. There is a chance that this information may be used maliciously, even if it is occasionally utilized for good. These records are also used by many organizations to better understand and analyse users. The information recorded is referred as digital footprint, which includes all website visits, emails, and information sent to online services while using the internet. In this study, it is mentioned how the digital footprint can be left consciously or unconsciously within the framework of tourism activities, how the returns to us are in the tourism sector with this information, what these digital footprints mean for tourism and what needs to be done for the safety of our digital footprints and the meaning of the digital footprint with the information collected from the literature and the examination of the major field literature studies previously written on this topic. The research's aim is to provide a superficial response to some fundamental issues about how important a role the digital footprint plays in the industry and how it is employed in the travel and tourism industry. Therefore, the actions recorded in online networks that provides an extensive data library, are crucial in the tourism industry. the digital footprint plays a significant role in determining popular destinations, infrastructure investments of local governments, business concepts and service expectations by using the wide range of data in tourism. It is seen that the digital footprint plays a key role in deciding popular locations, local government infrastructure investments, company conceptions, and service expectations by utilizing the vast amount of data in the tourism industry. Finally, it is recommended to increase the number of studies to increase the awareness of consumers about digital footprint.

Keywords: Digital Footprint, Data, Tourism, Internet

1. GİRİŞ

Sosyal paylaşım siteleri, kullanıcı profillerini arttırmak için özelleştirilmiş hizmetler sunmakta ve çeşitli fırsatlar geliştirmektedir. (Deeva, 2019) Bu sebeple sosyal medya bireyler için buldukları toplumda zaman ve mekan tarafından kısıtlanmadan, özgürce, nasıl davranmak istediklerini ve ne paylaşmak istediklerini seçme fırsatı sunmak durumunda olduklarını iyi bilinmektedir. (Camacho vd., 2012) Böylece insanlara bu özgürlüğü sunan sosyal medya devamlı yükselen katılımcı oranı ile kişilerin demografik özelliklerini ve kişiler bilgileri gibi özel verilere erişilebileceği dijital ayak izini meydana getirmiştir. Dijital ayak izleri bireylerin sanal ortamlarda hareketlerinin geride bırakmış olduğu izlerdir. Ayrıca dijital ayak izi bireylerin sosyal medya platformlarındaki sanal kimliklerini oluşturmaktadır. (Taş ve Bülbül, 2021) Turizm de yeni teknolojilerin kullanımı farklı boyutlara ulaşmıştır. Özellikle seyahat bilgilerinin araştırılması en sık online organizasyonlarından biri haline almaktadır. Ayrıca çok sayıda birey online seyahat önerileri kullanmakta ve kendileride birçok birey için çevrim içi önerilerde bulunmaktadır. Çok fazla seyahat eden kişilerin, bir başka turiste oranla çevrim içi içeriklerle ilgilenme olasılığı daha yüksektir. Bazı kullanıcılar tarafından sosyal medya uygulamaları üzerinden yayınlanan içerikler farklı turistlerin tüketim tercihlerini tutum ve davranışlarını etkilediği gözlenmektedir. (Dediu, 2017)

Bu araştırmada turizmde dijital ayak izine dair çalışma sayısı sınırlı olduğundan ulusal ve uluslararası yazından incelemeler doğrultusunda bir literatür çalışması oluşturmaktır. Çalışma kavramsal bir çerçeve kapsamında pilot çalışması olmuş ve dijital ayak izinin nasıl bırakıldığı ve turizmde büyük veri kavramlarından söz edilmiştir. Çalışma kapsamında farklı araştırmalar incelenerek kısa bir literatür cetveli oluşturulmuş ve sonuçları değerlendirilmiştir.

2. YÖNTEM

Dijital ayak izi, popüler destinasyonların belirlenmesinin ve çevrimiçi hareketlerle altyapı sistemlerinin oluşumunun büyük bir parçası olmaktadır. Bu nedenle turizm faaliyetlerinin internet ortamındaki varlığını, dijital ayak izinin belirlenmesiyle turistlerin seyahat tercihlerine etkisi önemine dikkat çekilmesi sağlanmaktadır. Bu çalışmanın amacı dijital ayak izinin turizm faaliyetleri açısından ele alınan araştırmaların analizini yapmaktır. Bu çalışma kapsamında evrensel literatür incelenmiş olup, dijital ayak izinin kavramı açığa çıkarılarak turizm de dijital ayak izinin ne şekilde kullanıldığının tespiti için literatür çalışması yapılmıştır ve konu kapsamında belli başlı yerli ve yabancı kaynaklarla sınırlandırılıp kaynak taraması yapılmıştır. Kaynak taramalarının temel gerekçeleri geçmiş kaynakların çalışma sürecinde ulaştığı sonu kavramak, kaynaklardaki kısıtlılık ve ertelemelerin erişilen noktadaki

eksiklerinin tespit edip yeni çalışmanın düzeninin ve seyrinin oluşumuna katkı sağlamaktır. (Demirci, 2014) Literatür taraması sonucunda birçok çalışmadan farklı kullanım örnekleri toplanmış ve kullanım amaçları çalışmanın sorularını destekler nitelikte açığa çıkarılmıştır. Fakat kısıtlı zaman zarfından ve kaynak yetersizliğinden araştırmamız kavramsal çerçevede incelenmiş literatür taraması sonucu derleme yapılmıştır.

3. KAVRAMSAL ÇERÇEVE

Dijital ayak izi interneti kullanan herkesin aktif hareketleri doğrultusunda arkasında bıraktığı izlerden oluşmaktadır. Sanal ortamda bilgiyi araştırırken, sosyal paylaşım profillerinden anlık durum paylaşırken veya mobil cihazlara bir uygulama indirip deneyimlerken bile dijital iz bırakılmış bulunmaktadır. Basın yayın organlarında etkileşim halindeyken arkamızda bıraktığımız tüm izler her zaman bizim yararımıza olmaktan çıkıp bize olumsuz etkilerde bırakabilmektedir. Örneğin akıllı telefonlar aracılığı ile online bir alışveriş sitesinden bir kitap aratırken veya satın alırken daha sonra farklı bir web sitesinde kitaplar ile ilgili reklamlar ve öneriler karşımıza gelebilmektedir. Bu durum sanal camiadan ayak izlerimizin takip edildiğini göstermektedir. Ancak bu izler her zaman düzgün karşımıza çıkmaz paylaştığımız fotoğraflardan kişisel hesap bilgilerine ulaşılabilir (RTÜK, 2020)

Aktif ayak izi, kullanıcının arkasında kendi izni ile bıraktığı veriler olarak söylenmektedir. Pasif ayak izi ise, kullanıcının dijital platformlardaki farkın ve izni olmadan bırakmış olduğu izlere denilmektedir. Aktif ayak izi, birine e-posta göndermek, blog yazıları yayınlamak, sosyal medya platformlarında paylaşımlar, örneğin; tweet, facebook durumları ve instagram fotoğrafı paylaşımları ve e-postalara abonelik veya metin güncellemelerini içeren formları doldurmak anlamındadır. Pasif ayak izi, kullanıcıların konumlarını belirlemek için kullandıkları konum uygulamaları ve web siteleri, reklam verilen ürünlerin bağlantılarını kullanmaktır. (Uğurdağ, 2019)

Web siteleri, online alışveriş siteleri ve ürün geliştirme adresleri genellikle sanal sitelerden web sitelerine geçişleri takip edebilen ve yakın zamanda araştırdığınız veya satın aldığınız ürünleri karşınıza çıkaracak reklamlarla olanak sağlayan depolanan bilgiler bırakmaktadır. (Kabacan, 2020)

Sosyal medya platformlarındaki retweetler ve sosyal medyadaki kullanıcı yorumları “dijital kayıt” olarak adlandırılmaktadır. Sosyal medya hesaplarındaki önerilen gizlilik ayarlarının eksiksiz yapıldığından emin olmak gerekmekte ve bunların güncellenmesine özen gösterilmesi önerilmektedir ve online paylaşım siteleri çoğunlukla bilgilerin şeffaflığını

belirten yenilenmiş politikalar ve ayarlar geliştirmektedirler. Cep telefonları, tabletler ve dizüstü bilgisayarlar ve web siteleri genellikle sitelerin ziyaret edildiği sırada erişim sağlanan cihazları kayıt altına almaktadırlar (Kabacan, 2020)

Turistlerin dijital ayak izlerinin belirlenmesinde en büyük etken çok fazla fotoğraf çekiyor ve bunları paylaşıyor olmaları ilk sıralarda bulunmaktadır. Banka kartlarını kullanarak alışveriş yapılması, cep telefonlarıyla konuşulması ve mesajlaşması, sosyal ağlarda çevrim içi (aktif) olunması gibi dijital faaliyetlerle tespiti ve analizleri yapılabilmektedir. Ayrıca turistlerin hareketlerinin belirlenmesinde farklı ekenlerde bulunmaktadır (Liviu, 2017)

Turistler en çok fotoğraflanan mekanlara gitmeyi ve kendilerinin de oralarda fotoğraflarının olmalarını istemektedir. Aynı zamanda en meşhur alışveriş noktalarında alışveriş yapmakta ve bilindik mekanlarda yemek yemektedirler. Gezilecek bölgelere yakın yerlerde konaklamakta ve böylelikle ayak izlerini her bir noktada bırakmış olmaktadır. İlâveten konakladıkları otellerin çevresinde ve otellerde bulunan internete bağlanmakta, ortamdaki wifi ağlarındaki boşluklar etkisiyle bilgileri kolaylıkla yansıtılabilmektedir (Walden vd., 2018) Bu alandaki çalışmalar kitle kaynaklı coğrafi bilgileri belirlemede, turizm kaynaklı bilgi toplamakta, sosyal alanda turist izlemesi ve hareketleri bu hareketlerin yönetilmesiyle ilgili konular geneline yayılmaktadır (Jiawei vd., 2020).

Bu alanda yapılan çalışmalara yer verilirken popüler destinasyonlarda tarama gerçekleştirilmiş ve bu çalışmalar kapsamında turistlerin turistik faaliyetlerini gerçekleştirdikleri sırada nereleri tercih ettikleri bu alanda hangi faaliyetleri sürdürdükleri nerelerde yemek yedikleri hangi sokaklarda alışveriş yaptıkları hepsi tespit edilmektedir. Bu tespitlerin hem popüler mekanların belirlenmesinde hem de araştırmanın yapıldığı destinasyonların yerel yönetimlerinde şehircilik faaliyetlerine katkı sağlayacakları düşünüldüğü belirtilmektedir (Olmedo vd., 2018).

Girardin vd. (2008) yılında yapmış oldukları çalışmada turizm alanında yapılan dijital ayak izi çalışmalarının çoğunluğunun büyük veri kaynaklarının karşılaştırılması üzerine yapılmış olduğu ve dijital ayak izinin belirlenmesinde büyük veri (Big Data) kaynaklarının önemli rol oynamakta olduğu belirtilmiştir. Turizm araştırmalarında da kullanılan çok sayıda verinin turistlerin uzay-uzamsal örüntülerinin analizi sonucunda elde edilmekte olduğu ve büyük verinin birçok farklı alanı da kapsamakta olduğu ayrıca turistlerin dijital ayak izi bırakmakta, büyük veri ise turistlerin şehirdeki ziyaretleri sırasında davranışlarının dokümanını oluşturmakta olduğu savunulmuştur.

Büyük verinin tanımı ile ilgili birçok görüş bulunmaktadır. Ancak genel olarak büyük veri ile ilgili tanımlar yapılırken ne olduğu ya da ne işe yaradığıyla ilgili tanımlar ortaya çıkmaktadır. Çoğu çalışmada ne için kullanıldığına göre tanımlanan büyük veri kullanım biçimine göre de şekillenmektedir. Büyük verinin tam açıklanamamasının sebebi kullanımında büyük payı olan uluslararası arama motorlarının üzerine yüklediği anlamdan kaynaklanmaktadır (Şen ve Ünlüöner, 2021, s. 278)

Son yıllarda güvenilir veri kaynağı olarak görülen büyük veri bilginin elde edilmesinde önemli katkılarda bulunmaktadır. İnternet teknolojileri; web sistemleri, sosyal paylaşım siteleri, iletişim araçları ve dahası ile veri toplamak, toplanan verilerin içerisinden uygun olanların ayrıştırılıp işe yarar olanların depolanması gerekmektedir. Büyük veri sayesinde de elde edilen ve saklanan bu veriler turizm alanında ciddi boyutlarda kullanılmaktadır (Ercan, 2020, s. 5233-5234)

4. LİTERATÜR ÇALIŞMALARI: DİJİTAL AYAK İZİ

Bu bölümde dijital ayak izinin turizm araştırmaları kapsamında hangi konuları ele aldığı ve hangi alanlarda araştırıldığına dair literatürdeki ilgili çalışmaların bir kısmı aşağıdaki gibi derlenmiştir.

Tablo 1. Turizmde Dijital Ayak İzi ile İlgili Çalışmalar

	Yazar/ Yazarlar	Çalışmanın Amacı, Yöntemi, Sonucu
1	Salas-Olmedo vd. (2017)	Çalışmada kentlerdeki turistlerin mekânsal davranışları hakkındaki bilgileri ve ziyaretleri sırasında üretilen verileri ve bu veri kaynaklarını araştırmaktadır. Çalışmanın amacı şehirli turistlerin dijital ayak izini büyük veri aracılığı ile analiz etmektir. Tek bir kaynak kullanan diğer makalelerden farklı olarak bu makalede şehirlerdeki farklı turizm faaliyetlerini yansıtmak için üç veri kaynağı incelenmektedir. Bu kaynaklar sosyal paylaşım sitelerinden oluşur Panoramio (gezi), Foursquare(konum) ve Twitter (bağlantı-konaklama) bu siteler incelenerek turistlerin şehir hareketlerinin analizleri keşfedilmiştir. Araştırmanın sonucun da bu üç platform aracılığı ile verilerin kısmen mekânsal olarak gereksiz kısmen de tamamlayıcı olduğunu ve çok işlevli turistik mekânların çeşitliliğini, aktivitelerini mekanların kategorizasyonuna izin verildiğini göstermektedir. Şehirlerdeki turistik faaliyetlerini analiz edebilmek için tek bir kaynağın kullanımının yetersiz olduğunu birkaç tamamlayıcı kaynaktan elde edilen verilerle sağlıklı bir araştırmanın ortaya konulabileceğidir.

2	Stienmetz ve Fesenmaier (2016)	<p>Bu çalışmada düşük maliyetli ve kolayca erişilebilen gönüllü coğrafi bilgi (VGI) araçlarının turist davranışlarındaki güvenilirliğine ilişkin bir vaka çalışması yapılmıştır. Çalışmanın amacı bir turizm destinasyonundaki ziyaretçilerin hareket modellerini tanımlamak amacıyla VGI verilerinin kullanımını değerlendirmektir. Bir vaka çalışması olarak St. Augustine, Florida'yı kullanan bu araştırmada Instagram'dan elde edilen ve geleneksel çevrimiçi anket metodolojisi kullanılarak toplanan verilerle ziyaretçi akış ağları incelenmiş ve ardından sonuçlar karşılaştırılmıştır. Makalenin sonucunda turizm araştırmaları için VGI verilerinin kullanılmamanın avantajları vurgulanmış ancak aynı zamanda le alınması gerek potansiyel tehditlere de dikkat çekmektedir.</p>
3	Önder vd. (2014)	<p>Çalışma kapsamında turizm araştırmalarında güncel veri toplama araçlarının pahalı, zaman alan ve gecikmelerin olabileceği yöntemler olduğundan bahsedilmektedir. Verilerin toplanması ve analizi sırasında belli bir zaman kaybının olabileceği fakat günümüzde tüm bireylerin internette turizm araştırmaları içinde kullanabilecek dijital izler bıraktıklarını bu izlerin araştırmalar kapsamında kullanılabileceği öngörülmüştür. Dijital ayak izinin kullanılabileceği bazı uygulamaların olduğundan bu uygulamaların Flickr adı verilen bir web sitesi gibi sitelerinden oluştuğundan bahsedilmektedir. Çalışmanın amacı Flickr'daki, dijital ayak izlerinin turizm için yararlı bir veri akışı sağlayıp sağlamadığını belirlemek i.in 2007 ve 2014 yılları arasında "Avusturya" da etiketlenen fotoğraflar Flickr kullanılarak toplanmıştır. Bu veriler kullanılarak bölge sakinleri ile turistler birbirinden ayrılmış turistler tarafından oluşturulan verilerin mekânsal analizleri yapılmıştır. Araştırmanın sonucunda Avusturya'daki coğrafi etiketli fotoğrafların şehir düzeyindeki gerçek turist sayılarını bölgesel düzeyden daha fazla olduğu sonucuna varılmıştır.</p>
4	Pang vd. (2018)	<p>Çalışma kapsamında turizmin imaj algısına yönelik bir araştırma yapılmıştır. Destinasyonlar ve imajları turizm araştırmalarında önemli bir konu olduğu vurgulanmıştır. Araştırmanın kapsamını Çin'in Xi'an şehri oluşturmaktadır. Seyahat noktalarını ve dijital ayak izinin veri kaynağı olarak belirlenmesinde Roast ContentMing yazılımı kullanılmış Xi'an ın turizm imajının yüksek frekanslı özellikleri ve anlamsal ağı oluşturulmuştur. İçerik analizi yöntemini benimser ve bilişsek imajı analiz etmek için temellendirilmiş teori ve Xi'an ın turizminin duysal örüntüsü oluşturulmuştur. Sonuç olarak Xi'an daki turistlerin kültürel ve bireysel turist oldukları gözlenmiştir. Xi'an ın turizm imajının genel taşıyıcının bin yıllık tarihi ve eski başkentinin olduğu, Güçlü kültürel atmosferinin köklü insanlık duygularının ve seçkin tarihinin turizm çekiciliğine sahip olduğu tespit edilmiştir. Turistlerin Xi'an a karşı genel</p>

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

		duyularının pozitif olduğu bu algısında turizm unsurlarından kaynaklandığı olumsuz algılarının da manzara ve yönetim hizmetlerinden kaynaklandığı sonucuna varılmıştır.
5	Marti vd. (2021)	Çalışma kapsamında kentsel turizm ile ilgili fenomenler hakkında fikir vermektedir. Açık ve gönüllü katılımcılar tarafından oluşturulan içeriği analiz etmektedir. Referans çerçeve yöntemi ve açıklayıcı vaka çalışması uygulanmıştır. Turistik faaliyet merkezlerinin belirlenmesinde ve kentsel bağlamda dinamik bölgelerin güncel kategorizasyonunu elde etmek için sosyal ağlardan alınan veriler turistik kentsel aktiviteleri belirlemek için kullanılmıştır. Bu yöntem ile turizm ile ilgili ilgi çekici yerlerin analizini kolaylaştırır ve dijital ayak izleri sayesinde açığa çıkan kullanıcı tercihleri arasındaki boşluğu doldurmada ilerleme sağlamaktadır. Araştırma sonucunda kullanılan yöntem ile kentsel planlamada karar verme sürecinde tamamlayıcı bir araç olarak dijital ayak izi potansiyelini göstermektedir.
6	Girardin vd. (2008)	Bu çalışmada toplu dijital ayak izlerinin büyük kümeler analizi yoluyla ortaya çıkan kalıpları, insanların şehri nasıl deneyimledikleri bu kalıpla arasındaki itici güçleri hakkında bilgiler sağlayabildiği gösterilmektedir. Çalışma New York şehri şelaleleri alanında bir vaka çalışmasıdır. Özellikle kentsel mekânın çekiciliğinin evrimini ölçme kapasitesini araştırmaktadır. Araştırma kapsamında farklı zamanlarda çekilen fotoğrafların yoğunluk ve dağılımı gibi ziyaretçilerin oluşturduğu dinamik verilerden yararlanılmaktadır. Sonuç olarak çalışma halka açık cazibe ve etkinlik alanlarının ziyaretçiler açısından dağılımı üzerindeki etkisini ölçmenin yeni yollarını savunmaktadır. Ulaşılan bilgiler yerel yönetimler ve araştırmacılar ve mobil ağ operatörleri gibi hizmet sağlayıcıları tarafından da kullanılabilir yapıdadır.
7	Kasinathan vd. (2017)	Çalışma kapsamında karma gerçekliğe dayalı prototip turizm arama uygulaması inşa etmek ve denemek amacıyla hazırlandığı bildirilmiştir. Telefon uygulaması kapsamında cep telefonu kamerasının odaklandığı görüntünün üzerine turizmle ilgili bilgileri yerleştirildiği, karma gerçeklik ortamında android tabanlı bir turizm bilgi arama uygulaması oluşturulduğu buna "Footprint"i adının verildiği belirtilmiştir. Uygulamanın kullanımından bahsedilmiş ve kullanıcının uygulamayı, yalnızca cep telefonu kamerasını ile belirli bir noktaya doğrultmasıyla bilgi alması yeterli olacağı ve Footprint uygulamasının 30 metreye kadar uzaktaki coğrafi etiketli turizm nesnelere tüm bilgileri kapsayacağını belirtmektedir. Kullanıcıların ayrıca arama bilgilerini bilgi kaynağına (Google veya Wiki gibi) veya kategoriye (Yiyecek veya Yer İşareti gibi) göre filtreleyebileceği ve bu deneyimin bir gün bir trend haline

	geleceğinin umut edildiği belirtilmektedir. Sonuç olarak daha fazla gerçeklik ortamı nesnelerin internet aracılığıyla gerçeküstü, ancak sanal alternatiflere dönüştürülecek ve birçok cihaz, ağ ve uygulamanın kullanıcı içeriği oluşturulmasında dijital kaynaklar yardımıyla turizm faaliyetlerini kolaylaştıracağı düşünülmektedir.
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4. SONUÇ

Turizm sektörü gerek yerli gerekse yabancı turistlerin seyahatleri sırasında gördükleri ve deneyimledikleri her olayın her dakikasının pozitif yönlü gelişmesini amaçlamaktadır. Bu amaç doğrultusunda gelişerek ve yenilenerek bünyesine yeni teknolojiler eklendiği görülmektedir. Teknolojinin gelişmesiyle seyahat sırasında deneyimlerimizi internet ve sosyal platform ağları aracılığı ile her yerden paylaşabiliyor olmamız kolay erişilebilir olduğunu göstermektedir. Bu paylaşımlar aslında hiç kaybolmayacak bir sistem sayesinde dijital ayak izi terimi ile (büyük veri) depolanmakta ve hiçbir zaman silinmesi mümkün olmayan bir sistemin içine dahil olmaktadır.

Araştırma kapsamında görülmektedir ki bir destinasyonda en fazla gezilen, fotoğraflanan ve turistlerin vakit geçirmekten hoşlandığı noktalar tek tek kayıt altına alınmakta ve büyük veri uzay-uzamsal zamanda depolanarak turistlerin her hareketi belirlenmektedir. Bu verileri bireylerin kendi izinleri doğrultusunda ya da haberleri olmadan arkalarında bıraktıkları izler ile sağlanmaktadır. Bireylerin izinleri olmadan alınan bilgiler genellikle dijital ortamdaki kimliklerinde güvenlik açıkları sebebiyle belirlenmektedir. Bireylerin dijital platformlardaki güvenlik aşamalarına dikkat etmeleri gerekmektedir. Bu çalışmada dijital ayak izi kavramından ve turizmde dijital ayak izinin kullanımından bahsedilmiştir. Dijital ayak izi kaynaklarının çoğunun büyük veri (big data) ve sosyal medya uygulamaları aracılığıyla verilerinin toplandığı ve bir kısım kişilerin verilerinin kullanıldığından haberdar olmaması ile bir kısım kullanıcıların kendi rızaları doğrultusunda ulaşılabilir olduğu görülmüştür. Araştırma kavramsal çerçevede kalmış bir literatür araştırmasıdır. Bu konudaki çalışmaların sayısının arttırılarak literature katkı sağlanması tavsiye edilmektedir.

KAYNAKLAR

1. Camacho, Deniz, Minelli, Janaina, Grosseck, Gabriela (2012) "Self and İdentity: Raising Undergraduate Students' a Wareness on Their Digital Footprints" *Procedia-Social and ehavioral Sciences*. 46 (2012) 3176-3181.
2. Deeva, Irina (2019) "Computational Personality Prediction Based on Digital Footprint of A Social Media User" 8th International Young Scientist Conference on Computational Science. 156 (2019) 185-193.
3. Dediv, Liviu (2017) Manipulation Of User's Behavior Under "Social Manıtarın" In Tourist Services. *Cactus Tourism Journal* Vol.15, Issue 1, 2017, Pages 53-62, ISSN 2247-3297
4. Demirci, Ali, (2014) *Coğrafya Araştırma Yöntemleri*. Balıkesir: Coğrafyacılar Derneği.
5. Ercan, Fatih (2020). "Akıllı Turizmde Büyük Veri Kullanımı: Sistematik Bir Derleme." *Uluslararası Toplum Araştırmaları Dergisi*, 16(32) DOI: 10.26466/opus.780017
6. Girardin, Fabien, Blat, Josep, Calabrese, Francesco, Dal Fiore, Filippo, Rotti, Carlo (2008). "Digital Footprinting: Uncovering Tourists With User-Generated Content". *IEEE Pervasive Computing*, 7(4), 36-43 DOI: 10.1109/MPRV.2008.71
7. Kasinathan, Vinathini, Mustapha, Aida, Seong, Yeap Chee, Abidin Zainal, Aida Zannah, (2017) *Footprint: Tourism Information Seach Based On Mixed Reality*. *Information Journal On Advuanced Science Engineering Information Technollogy* Vol.7 (2017) No:4-2 ISSN:2088-5334
8. K peli Ően, Tuęba,  nl onen, Kurban (2021). "Veri Madencilięi ve Turizmde Veri Madencilięi  alıřmaları." *Journal of Tourism and Gastronomy Studies*, 9(1), 275-298 ISSN: 2147-8775
9. Marti, Pablo, Garcia-Mayor, Clara, Serrano-Estrada, Leticia (2021). "Taking The Urban Tourist Activity Pulse Through Digital Footprints." *Current Issues in Tourism*, 24(2), 157-176 DOI: 10.1080/13683500.2019.1706458
10. Onder, İrem, Koerbitz, Wolfgang, Hubmann-Haiduogel, Alexander (2014). "Tracing Tourists by Their Digital Footprints: The Case of Austria." *Article in Journal of Travel Research*, DOI: 10.1177/00472875/4563985
11. Pang, Wen, Wang, Shu, Chen, Donqing, Wong, Refeng (2018). *Research on Destination Image Perception Based on Digital Footprint of Tourism*. 3. *Uluslararası  aędař Eęitim, Sosyal Bilimler ve Beřeri Bilimler Konferansı*, cilt 233
12. Salas-Olmedo, Maria Henar, Moya-Gomez, Borja, Garcia-Palomores, Juan Carlos, Gutierrez, Javier, (2018) *Tourists' Digital Footprint İn Cities: Comparing Big Data Sources*. *Tourism Management* 66 (2018) 13-25
13. Schreiner-Walden, Chelsey, Leung, Yu-Fai, Toteosian (2018) "Digital Footprints: Incorporating Crowdsourced Geographic Information For Protected Area Management." *Applied Geography*, 90, 44-54
14. Stienmetz, Jason L., Fesenmaier, Daniel (2016) "Validating Volunteered Geographic Information: Can We Reliably Trace Visitors Dijital Footprints?." *Travel and Tourism Research Association: Advancing Tourism Research Globally*, 24
15. Tař, A., B lb l, H. İ. (2021). *Sosyal Medya Kullanıcılarının Dijital Ayak İzi Farkındalıęı*, *Sosyal, Beřeri ve İdari Bilimler Dergisi*, 4(3): 205-216
16. Yi, Jiawei, Du, Yunyan, Liang, Fuyuan, Tu, Wenna, Qi, Wei, Ge, Yong, (2020) "Mopping Human's Digital Footprints On The Tibetan Plateau From Multi-Source Geospatial Big Data. *Science Of The Total Enviroment*, 7(11), 134-540

17. RTÜK. (2020, 30 Mart). Dijital Ayak İzi Nedir? Elde edilme tarihi: 27 Nisan, 2021, https://medyaokuryazarligi.gov.tr/haber_goster.php?Guid=20E98A64-49DB-415E-B0CD-3682E77DE48D
18. Kabacan, D. (2020, 18 Kasım). Dijital Ayak İzi Nedir? Nasıl Yönetilir? Elde edildiği tarihi: 27 Nisan, 2021, <https://www.yapayzekatr.com/2020/11/18/dijital-ayak-izi-nedir-nasil-yonetilir/>
19. Uğurdağ, S. (2019, 23 Eylül) Dijital Ayak İzi Nedir? Elde edildiği tarihi: 27 Mayıs, 2021, bugday.org/blog/dijital-ayak-izi-nedir/

**YAPBOZ OLUŞTURMA TEKNOLOJİLİ MATERYALİN OKUL ÖNCESİNDE
PARÇA-BÜTÜN İLİŞKİSİNİ GELİŞTİRMEYE ETKİSİ**

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ÖZET

Bu çalışma, okul öncesi dönemdeki çocukların bilişsel gelişim göstergelerinden biri olan parça-bütün ilişkisini teknolojik materyal kullanarak kazandırmayı amaçlamaktadır. Araştırmanın katılımcılarını Amasya ili Milli Eğitim Bakanlığı (MEB)'na bağlı bir köy okulunda okulöncesine devam eden 6 çocuk (4 kız, 2 erkek) oluşturmaktadır. Katılımcıların yaşları 48 ile 72 ay arasında değişmektedir. Bu çalışmada çocuklar akıllı tahta ve Jigsaw Planet Web 2.0 uygulamasıyla 9 parçalı yapbozu tamamlama sürelerine göre puanlandırılmıştır. Deneysel yöntemle yapılan bu çalışmada aynı gruba ön test- son test puan karşılaştırmaları yapabilmek için İlişkili Örneklem t Testi kullanılmıştır. Çalışmanın analizinde Microsoft Excel ve SPSS 20.0 istatistik paket programı kullanılmıştır. Verilerin normal dağılım gösterip göstermedikleri Kolmogorov- Smirnov testi ile kontrol edilmiş ve normal dağılım gösteren verilere nonparametrik testler uygulanmıştır. Sonuçlar $p=0.05$ anlamlılık düzeyine göre yorumlanmıştır. Araştırma sonucunda dijital bir oyun olan puzzle web 2.0 aracının çocukların parça- bütün ilişkisini kavramalarında anlamlı bir etkisinin olduğu sonucuna ulaşılmıştır. Ayrıca bu dijital oyunun telefon ile ve akıllı tahta ile oynandığında yapbozun tamamlanma sürelerinde telefon lehine değişiklik görülmüştür. Çocukların bu uygulamadan sonra dijital olmayan 24 parçalı yapbozu önceki sürelerine oranla daha kısa sürede tamamladıkları görülmüştür ve bu uygulamanın çocukların yapboz oyununa karşı olumlu tutum geliştirdikleri sonucuna ulaşılmıştır. Sonuç olarak, okul öncesi öğretmenleri öğretim sürecini Web 2.0 teknolojileriyle destekledikleri takdirde çocuklar okul öncesi dönemin bilişsel gelişim basamağının bir kazanımı olan parça-bütün ilişkisini kavramış olurlar.

Anahtar Kelimeler: Parça-bütün ilişkisi, okul öncesi, teknolojik materyal, Web 2.0 araçları.

**EVALUATION OF PRESCHOOL CHILDREN'S PERFORMANCE OF
TECHNOLOGICAL MATERIAL WITH PUZZLE CREATION FOR THE
ACQUISITION OF THE PART-WHOLE RELATIONSHIP**

ABSTRACT

This study aims to gain the part-whole relationship, which is one of the cognitive development indicators of preschool children, by using technological material. The participants of the study consist of 6 children (4 girls, 2 boys) attending preschool in a village school affiliated to the Ministry of National Education (MEB) in Amasya province the ages of the participants ranged from 48 to 72 months. In this study, children were scored according to their time to complete the 9-piece puzzle with the smart board and Jigsaw Planet Web 2.0 application. In this experimental study, the Related Samples t-Test was used to compare the pre-test and post-test scores of the same group. SPSS 20.0 statistical package program was used in the analysis of the study. Whether the data showed normal distribution was checked with the Kolmogorov - Smirnov test and nonparametric tests were applied to the data showing normal distribution. The results were interpreted according to the $p=0.05$ significance level. As a result of the research, it was concluded that the puzzle web 2.0 tool, which is a digital game, has a significant effect on children's understanding of the part-whole relationship. In addition, when this digital game is played with a phone and a smart board, a change was observed in the completion times of the puzzle in favor of the phone. After this application, it was observed that the children completed the non-digital 24-piece puzzle in a shorter time than before, and it was concluded that this application developed a positive attitude towards the puzzle game. As a result, if preschool teachers support the teaching process with Web 2.0 technologies, children will understand the part-whole relationship, which is an achievement of the cognitive development step of the preschool period.

Keywords: Part-whole relationship, preschool, technological material, Web 2.0 tools.

1.GİRİŞ

Okul öncesi eğitim günümüzde önemi tartışılmayacak şekilde alınması gereken ilk eğitim olarak karşımıza çıkar. Aileden sonra çocuğun karşılaştığı, kaynaştığı, bilgi ve beceri ile donandığı yerdir. Zeka gelişiminin en önemli olduğu 0-6 yaş aralığında çocuk algıları açık, öğrenmeye hazır ve yeni bilgiler almaya isteklidir. Bu nedenle sınıf ortamının çocuğun yeteneklerini keşfedici, merakını giderici, problemlere çözüm üretebileceği zengin uyarılardan oluşması gerekmektedir (Büyükkaragöz, 1993).

Okul öncesine yönelik hazırlanan oyun ve oyuncaklar, öykü kitapları eskiden az sayıda iken günümüzde çocuklar için hazırlanan materyallerin çeşitleri artmış ve birçoğu yaş gruplarına göre ayrılarak sorgulama ve düşünme temelli oyun, oyuncaklar, çocuk kitapları hazırlanmaya başlamıştır. Günümüzde oyuncularda da çeşitliliğe gidilerek plastik legolardan, yapı-inşa oyuncaklarından, dramatize (evcilik) oyuncaklarından ziyade günümüzde ahşaptan yapılmış akıl- zeka oyunları, satranç, ritm aletleri, montessori uygulamaları, bulyap oyun ve oyuncakları, yapboz oyuncakları kullanılmaya başlanmış hatta dijital öyküler ve web 2.0 teknolojisiyle hazırlanan e öğrenme oyun ortamları eğitime entegre edilmiştir (Usta, 2020; Yesilyurt, 2021).

Okul öncesi eğitimi yeni yaklaşımlarından biri de yapboz tekniğidir. İlk olarak Elliot Aronson ve arkadaşları tarafından geliştirilen bu teknikle çocukların parça-bütün ve bütün-parça ilişkisini kavrayarak görsel-uzamsal zekalarını geliştirmek amaçlanmıştır. Bu amacı gerçekleştirirken de sıradan eğitim anlayışından ziyade daha etkileşimli, farklı, 21. Yüzyıl becerilerini geliştirmeye yatkın, zaman, mekan ve somut materyalden bağımsız teknolojik uygulama tercih edilmiştir.

Yapboz (puzzle) yapmanın katkılarında biri sağ ve sol beyni aynı anda çalıştırmasıdır. Bu da çocuklarda problem çözme ve dikkat becerilerini geliştirir. Kısa süreli belleği de geliştirerek hafızayı kuvvetlendirir. Ayrıca puzzle tekniği görsel-mekansal akıl yürütme becerilerini de geliştirir, stres giderir (Master, 2018; Küçük, Palabıyık, Ersoy & Yeşilyurt, 2020; Yüksel, Yılmaz & Yeşilyurt 2022).

Bu dönemde çocukların yaşama dair sorumluluk ve disiplin kazanmaları, sosyal duygusal, psikomotor, bilişsel ve dil gelişimi, öz bakım becerileri gibi alanlarda kendi yeteneklerini ortaya çıkarabilmeleri ve buna uygun ortamlarda kendilerini geliştirebilmeleri için okul öncesi eğitimi programı hazırlanmıştır (MEB, 2013).

Buna göre bilişsel gelişim göstergelerinden biri olan K15, “Parça--bütün ilişkisini kavrar.” kazanımının göstergesi olan “G1 Bir bütünün parçalarını söyler, G2 Bir bütünü parçalara böler, G3 Bütün ve yarımı gösterir, G4 Parçaları birleştirerek bütün elde eder.” Göstergeleri teknolojik materyal kullanılarak okul öncesinde değerlendirilmiştir.

Bu çalışmada 4-6 yaş grubu okul öncesi öğrencilerinin yaşlarına uygun olarak Jigsawplanet Web 2.0 teknolojisiyle hazırlanan 9 parçalı puzzle öğrencilere uygulanmıştır. Uygulama sonunda bilişsel gelişim göstergelerinden biri olan K15, “Parça--bütün ilişkisini kavrar.” kazanımı değerlendirilmiştir.

1.1 Problem Durumu

Okul öncesinde eğitim farklılaştırma yoluna gidilerek oyun temelli, dijital e öğrenme ortamlarıyla öğrenciler tanıştırılarak eğitimde yeniliğe gidilmiştir. Parça-bütün ilişkisini kazandırmayı amaçlayan yapboz tekniği, jigsawplanet uygulamasıyla öğrencilere sunulmuştur.

Bu çalışmanın problem cümlesi ise yapboz oluşturma teknolojik materyalin okul öncesinde parça-bütün ilişkisini geliştirmeye etkisi nedir?

1.2 Alt Problemler

Yukarıda belirtilen problem kapsamında bu araştırmada aşağıda belirtilen alt problemlere yanıt aranmaktadır. Bunlar:

- 1.Yapboz oluşturma içerikli teknolojik materyalle yapılan öğretimin öğrenci motivasyonuna etkisi nedir?
2. Yapboz oluşturma içerikli teknolojik materyalle yapılan öğretim, öğrencileri etkinlik sırasında ne kadar aktifleştirmektedir?
- 3.Bu teknolojinin etkinlik sırasında kullanımın öğrenim sürecini kolaylaştırmaya etkisi nedir?
- 4.Etkili öğretim açısından bakıldığında yapboz oluşturma içerikli teknolojik materyalin önemi nedir?

1.3 Araştırmanın Amacı

Bu araştırmanın amacı okul öncesi öğrencilerinde, bilişsel gelişim kazanımı olan ‘Parça-bütün ilişkisini kavrar’ kazanımını, yapboz oluşturma teknolojik materyalle öğretim yaparak öğrencilerin kazanıma ne oranda ulaştığı incelemektir.

1.4 Araştırmanın Önemi

Okul öncesi dönem öğrencilerin yaşları ve gelişim özellikleri itibariyle somut yollarla öğrendiği, dikkat süresinin kısa olduğu ve bu nedenle çok yönlü materyallere en çok ihtiyaç duyduğu dönemdir. Bu nedenle çocuklar bu dönemde en çok yaparak-yaşayarak öğrendiği,

anında geri bildirim alabildiği, ilgi çekici görsel ve işitsel uyarıcılara ihtiyaç duyar. 21. yy teknoloji çağı da birçok alana yenilik getirmiştir. Farklılaştırılmış yöntem tekniklerden olan teknolojik eğitim okul öncesi dönemdeki çocukların belirlenen kazanımlara ulaşmasında aracı olmuştur. Nitekim bu çalışmada okul öncesi dönemdeki çocukların teknolojik materyalle yapılan öğretim sonucu bilişsel gelişim kazanımına katkısı olduğu görülmüştür.

1.4 Araştırmanın Sınırlılıkları

- Bu araştırma Amasya’da bir devlet okulunda anasınıfına giden 6 öğrenci ile sınırlıdır.
- Bu araştırma 2022-2023 eğitim öğretim yılı ikinci yarısı ile sınırlıdır.
- Bu araştırma ‘Parça-bütün ilişkisini kavrar’ kazanımıyla sınırlıdır.
- Bu araştırma ön test ve son test uygulaması ile sınırlıdır.

2. YÖNTEM

Bu bölümde araştırmanın modeli, evreni ve örneklemini, veri toplama aracı ve veri toplama süreci yer almaktadır.

2.1 Araştırma Modeli

Bu çalışmada nicel araştırma yöntemlerinden yarı deneysel desen kullanılmıştır. Nicel araştırma yöntemleri gözlem ve ölçmeye dayandığı için tekrarlanabilir verilerdir. Bu çalışmada, belirli sınıflardaki okul öncesi öğrencilerine ön test son test uygulanarak yarı deneysel araştırma modeli kullanılmıştır. Yarı deneysel desenlerin tam deneysel desenden farkı iç ve dış geçerlik yönünden eksikliklerinin olmasıdır (Can, A. 2022).

2.2 Çalışma Grubu

Araştırmanın çalışma grubunu 2022-2023 eğitim öğretim yılının ikinci döneminde Amasya il merkezine bağlı köy okulunun anasınıfında öğrenim gören 4 kız, 2 erkek olmak üzere toplam 6 okul öncesi öğrencisi oluşturmaktadır.

2.2.1 Öğrenen Analizi

Araştırmada seçilen örneklem grubu araştırmacının sınıfında olmak üzere 4-6 yaş aralığındadır. Yaşlar genel olarak birbirine yakındır ve 5 yaş civarındadır. Öğrenciler daha önce akıllı tahta ile dijital eğitsel oyun oynadıkları için nasıl kullanıldığını bilirler. Ancak jigsawplanet yapboz içerikli oyun tüm öğrencilere kısaca tanıtılmıştır. Öğrenciler oyunu oynamada istekli ve yapbozu tamamlama sırasında heyecanlı ve meraklıdırlar.

2.2.2 Kazanım Sıralaması

Bu çalışmada okul öncesi öğrencilerinde, bilişsel gelişim kazanımı olan ‘Parça-bütün ilişkisini kavrar’ kazanımını, yapboz oluşturma teknolojik materyalle öğretim yaparak

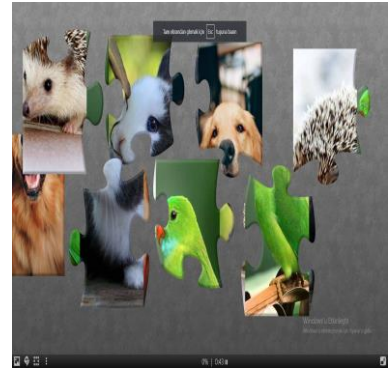
öğrencilerin kazanıma ne oranda ulaştığı incelenmektedir. Bu çalışmada <https://www.jigsawplanet.com/> web sitesindeki yapboz oyunları kullanılmıştır.

2.2.3 Öğretim Teknikleri

Bu araştırmada yaşları 48-72 ay arasında değişen çocuklara 6 hafta boyunca her gün 20 dk akıllı tahta yardımıyla puzzle oluşturma teknolojili 4,9 ve 12 parçalı yapboz tamamlanmıştır. Akıllı tahta ile daha önce dijital oyun oynayan çocuklar ilk kez yapboz yapmışlardır. Buna göre çocuklara ön test ve son test uygulanmış ve yapboz tamamlama süreleri ölçülmüştür.

2.2.4 Uygulanan Öğretim Modeli

Bu araştırmada akıllı tahta-bilgisayar destekli öğretim kullanılmıştır. <https://www.jigsawplanet.com/> web sitesinden kazanıma ve öğrencilerin yaşlarına uygun yapbozlar seçilmiştir.



Görsel 1: 4 parçalı etkinlik örneği Görsel 2: 6 parçalı etkinlik örneği Görsel 3: 9 parçalı e.ö



Görsel 4: 16 parçalı etkinlik örneği

2.3 Veri Toplama Aracı

Araştırma okul öncesi öğrencilerine yönelik olduğu için kazanım değerlendirme başarı testinden ziyade öğrenci performansını ölçen ön test ve son test süreleri ile veri toplanmıştır. Bilişsel gelişim ‘Parça-bütün ilişkisini kavrar.’ kazanımı performansı değerlendirilmiştir.

2.4 Veri Analizi

Toplanan verilerin analizi Microsoft Excel 2016’da t-testi: ortalamalar için iki örnekle yapılmıştır. Öğrencilerin almış olduğu puanlar tek tek girilip Değişken 1’e ön testten alınan puanlar Değişken 2’ye son testten alınan puanlar eklenmiştir. Ortalamalar ve standart sapmalara bakılmıştır.

3. ARAŞTIRMA VE BULGULAR

Çizelge 1. Öğrencilerin dijital yapbozu tamamlama süreleri

Yaş grupları	Ön Test (Süre/sn)	Son Test (Süre/sn)
	180	160
	150	120
48-60 Ay	120	90
	145	115
60-72 Ay	95	80
	164	128

Veriler Excel üzerinden analiz edildikten sonra t-Testi sonuçları elde edilmiştir. Elde edilen bu veriler aşağıda sunulmuştur.

Çizelge 2. Yaş gruplarına göre t Testi Karşılaştırması

	Yaş Grubu		Gruplar		Anlamlılık
	48-60 Olan Öğrenciler	Grubu Ay	60-72 Olan Öğrenciler	Grubu Ay	
Ön Test	\bar{x} 150	SS 30	\bar{x} 134	SS 35	P 0,000188
Son Test	123	35	107	24	0,000376

3.1 ÖN TEST VE SON TESTİN KARŞILAŞTIRILMASI

‘Parça-bütün ilişkisini kavrar’ kazanımını, dijital puzzle oyunuyla tamamlama sürelerine bakılarak yapılan ön test-son test sonucu çizelge 3’de gösterilmiştir.

Çizelge 3. Ön Test ve Son Testin Karşılaştırılması

t-Test: Ortalamalar İçin İki Örnek

	<i>öntest</i>	<i>sontest</i>
Ortalama	142,3333	115,5
Varyans	938,6667	813,5
Gözlem	6	6
Pearson Korelasyonu	0,968135	
Öngörülen Ortalama Farkı	0	
df	5	
t Stat	8,473684	
P(T<=t) tek-uçlu	0,000188	
t Kritik tek-uçlu	2,015048	
P(T<=t) iki-uçlu	0,000376	
t Kritik iki-uçlu	2,570582	

Buna göre son teste ait p değeri 0,00 çıkmıştır. Son test p değeri 0.05’ten küçük olduğu için çocuklar akıllı tahta ile dijital puzzle oyunu oynadıktan sonra yaş grupları arasında oyunu bitirme süresi kısalarak dijital oyun ile yapbozu kısa sürede bitirme arasında anlamlı bir fark olduğu görülmüştür.

4. SONUÇ

Bu araştırma ön test ve son test gruplu yarı deneysel bir araştırmadır. Elde ettiğimiz bulgulara baktığımızda dijital puzzle oyunu ile parça-bütün öğretiminin öğrencilerin performansı üzerinde olumlu yönde katkı sağladığı sonucuna varılmıştır ($p < 0,05$).

Araştırmanın alt problemlerine ait sonuçlar ve tartışma aşağıda aktarılmıştır:

1. Yapboz oluşturma içerikli teknolojik materyalle yapılan öğretimin öğrenci motivasyonuna etkisi nedir? sorusuna cevap aranmıştır. Bu doğrultuda dijital puzzle oyunu ile öncelikle öğrencinin dikkati toparlanmıştır. Sıradan puzzle oyunlarından farklı olan bu içerikle öğrenci motivasyonu aktif kılınmış ve öğrenci yapbozu tamamladıkça oyun oynamaya olan ilgisi ve isteği artmıştır.

2. Yapboz oluşturma içerikli teknolojik materyalle yapılan öğretim, öğrencileri etkinlik sırasında ne kadar aktifleştirmektedir? sorusuna cevap aranmıştır. Bu doğrultuda öğrencilere uygulama imkanı sağlayan teknolojiyle öğretim öğrencide ilgi, istek ve merak uyandırdığı için öğrenciyi etkinlik sırasında daha fazla aktifleştirmiştir. Yapbozu tamamlama süresinin farkına varan öğrenci çabuk ve daha kısa sürede bitirmek isteyerek eğitici dijital oyunu oynamaya olan isteğinde artış gözlenmiştir.

3. Bu teknolojinin etkinlik sırasında kullanımının öğrenim sürecini kolaylaştırmaya etkisi nedir? sorusuna cevap aranmıştır. Bu doğrultuda dikkatini toplamada zorluk çeken öğrenciler yapbozu tamamlamada daha istekli davranarak oyunu bitirmeye karşı olumlu güdülenmişlerdir.

4. Etkili öğretim açısından bakıldığında yapboz oluşturma içerikli teknolojik materyalin önemi nedir? sorusuna cevap aranmıştır. Bu doğrultuda çocuklar düzeylerine uygun ve adım adım ilerleme yoluyla hem seviyelerine uygun ilerleme imkanı buldular hem de kısa sürede çeşitli içeriklerle tanışma fırsatı yakalamış oldular. Ayrıca birbirlerinin oyununu sırası gelene kadar takip ederek dikkatlerini beklenenden daha uzun süre sürdürerek birbirlerinden de öğrenmiş oldular. Kağıt puzzle oynarken çabuk sıkılan ya da puzzle tamamlamayı sevmeyen öğrencilerde yapboz oyunlarına karşı olumlu tutum oluşmuş ve eskisine oranla 24 parçalı yapbozu daha kısa sürede tamamladıkları görülmüştür.

Araştırmadan elde edilen sonuçlara göre aşağıdaki önerilerde bulunulabilir:

21. yy eğitim-öğretim anlayışında daha çok duyu organına hitap eden, günlük hayatla ilişkili, zaman ve mekan sınırlaması olmayan, eğitici dijital ortamlarla iç içe yapılan eğitimler önem kazanmaktadır. Yapılan bu çalışmada olduğu gibi öğrenciler bu şekilde etkinliklere daha motive olarak katılmakta ve dikkatlerini uzun süre sürdürebilmektedir.

Eđitici e öğrenme ortamlarıyla öğrenciler eğlenerek, takip ederek ve aktif şekilde katılarak dakikalar içinde birbirinden farklı çalışmalarını tamamlama fırsatını bulmaktadır.

Bu nedenle bundan sonra yapılacak çalışmalarda teknolojiyi eğitim hayatımıza entegre ettiğimizde eğitimden alınacak verimin kalitesi artmaktadır. Bu çalışma öğrencilerin ‘Parça-bütün ilişkisini kavrar.’ Kazanımına nasıl ulaşıldığını açıklar niteliktedir. Ancak çalışmada kullanılan kişi sayısının ve tekniklerin artırılması ve okul öncesi dışında farklı alanlarda kullanılması önerilir.

5. KAYNAKÇA

- Büyükkaragöz, S. (1993). *Ana babalarla, öğretmenlerin “okulöncesi eğitim programları” hakkındaki görüşleri*, Okul Öncesi Eğitimi Ve Yaygınlaştırılması Semineri. YaPa Yayınları,66-76.
- Can, A. (2022). *Spss ile Bilimsel Araştırma Sürecinde Nicel Veri Analizi*. Ankara: Pegem Akademi.
- <https://www.jigsawplanet.com/> (2023, Mart).
- Küçük E., Palabıyık İ., Ersoy B. & Yeşilyurt M., (2020). 21. yy Öğretmenlerinin Web 2.0 Araçlarını Kullanmasının Öğrenmeye Olan Etkisinin İncelenmesi, 3. *Uluslararası 19 Mayıs Yenilikçi Bilimsel Yaklaşımlar Kongresi*, pp 2-13, Samsun, Turkey,
- Master, P. (2018, Eylül 20). Yapboz (puzzle) çözmenin 7 şaşırtıcı yararı. *Puzzle Pedia*. <https://www.puzzleteacher.com/2018/09/yapboz-puzzle-cozmenin-7-sasirtici.html>
- MEB, (Milli Eğitim Bakanlığı Temel Eğitim Genel Müdürlüğü) (2013). *Okul öncesi eğitim programı*, Ankara.
- Usta, İ. (2020). Eğitici ahşap oyuncaklar bağlamında kategorik detaylandırmalar: Bulyap ve yapboz için benzerlikler ve farklılıklar karşılaştırması. *Anadolu Öğretmen Dergisi*, 4(2), 2587-1706 <https://doi.org/10.35346/aod.769721>
- Yesilyurt, M. (2021). Meta-Analysis of the Effect of Technologies on Primary School, *Journal of Primary Education*, 3(2), 26- 41. <https://doi.org/10.52105/temelegitim.3.2.3>
- Yüksel R, Yılmaz M & Yeşilyurt M (2022). Eğitsel Oyunun Başarıya Etkisinin Meta Analizi/ Meta-Analysis of The Effect of Educational Game on Achievement, 2st-International Congress on Modern Sciences Tashkent Chemical-Technological Institute.

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ÖZET

Nervus alveolaris inferior, ağız ve çene cerrahisinde hekimler açısından son derece büyük bir önem arz etmektedir. Alveolar sinir, mandibulanın posterior bölgesinde yapılan implantlarla birlikte farklı işlemlerin planlanmasında, cerrahi işlemlerde ve işlem sonrasında büyük önem taşımaktadır. Çalışmamızın amacı, inferior alveolar sinir hasarında, elajik asitin etkisini göstermektir. Çalışmada, sağlıklı 20 sıçana genel anestezi koşullarında unilateral sinir kesisi uygulandı. Sıçanlar rastgele iki gruba ayrıldı. Her iki gruptaki sıçanların sol inferior alveolar sinirleri kesildi. Sağda yer alan sinirlere ise herhangi bir işlem uygulanmadı. İşlemden sonra gruplardan birine gavaj yoluyla 14 gün boyunca 10 mg/kg/gün dozda elajik asit verildi. Ardından sıçanlar sakrifiye edilerek alveolar sinirleri alındı. Sol inferior alveolar sinirler, deney grubu olarak kabul edilirken, sağdakiler kontrol grubu olarak kabul edildi. Alınan örnekler immünohistokimyasal olarak incelendi. İnfior alveolar sinir kesitleri, S100 beta antikoru ile immün boyanarak, ışık mikroskobu altında değerlendirildi. Sinir hasarı oluşturulan gruba ait kesitlerin incelemesinde, sinir fasiküllerinde dejenerasyon ve yoğun S100 beta ekspresyonu izlendi. Elajik asit verilen grubun S100 beta immün boyamasında ise, sinir fasiküllerinin dejenerasyonunda ve S100 beta ekspresyonunda azalma görüldü. Ayrıca sinir fasiküllerinde histolojik görünüm, normale yakın olarak izlendi. Elajik asitin farklı biyolojik aktivitelerinin olduğu bilinmektedir. Elajik asitin antioksidan, antiinflamatuvar, immünomodülatör, antimikotik, antimutajenik, antidepresan, antidiyabetik, antimikrobiyal, antikanserojenik ve antihiperlipidemik etkileri ortaya konulmuştur. Çalışmamızda sinir hasarı sonrası, elajik asit tedavisinin iyileştirici etkisinin olması, bu bileşiğin nöroprotektif özelliğini göstermesi açısından önemlidir. Ayrıca S100 beta ekspresyonu, sinir hasarının derecesinin gösterilmesinde bir marker olarak kullanılabilir.

Anahtar Kelimeler: N. alveolaris inferior, Sinir hasarı, Elajik asit, S100 beta

EFFECT OF ELLAGIC ACID ON ALVEOLAR NERVE DAMAGE

ABSTRACT

N. alveolaris inferior is of great importance for physicians in oral and maxillofacial surgery. The alveolar nerve is of great importance in the planning of different procedures with implants in the posterior region of the mandible, in surgical procedures, and after the procedure. The aim of our study was to show the effect of ellagic acid on inferior alveolar nerve injury. In the study, 20 healthy rats underwent unilateral nerve incisions under general anaesthesia. The rats were randomly divided into two groups. Left inferior alveolar nerves of rats in both groups were dissected. No procedure was performed on the right nerves. After the procedure, one of the groups was given ellagic acid at a dose of 10 mg/kg/day for 14 days by gavage. The rats were then sacrificed, and the alveolar nerves were removed. The left inferior alveolar nerves were considered as the experimental group, while the right ones were considered as the control group. The samples were analysed immunohistochemically. Inferior alveolar nerve sections were immunostained with S100 beta antibody and evaluated under light microscope. In the examination of the sections of the group with nerve damage, degeneration and intense S100 beta expression were observed in the nerve fascicles. In the S100 beta immunostaining of the group given ellagic acid, a decrease in the degeneration of nerve fascicles and S100 beta expression was observed. In addition, the histological appearance of nerve fascicles was close to normal. It is known that ellagic acid has different biological activities. Antioxidant, anti-inflammatory, immunomodulatory, antimycotic, antimutagenic, antidepressant, antidiabetic, antimicrobial, anticarcinogenic, and antihyperlipidemic effects of ellagic acid have been demonstrated. In our study, the curative effect of ellagic acid treatment after nerve damage is important in terms of demonstrating the neuroprotective property of this compound. In addition, S100 beta expression can be used as a marker to indicate the extent of nerve damage.

Keywords: N. alveolaris inferior, nerve injury, ellagic acid, S100 beta

1. GİRİŞ

Hekimler açısından nervus alveolaris inferior, ağız ve çene cerrahisinde büyük önem taşımaktadır. Alveolar sinir mandibulanın posterior bölgesinde yapılacak olan implantların planlanmasında, cerrahi safhasında ve gerçekleştirilen ameliyat sonrası durumlarda son derece önemlidir (1).

İnferior alveolar sinir, mandibular sinirin arka bölümünden gelir ve pterygoideus externusun mediali ile ramusun iç tarafı ve pterygomandibular ligamentin arasından aşağıya doğru iner. Buradan da ramusun medialindeki pterygomandibular aralığın içerisinden foramen mandibulaya girer. Kanalin içerisinden dental pulparların innervasyonunu sağlayan, alt çenede bulunan dişlerin foramen apikalelerinden içeriye doğru giren dallar verir. Bazı dallarıysa periodontal membran, alveolar duvar ile diş etlerine gider. Ardından Inferior alveolar sinir mental foramene ulaşarak bu bölgede mental sinir şeklinde uç dallar verir. Söz konusu sinir dalları çene ucunun derisine, alt dudağın derisi ile birlikte mukozasına, alt bölgede bulunan kesici dişlerin vestibülünde yer alan dişeti ile birlikte bölgedeki yumuşak dokuya dağılır. Sinir dallarının bir kısmıysa kemiğin içerisinde çenenin ucuna doğru dağılır ve alttaki ön dişlerin pulparlarının innervasyonunu sağlar (2). Gerek yapısal özelliklerinden gerekse de konumundan kaynaklı olarak inferior alveolar sinirin lokal olarak uygulanan basit anestezi enjeksiyon uygulamalarından çene cerrahisi ameliyatlarına kadar uygulanan işlemler esnasında veya sonrasında hasarlanabilmektedir (3). Periferik sinirlerde meydana gelen yaralanmaların Seddon (4) ile Sunderland'ın (5) geliştirmiş oldukları sınıflandırma metoduna göre incelenmesi mümkündür.

Elajik asit bitkilerde, bitkilerin hücre duvarlarının ve hücre zarlarının yapısal bileşenlerinden bir tanesi olan elaji tanen formunda bulunmaktadır (6). Elaji tanenler, polifenollerin hidrolize edilebilen tanen sınıfına mensup elajik asidin kompleks türevleridir (7). Ellajik asit, gallik asidin dimerik türevi şeklinde bilinmektedir. Fizikokimyasal olarak değerlendirildiğinde; erime noktasının 360°C'nin üzerinde olduğu, kaynama noktasının 796,5°C olduğu, molekül ağırlığının 302.197 g mol⁻¹ olduğu görülür. Koyu sarı renkli kristal toz formunda olan elajik asit, termal stabilite bakımından son derece kararlı olan fenolik maddelerden bir tanesidir (8). Elajik asit birçok bitkide bulunmakla birlikte böğürtlenlerde, çilekte, narda, ahududu, kırmızı üzüm çekirdeklerinde, bademlerde, cevizde ve yeşil çayda bol miktarda bulunmaktadır (9). Birçok biyolojik aktivitesinin bulunduğu yapılan bilimsel araştırmalar ile ortaya konulmuştur. Ellajik asidin sağlık açısından da son derece önemli etkileri bulunmaktadır. Bu etkiler arasında

antioksidan, antiinflamatuvar, antimikotik, antimutajenik, antidepresan, antidiyabetik, antimikrobiyal, antikanserojenik ve antihiperlipidemik gibi etkiler sayılabilir. Elajik asidin yıkıcı olan serbest oksijen radikallerini temizleme ya da bağlama özelliği bulunmaktadır (10). Çalışmamızın amacı, inferior alveolar sinir hasarında, elajik asitin etkisini göstermektir.

2. MATERYAL VE METOT

2.1. Hayvan Deneyi

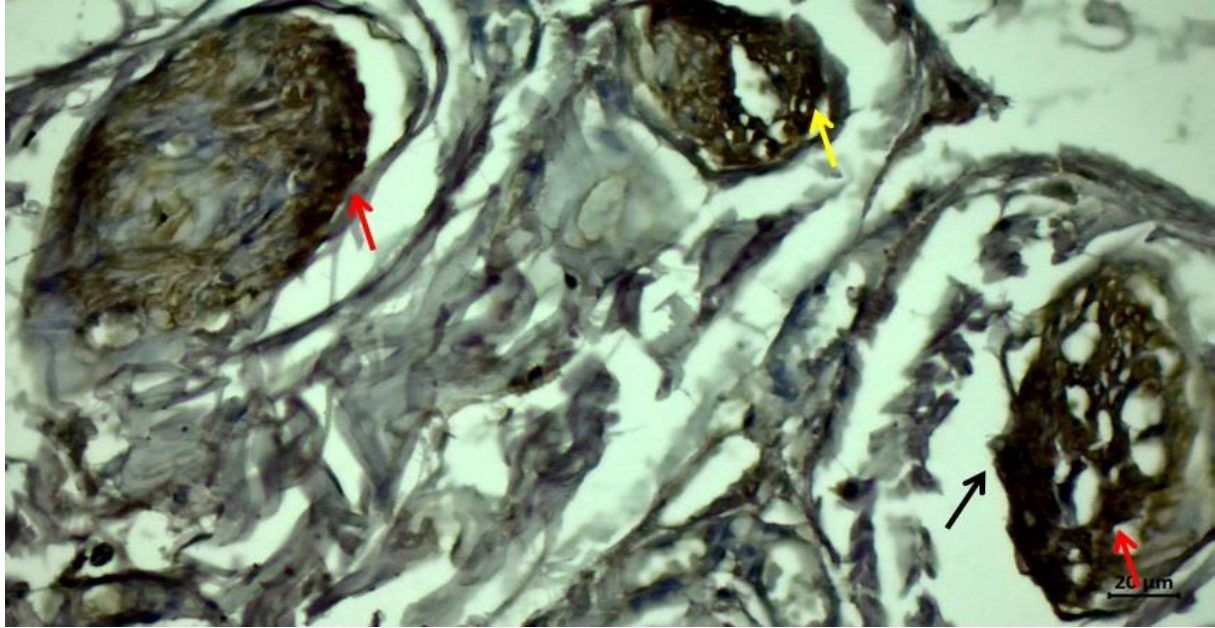
Çalışmamızda, sağlıklı olan 20 adet sıçana genel anestezi koşullarında unilateral sinir kesisi uygulandı. Ardından sıçanlar rastgele iki gruba ayrılarak grupların ikisinde de sıçanların sol inferior alveolar sinirleri kesildi. Sağ tarafta bulunan sinirlere ise herhangi bir işlem uygulanmadı. İşlemden sonra gruplardan birine gavaj yoluyla 14 gün boyunca 10 mg/kg/gün dozda elajik asit verildi (11). Ardından sıçanlar sakrifiye edilerek alveolar sinirleri alındı. Alınan sol inferior alveolar sinirler, deney grubu olarak kabul edilirken, sağdakiler ise kontrol grubu olarak kabul edildi. Alınan örnekler immünohistokimyasal olarak incelendi. İnfierior alveolar sinir kesitleri, S100 beta antikoru ile immün boyanarak, ışık mikroskobu altında değerlendirildi.

2.2. İmmünohistokimya Boyama Protokolü

Parafinden arındırılmak için 5 µm kalınlıktaki kesitler ksilolde iki seri şeklinde 15 dakika boyunca bekletildikten sonra azalan alkol serilerinin içerisinde 5'er dakika boyunca bekletildi ve ardından distile suya kondu. PBS ile iki seri şeklinde 5'er dakika boyunca yıkanan dokulara 30 dakika kadar endojen peroksit blokajı uygulandı ve yeniden 2x5 dakika boyunca PBS'te yıkandı. Ultra V Blok solüsyonu ile 7 dakika boyunca inkübasyonu gerçekleştirilen kesitlere S100 beta antikoru uygulandı ve geçe boyunca beklendi. Daha sonra PBS ile yıkanan dokulara sekonder antikor damlatıldı ve yeniden PBS ile yıkandı. Bu işlemin ardından kesitlerin üzerine 30 dakika kalacak şekilde Streptavidin peroksidaz uygulandı. PBS ile yıkanan dokulara DAB damlatılarak reaksiyon takip edildi. Reaksiyon gösteren dokular, PBS ile yıkandı ve ardından çeşme suyu ile yıkandı. İşlemin sonunda kesitlere 1 dakika boyunca hematoksilen uygulandı ve daha sonra artan alkol serilerinden geçirilen kesitler, 15'er dakika boyunca ksilolde bekletilerek üzerleri kapatıldı.

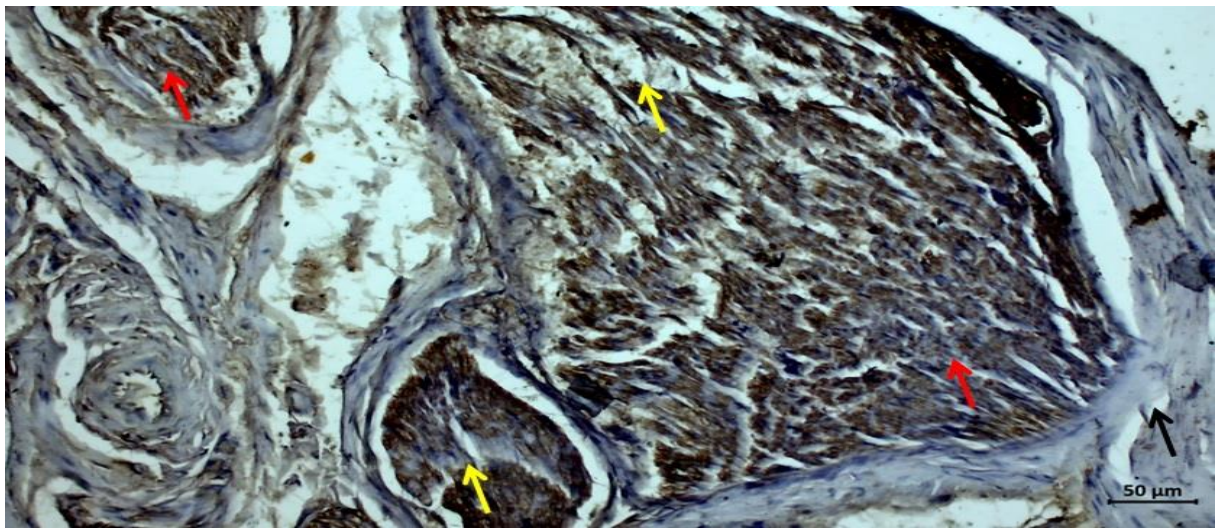
3. BULGULAR

Sinir hasarı oluşturulan grubun S100 beta immün boyamasında; sinir fasiküllerinde hasar (sarı ok) ve S100 beta ekspresyonunda yoğun (kırmızı ok) boyanma izlendi. Ayrıca hasar sonrası sinir fasiküllerinde dejenerasyon izlendi (Şekil 1).



Şekil 1. Sinir hasarı oluşturulan grupta S100 beta ekspresyonu.

Elajik asit verilen grubun S100 beta immün boyamasında ise, sinir fasiküllerinin dejenerasyonunda (sarı ok) ve S100 beta ekspresyonunda azalma (kırmızı ok) görüldü. Ayrıca sinir fasiküllerinde histolojik görünüm, normale yakındı (Şekil 2).



Şekil 2. Elajik asit verilen grupta S100 beta ekspresyonu.

4. TARTIŞMA

Herhangi bir nedenden dolayı inferior alveolar sinirlerde meydana gelen disfonksiyonlar hastaları son derece tedirgin eden durumlardan biridir. Duyularda meydana gelen değişiklikler ya da ortaya çıkan ağrı, hastaların bu durumdan yakınmalarına sebebiyet verir. İnfior alveolar sinirlerin hasarlanması sonucu ortaya çıkan bu durumlar mandibulada, dudaklarda

yananın belli bir kısmında ve oral mukozada fonksiyonun zarar görmesine neden olabilir. Ortaya çıkan duyuşal deęişikliklerin sonucu olarak hastalarda ağrı, istemsiz bir şekilde dudaklarını ya da ısırma ları, besinleri ve sıvıları ağızda tutamamaları gibi çeşitli semptomların ortaya çıkması söz konusu olabilir (12).

Zarar görmüş olan sinirlerin tamirlerinin başarılı olabilmesi için çeşitli faktörler söz konusudur. Sinirlerin hasarlanması ve cerrahi operasyonla tamir edilmeleri arasında geçmiş olan süre, sinirde meydana gelmiş olan hasarın tipi, hasar görmüş olan bölgede kanlanmanın olup olmaması, greft uygulanmışsa eęer kullanılan greft ile sinir arasında uyumun olması, greft atılmışsa bu greftin uzunluęunun ne kadar olduęu, greftin nasıl hazırlandıęı, cerrahi operasyon sırasında oluşmuş olan gerilim, hastanın genel durumu gibi birçok etkeni bu faktörler arasında saymamız mümkündür (13).

Coulthard ve arkadaşları yapmış oldukları çalışmada, inferior alveolar sinir sinir hasarlarından sonra uygulanabilecek tedavi yöntemlerini üç başlık altında toplamıştır. Bunlardan ilki sinirin açığa çıkarılması, eksternal ve internal nöroliz, nöromada eksizyon, greft atılması ve lazer uygulaması, nöromada eksizyon gibi cerrahi uygulamalardır. İkincisi ise çeşitli analjezik, antiepileptik, anestetik ve benzeri ilaçlarla uygulanacak olan medikal tedavi, üçüncüsü ise çeşitli danışmanlık ve terapi yöntemlerini içerisinde barındıran psikolojik yöntemlerdir (14). Doğada fazlasıyla bulunan ve çoęu hastalığın tedavi edilebilmesi için geleneksel olarak uzun yıllardır kullanılan bitki kaynaklı olan bileşikleri, fitokimyasallar olarak tanımlayabiliriz. İnsan saęlığını tehdit eden yönlerinin son derece sınırlı olması ya da hiç olmaması bunların dikkat çekici özelliklerinden bir tanesidir. Son yıllarda yapıları çalışmaları ile Hussain ve arkadaşları yaptıkları çalışmalarda alkaloid, flavonoid ve tanen benzeri fitokimyasalların beyin hastalıklarındaki iyileştirici etkisini tanımlamışlardır. (15,16). Bu çalışmada, elajik asitin inferior alveolar sinir yaralanması sonrası atılmış olan greftin iyileşme sürecine olumlu katkı sağladığının gösterilmesi, literatürü desteklemesi açısından önemlidir.

5. SONUÇ

Çalışmamızda sinir hasarı sonrası, elajik asit tedavisinin iyileştirici etkisinin olması, bu bileşiğin nöroprotektif özelliğini göstermesi açısından önemlidir. Ayrıca S100 beta ekspresyonu, sinir hasarının derecesinin gösterilmesinde bir marker olarak kullanılabilir..

REFERANSLAR

1. Güven, O, Güneş O. 2010. Dental İmplantolojide Nervus Alveolaris Inferior'un Önemi. Ağız Diş Çene Hastalıkları ve Cerrahisi AD, Ankara Üniversitesi Diş Hekimliği Fakültesi Dergisi, 1(1).
2. Savran A. 2006. Alt gömük akıl dişlerinin operasyonlarından sonra, n. lingualis ve n. alveolaris inferior'da meydana gelen iletsel ve fonksiyonel değişikliklerin klinik ve elektrofizyolojik olarak değerlendirilerek, lazer ve tens fizik tedavi yöntemlerinin sinir rejenerasyonu üzerine olan etkilerinin karşılaştırılması. Doktora Tezi, Ege Üniversitesi Sağlık Bilimleri Enstitüsü.
3. Uygun S, Apaydın A. 2008. Maksillofasiyal bölgede periferik sinir yaralanmaları ve tedavisi. İstanbul Üniversitesi Diş Hekimliği Fakültesi Dergisi, 42: 11-17.
4. Seddon HJ. 1943. Three types of nerve injury. Brain, 66: 247-88.
5. Sunderland S. The anatomy and physiology of nerve injury. Muscle Nerve, 1990; 13: 771-84.
6. Vattem, D. and Shetty, K. 2005. Biological functionality of ellagic acid: A review. Journal of food biochemistry, 29(3): 234-266.
7. Quideau, S. and Feldman, K.S. 1996. Ellagitannin chemistry. Chemical Reviews, 96(1): 475-504.
8. Fotie, J. 2010. The potential of ellagic acid as a possible antimalarial drug candidate. Current Bioactive Compounds, 6(3): 161-177.
9. Tıkırdık, M. 2019. Ellajik Asit, Kafein ve Betainin Telomeraz Enzim Aktivitesi Üzerine Etkisi, Yüksek Lisans Tezi, Burdur Mehmet Akif Ersoy Üniversitesi.
10. Akkuş, S. ve Değer, Y. 2017. The effect of different doses of ellagic acid on the serum lipid profile and total antioxidant of rat, Van Veterinary Journal, 28(3), 127-130.
11. Padma VV, Selvi PK, Sravani S. 2014. Protective effect of ellagic acid against TCDD-induced renal oxidative stress: Modulation of CYP1A1 activity and antioxidant defense mechanisms. Molecular Biology Reports. 41, 4223-4232.
12. Rosén A, Tardast A, Shi T-J. 2016. How Far Have We Come in the Field of Nerve Regeneration After Trigeminal Nerve Injury? Curr oral Heal reports. 3: 309-313.
13. Wolford, L. M., & Stevao, E. L. (2003, April). Considerations in nerve repair. In Baylor University Medical Center Proceedings (Vol. 16, No. 2, pp. 152-156). Taylor & Francis.
14. Coulthard P, Kushnerev E, Jm Y, Walsh T, Patel N, Bailey E, Tf R. 2014. Interventions for iatrogenic inferior alveolar and lingual nerve injury. Cochrane Database Syst Rev. 16.
15. Hussain G, Zhang L, Rasul A. et al. 2018. Role of plant-derived flavonoids and their mechanism in attenuation of Alzheimer's and Parkinson's diseases: An update of recent data. Molecules. 23(4): 1-26.
16. Hussain G, Rasul A, Anwar H. et al. 2018. Role of Plant Derived Alkaloids and Their Mechanism in Neurodegenerative Disorders. Int J Biol Sci. 14(3): 341-357.

**KALVARYAL DEFEKT OLUŞTURULAN SIÇANLARDA GREFT SONRASI
GALLİK ASİTİN ETKİSİ**

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ÖZET

Kemik dokusu iskelet sisteminin temelini oluşturmaktadır ve çeşitli organik ve inorganik komponentlerin oluşturduğu bir bağ dokusudur. Kemiğin sahip olduğu mineralize ekstraselüler yapı onu diğer bağ doku türlerinden ayırmaktadır. Frontal kemiklerle birlikte parietal kemiklerin tamamının ve oksipital kemikle temporal kemiğin az bir kısmının oluşturduğu yapı kalvaryum olarak isimlendirilir. Bu yapı beyin dokusunu çevreler. Çeşitli travmalar, enfeksiyonlar, neoplazmalar ile konjenital anomaliler, kalvaryal kemiklerde kusurların gelişmesine sebebiyet verebilir. Kalvaryal kemiklerde meydana gelen defektler çeşitli yöntemlerle tedavi edilebilmektedir. Lazer ve ozon uygulamaları ile birlikte çeşitli kemik greftleri kullanılmak suretiyle, kemiklerde meydana gelen defektler iyileştirilebilmektedir. Çalışmamızda, kalvaryal defekt oluşturulmuş olan sıçanlarda, greft sonrası gallik asitin etkilerini göstermek amaçlanmıştır. Çalışmamızda sıçanlar iki gruba (n:8) ayrıldı. İlk grupta kalvaryal kemikte 5 mm'lik defekt oluşturuldu, ardından oluşturulan defekte allogreft uygulanarak yara dikildi. Kalvaryal kemikte 5 mm'lik defekt oluşturularak allogreft uygulanan ikinci gruba 14 gün boyunca oral yoldan 20 mg/kg gallik asit (GA) verildi. Ardından kurban edilen hayvanların kalvaryal kemikleri çıkarıldı. Alınan örnekler histopatolojik inceleme için hematoksilen eozin ile boyanarak, ışık mikroskobu altında değerlendirildi. Defekt + greft grubu hematoksilen eozin boyamasında, defekt alanında kemik trabeküllerinde artış, periosteum da yoğun kollajen lif artışı, osteositlerde azalma ve vasküler dilatasyon izlendi. Defekt + greft + GA grubu hematoksilen eozin boyamasında, defekt alanında gallik asit tedavisi sonrası kemik trabeküllerinin birleştiği, endosteumda yoğun kemik iliği, osteositlerde artış ve vasküler dilatasyonda azalma izlendi. Gallik asit gerek farmasötik gerekse de biyomedikal endüstrilerinde kullanılmakta olan temel bir doğal biyoaktif bileşendir. Ayrıca antifungal, antioksidan ve antiviral etkileri yapılan çalışmalarla ortaya konulmuştur. Çalışmamızda, kalvaryal defekt sonrası greft uygulamasında, gallik asitin oluşan kemik patolojisini histolojik olarak onardığının gösterilmesi, bu bileşenlerin kemik defektlerinin tedavisinde kullanılabileceğini düşündürmektedir.

Anahtar Kelimeler: Kalvaryal defekt, Kemik grefti, Gallik asit

**THE EFFECT OF POST-GRAFT GALLIC ACID IN RATS WITH CALVARIAL
DEFECT**

ABSTRACT

Bone tissue forms the basis of the skeletal system and is a connective tissue composed of various organic and inorganic components. The mineralised extracellular structure of bone distinguishes it from other types of connective tissue. The structure formed by all of the parietal and frontal bones and a small portion of the occipital and temporal bones is called the calvarium. This structure surrounds the brain tissue. Various traumas, infections, neoplasms, and congenital anomalies can cause defects in the calvarial bones. Defects in the calvarial bones can be treated with various methods. Defects in the bones can be improved by using various bone grafts together with laser and ozone applications. In our study, we aimed to investigate the effects of gallic acid after grafting in rats with calvarial defects. In our study, rats were divided into two groups (n:8). In the first group, a 5 mm defect was created in the calvarial bone, then allograft was applied to the defect and the wound was sutured. The second group, in which a 5 mm defect was created in the calvarial bone and allograft was applied, received 20 mg/kg gallic acid (GA) orally for 14 days. The calvarial bones of the sacrificed animals were then removed. The samples were stained with haematoxylin and eosin for histopathological examination and evaluated under light microscope. In the defect + graft group, hematoxylin-eosin staining showed an increase in bone trabeculae, dense collagen fiber increase in the periosteum, decrease in osteocytes, and vascular dilatation in the defect area. In the defect + graft + GA group hematoxylin-eosin staining, after gallic acid treatment, bone trabeculae merged in the defect area, dense bone marrow in the endosteum, increase in osteocytes and a decrease in vascular dilatation were observed. Gallic acid is an essential natural bioactive component used in both pharmaceutical and biomedical industries. In addition, its antifungal, antioxidant and antiviral effects have been demonstrated by studies. In our study, the demonstration that gallic acid histologically repaired the bone pathology in graft application after calvarial defect suggests that these components can be used in the treatment of bone defects.

Keywords: Calvarial defect, Bone graft, Gallic acid

1. GİRİŞ

Kemik dokusu iskelet sisteminin temelini oluşturan çeşitli organik ve inorganik komponentlerin bir araya gelmesiyle oluşmuş olan özel bir bağ dokusu türüdür. Sahip olduğu mineralize ekstrasellüler matriks, kemiği diğer bağ doku türlerinden ayıran ön önemli

özelliğidir (1). Bağ dokularının tamamında olduğu gibi kemik dokusu da yapısında hücreler barındırmaktadır. Bununla birlikte yapısında barındırdığı inorganik maddeler, kemiği dış minesinden sonra vücuttaki en sert doku haline getirmiştir. Kemikler, kalsiyum ve fosfat gibi elementler için depo görevi görmektedir ve ihtiyaç halinde bu elementleri kana vermek suretiyle vücudun ihtiyaçlarını karşılar (2,3).

Frontal ile parietal kemiklerin tamamıyla, oksipital ile temporal kemiklerin küçük bir kısmının oluşturduğu ve beyin dokusunu çevreleyen yapı kalvaryum olarak isimlendirilmektedir [4,5]. Çeşitli travmalar, enfeksiyonlar, neoplazmalar ve konjenital anomaliler kalvaryal kemiklerde çok çeşitli kusurların gelişmesine neden olabilmektedir. Kemiklerde ortaya çıkan kusurların onarılması son derece önemli klinik problemlerden biridir. Bundan dolayı kraniyal bölgede yer alan kemiklerde meydana gelen kusurlardan kaynaklanan bozuklukların üstesinden gelebilmek ve o bölgede yer alan kemiklerdeki rejenerasyonun uyarılmasını sağlamak için çok sayıda tedavi yöntemi uygulanmaktadır (6). Kalvaryal defektleri tedavi edebilmek amacıyla lazer ve ozon uygulamaları kullanılmaktadır. Bunun yanı sıra alloplastik greft gibi çok çeşitli kemik greftleri de ortaya çıkmış olan kemik kusurlarının iyileşmesine katkıda bulunmaktadır (7).

Gallik asit (GA; 3,4,5-trihidroksibenzoik asit), doğal bir biyoaktif bileşendir. Farmasötik ve biyomedikal endüstriler başta olmak üzere çok çeşitli alanlarda kullanılmaktadır (8). Bitkilerin birçoğunda bulunmakla birlikte en çok mazıda, üzümde, çayda ve meşe kabuğunda bulunmaktadır. Meyvelerin olgunlaşmaya başladığı ilk zamanlar gallik asidin en yoğun olarak bulunduğu dönemdir (9). Yapılan araştırmalarda gallik asidin, antifungal, antioksidan ve antiviral çeşitli etkilerinin bulunduğu ortaya konulmuştur. Ayrıca kanser hücreleri üzerinde sitotoksik bir etkide bulunduğu ve bunu yaparken de normal olan hücrelere zarar vermediği gösterilmiştir. Kanama durumlarında damar yapılarının büzülmesini sağladığı ve diyabetin tedavisinde kullanıldığı çalışmalar da mevcuttur (10,11). Gallik asit bu özellikleri sayesinde yaygın bir şekilde alternatif tıpta, besinlerde ve ilaç yapımında kendisine kullanım alanı bulmuştur (12).

Çalışmamızda, kalvaryal defekt oluşturulmuş olan sıçanlarda, greft sonrası gallik asitin etkilerini göstermek amaçlanmıştır.

2. MATERYAL VE METOT

2.1. Hayvan Deneyi

Rastgele bir şekilde sekizerli iki gruba ayrılan sıçanlardan (n:8), ilk gruba 5 mm çapında olacak şekilde kalvaryal kemik defekti oluşturuldu. Ardından oluşturulan defekte allogreft

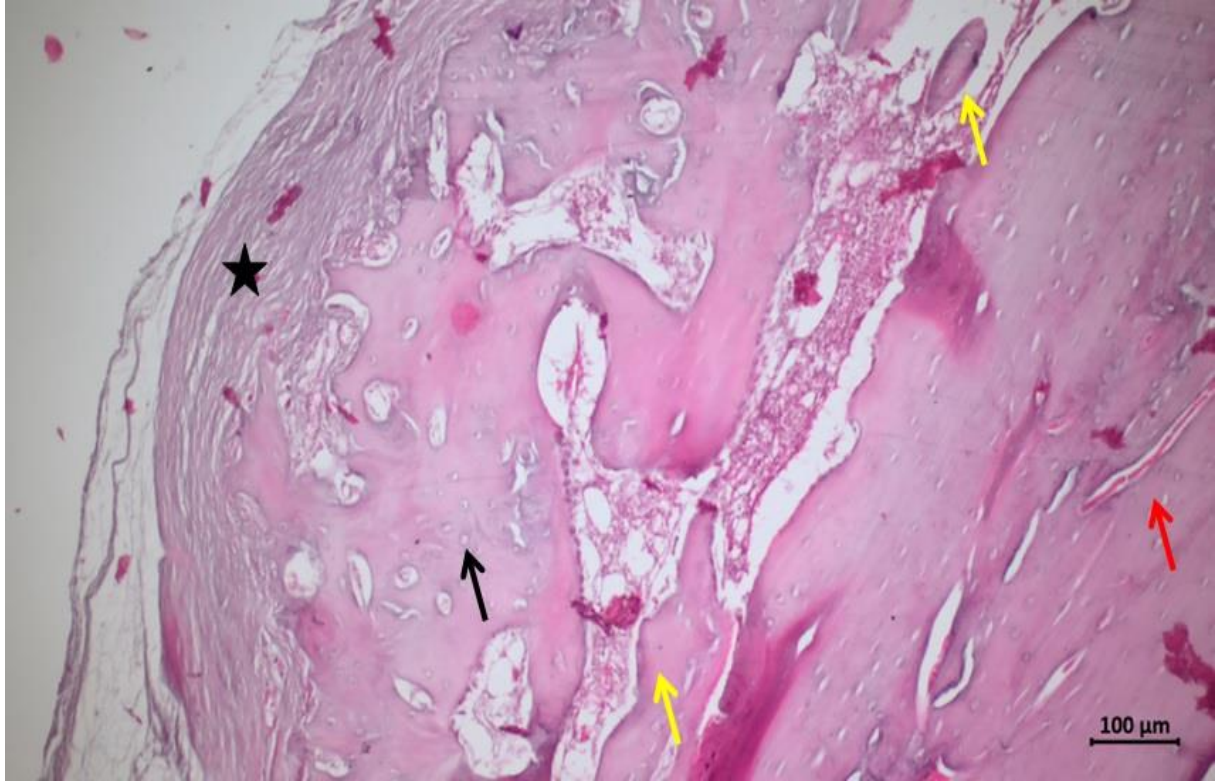
uygulandıktan sonra yara bölgesi dikildi. İkinci gruba ise 5 mm çapında olacak şekilde kalvaryal kemik defekti oluşturulduktan sonra defekte allogreft uygulanarak yara bölgesi dikildi ve 20 mg/kg olacak şekilde 14 gün boyunca oral yoldan gallik asit verildi. Uygulama sonunda sıçanlar sakrifiye edildi ve kalvaryal kemik çıkarıldı. Ardından alınan örnekler histopatolojik inceleme için hematoksilen eozin ile boyanarak ışık mikroskobu altında değerlendirildi.

2.2. Hematoksilen Eozin Boyama Protokolü

Ksilolün içerisinde deparafinize edilen parafin kesitler bu işlemin ardından azalan alkol serilerinden geçirildi ve daha sonra distile suyun içerisine alındı. Distile sudan alınan kesitler Harris hematoksilen solüsyonunda 8 dakika boyunca bekletildi. Daha sonra kesitler, 5 dakika akar suda bekletildi. Bu sayede dokuların üstünde bulunan fazla miktardaki hematoksilenin uzaklaştırılması sağlandı. Bu işlemin ardından kesitler zıt boyama için eozin solüsyonuna alındı ve burada 2 dakika boyunca bekletildi. Artan alkol serilerinden geçirilen kesitler daha sonra ksilolde bekletilerek şeffaflaşmaları sağlandı ve ardından entellan yardımıyla kapatılarak ışık mikroskobu altında incelendi.

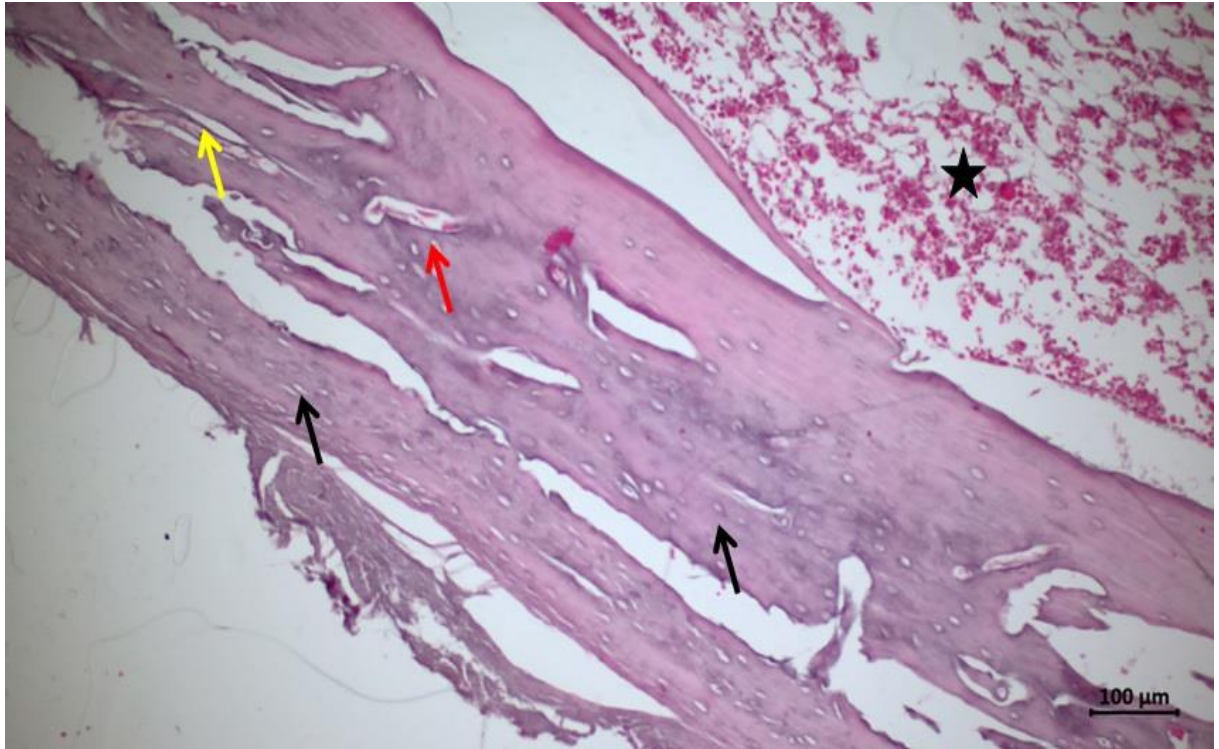
3. BULGULAR

Çalışmamızda, Defekt + greft grubu hematoksilen eozin boyamasında, defekt alanında kemik trabeküllerinde artış, periosteum da yoğun kollajen lif artışı, osteositlerde azalma ve vasküler dilatasyon izlendi (Şekil 1).



Şekil 1. Defekt + Greft grubu hematoksilen-eozin boyama görüntüsü.

Defekt + greft + GA grubu hematoksilen eozin boyamasında, defekt alanında, gallik asit tedavisi sonrası kemik trabeküllerinde birleşme, endosteumda yoğun kemik iliği, osteositlerde artış ve vasküler dilatasyonda azalma izlendi (Şekil 2).



Şekil 2. Defekt + greft + GA grubu hematoksilen-eozin boyama görüntüsü.

4. TARTIŞMA

Kişilerde bulunan konjenital defektler, oral veya maksillofasiyal bölgedeki cerrahi operasyonlar sonucu meydana gelen defektler, geçirilmiş travmalar sonucu ortaya çıkan defektlerin ortadan kaldırılması ve defekt oluşmuş olan bölgedeki kemik dokusunun rekonstrükte edilmesi son derece önemlidir. Boyutları sınırlı kemik defektlerinin kendiliğinden iyileşmeleri söz konusu iken boyutları geniş olan defektlerin iyileşebilmeleri için farklı biyomateryallerden yararlanılması gerekmektedir. Kemir greftleri bu maksatla en çok kullanılan biyomateryallerdendir. Kemik greftlerinin nasıl daha başarılı olabileceğini ve ossöz yapıya katılmalarının sağlanabileceğini anlayabilmek için çok sayıda çalışma yapılmıştır (13). Defektlerin iyileşmelerinin hızlandırılması ile birlikte oluşturulmuş olan greftin etkinliğinin artırılması için, son zamanlarda yapılan çalışmalarda sıklıkla bifosfonatlardan, lazer uygulamalarından, antibiyotiklerin etkinliğinden, ozon uygulamalarından ve trombosit zengin plazmadan yararlanıldığı görülmektedir (14).

Literatürde deneysel olarak oluşturulmuş olan kalvaryal kemik defektleri üzerinde yapılmış olan çalışmalarda farklı kemiklerin replasman materyallerinin etkinliği belirlenmeye çalışılmış ve bunların kemik otogreftleriyle birlikte üstün olan yanları ya da zayıf tarafları araştırılmıştır. Bahse konu araştırmalarda kullanılmış olan materyallerle kemiklerin iyileşmeleri ve yeni kemik oluşumları değerlendirilmiştir (15). Mokbel ve arkadaşları sıçanlar üzerinde yaptıkları çalışmada kalvaryal kemiklerde 8mm'lik defektler oluşturmuş ve bu defektlerin iyileştirilmesinde farklı greft materyallerinin iyileşme üzerindeki etkisini araştırmışlardır. Yapılan bu çalışma ile kullanılan materyalin kemik rejenerasyonuna etki ederek oluşan kemik miktarını arttırabildiği sonucuna varmışlardır (15).

Defektlerin iyileşebilmeleri için oluşturulmuş olan greftin etkinliğini arttırmak için, hangi etken maddelerin kullanılabileceği ile alakalı yapılmış çok sayıda çalışma vardır. Yapılan bir çalışmada kalsiyum sülfatla kombine bir şekilde uygulanan simvastatinin kemik rejenerasyonunun uyarılmasında etkili olup olmadığı incelenmiştir. Söz konusu çalışmada sıçan kalvarisinde kritik boyutlu olan kemik defektleri oluşturulmuş ve ardından bir gruba kalsiyum sülfat uygulanırken diğer gruba ise 1 mg simvastatinle birlikte kalsiyum sülfat kombinasyonu uygulanmış, böylelikle hayvanlar tedavi edilmeye çalışılmıştır. Yapılan incelemenin neticesinde simvastatin ve kalsiyum sülfattan oluşturulmuş olan kombinasyonun kemiklerde rejenerasyonu inflamatuvar cevaba rağmen uyardığı görülmüştür (16).

Gallik asitin en dikkat çekici özelliği antioksidan etkisidir. Bunun yanında gallik asidin çok farklı etkilerinin de olduğu yapılan çalışmalar ile ortaya konulmuştur. Gallik asidin,

antikanser, anti-HIV, antiülser, anti-inflammatuar, antimikrobial ve antifungal benzeri farmakolojik etkilerinin de olduğu yapılan çalışmalar ile tespit edilmiştir. Son zamanlarda yapılmış olan çalışmalar, gallik asidin Alzhemir hastalığının ilk evresinde görülen amyloid plaklara karşı etki gösterdiğini ortaya koyulmuştur (17). Gallik asidin serbest ve lipozom formlarının, kemik rejenerasyonuna katkıda bulunduğu ve bu sayede kalvarial kemiklerde oluşmuş olan yaraların iyileşmelerine yardım ettiği tespit edilmiştir (18). Çalışmamızda da gallik asidin greft atılmış olan kalvaryal kemiklerde rejenerasyona katkıda bulunduğu ve bu sayede kemiğin onarımına katkıda bulunduğunun tespit edilmesi, literatürdeki bu bilgiyi desteklemektedir.

5. SONUÇ

Çalışmamızda, kalyvaryal defekt sonrası greft uygulamasında, gallik asitin oluşan kemik patolojisini onardığı, kemik hücre ve matriksini arttırdığı ve kemik oluşumunu hızlandığı tespit edilmiştir. Bununla birlikte farklı canlı ve kemik türlerinde deneysel olarak oluşturulacak olan defektlere uygulanacak greftlerde de, gallik asidin etkinliğini görmek için yeni bilimsel çalışmaların yapılması son derece önemlidir.

REFERANSLAR

- 1- Ross, M.H., Romrell, L.J., Kaye., I.G. 1995. Histology A Text Atlas.Third Edition. Amerika: Williams & Wilkins.
- 2- Junqueira, L.C. and Carneiro, J. 2006. Temel Histoloji (Çeviri: Aytekin, Y., Solakoğlu, S.) İstanbul: Nobel Tıp Kitabevleri.
- 3- Sağlam, M., Aştı, R.N., Özer, A. 2001. Genel Histoloji (Genişletilmiş 6. Baskı) Ankara: Yorum Matbaacılık.
- 4- Tubbs, R.S., A.N. 2012. Bosmia, and A.A. Cohen-Gadol, The human calvaria: a review of embryology, anatomy, pathology, and molecular development. Childs Nerv Syst, 28(1): p. 23-31.
- 5- G.H.P., Anatomy of the head and neck. 1973. Philadelphia: WB. Saunders. 77.
- 6- Szpalski C, Barr J, Wetterau M, Saadeh PB, Warren SM. 2010. Cranial bone defects: Current and future strategies. Neurosurg Focus, 29(6): E8.
- 7- Kazancioglu HO, Ezirganli S, Aydin MS. 2013. Effects of laser and ozone therapies on bone healing in the calvarial defects. J Craniofac Surg, 24(6): 2141-2146.
- 8- Hsieh, S. C., Wu, C. C., Hsu, S. L. ve Yen, J. H. 2017. Molecular mechanisms of gallic acid-induced growth inhibition, apoptosis, and necrosis in hypertrophic scar fibroblasts, Life Sciences, 179, 130- 138.
- 9- Hudson, B. 1990. Food Antioxidants. J. Elsevier Science, 173-188.
- 10- Li ZJ, Liu M, Dawuti G, Dou Q, Ma Y, Liu HG, et al. 2017. Antifungal Activity of Gallic Acid In Vitro and In Vivo [Journal Article]. Phytother Res. 31(7): 1039–1045.
- 11- Teodoro GR, Ellepola K, Seneviratne CJ, Koga-Ito CY. 2015. Potential Use of Phenolic Acids as Anti-Candida Agents: A Review [Journal Article]. Front Microbiol. 6: 1420.
- 12- Zhu, X. F., Cao, Q. E., Yang, X. Q., Li, F., Wang, G. S. ve Ding, Z. T. 2009. Preparation and recognition mechanism of gallic acid imprinted polymers, Helvetica, 92(1), 78-87.
- 13- Simon M, Niehoff P, Kimmig B, Wiltfang J, Açıl Y. 2009. Expression profile and synthesis of different collagen types I, II, III, V of human gingival fibroblasts, osteoblasts and SaOS-2 cells after bisphosphonate treatment. Clin Oral Invest, 14(1): 51-58.
- 14- Marx RE, Carlson ER, Eichstaedt RM. 1998. Platelet-rich plasma growth factor enhancement for bone grafts. Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 85: 638–46.
- 15- Pryor ME, Susin C, Wikesjo UM. 2006. Validity of radiographic evaluations of bone formation in a rat calvaria osteotomy defect model. J Clin Periodontol, 33: 455–460.
- 16- Nyan, M., Sato, D., Oda, M., Machida, T., Kobayashi, H., Nakamura, T., & Kasugai, S. 2007. Bone formation with the combination of simvastatin and calcium sulfate in critical-sized rat calvarial defect. Journal of pharmacological sciences, 104(4), 384-386.
- 17- Fernandes, F. H. A. ve Salgado, H. R. N. 2016. Gallic Acid: Review of the Methods of Determination and Quantification. Critical Reviews in Analytical Chemistry, 46(3): 257-265.
- 18- Altan, A., Yuce, H., Karatas, O., Taskan, M., Gevrek, F., Çolak, S., & Akbulut, N. 2020. Free and liposome form of gallic acid improves calvarial bone wound healing in Wistar rats. Asian Pacific Journal of Tropical Biomedicine, 10(4), 156-156.

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Xülasə: Maliyyə sistemi kompleks bir quruluşa malikdir. Bu sistem banklar, sığorta şirkətləri, müştərək fondlar, maliyyə şirkətləri, investisiya bankları və qarşılıqlı fondlar kimi bir çox müxtəlif növ özəl sektor maliyyə institutlarından meydana gəlir. Maliyyə institutları, maliyyə bazarının işləməsini təmin edən qurumlardır. Bu institutların olmaması maliyyə bazarlarının vəsaitləri yığıcı edənlərdən məhsuldar investisiya imkanları olan insanlara köçürülə bilməməsi ilə nəticələnə bilər. Beləliklə, maliyyə institutları iqtisadiyyatda mühim rol oynayır.

Bəzən maliyyə sistemi maliyyə və qeyri maliyyə şirkətlərinin uğursuzluğu və aktivlərin qiymətlərindəki kəskin enişlə xarakterizə edilən maliyyə böhranlarını yaradır ki, buda maliyyə bazarında ciddi pozuntulara səbəb olur. Maliyyə böhranları yüz illərdir ki, kapitalist iqtisadiyyatlarının bir xüsusiyyəti kimi çıxış edib və adətən ardından ciddi iç böhranı gətirir. 2008-ci ildə başlayan maliyyə böhranları və eləcə də Covid-19 pandemiyasından sonra yenidən inkişaf edərək hələ də davam etməkdə olan böhranlar bu mövzunun aktuallığını qoruyur.

Bu məqsədlə də məqalədə maliyyə institutları və bu institutların fəaliyyətinə təsir edən xarici effektlərin təsiri araşdırılmışdır.

Açar sözlər: Maliyyə institutları, maliyyə böhranları, xarici effektlər, maliyyə bazarları

**THE IMPACT OF FINANCIAL CRISES ON THE ACTIVITIES OF FINANCIAL
INSTITUTIONS**

Summary: The financial system has a complex structure. This system consists of many different types of private sector financial institutions such as banks, insurance companies, mutual funds, finance companies, investment banks and mutual funds. Financial institutions are institutions that ensure the functioning of the financial market. The absence of these institutions could result in financial markets failing to transfer funds from hoarders to people with productive investment opportunities. Thus, financial institutions play an important role in the economy.

Sometimes the financial system creates financial crises, characterized by the failure of financial and non-financial companies and sharp declines in asset prices, which cause serious disruptions in the financial market. Financial crises have been a feature of capitalist economies for hundreds of years and are usually followed by a serious internal crisis. The financial crises that started in 2008, as well as the crises that have redeveloped after the Covid-19 pandemic and are still ongoing, maintain the relevance of this topic.

For this purpose, the article examines financial institutions and the influence of external effects affecting the activities of these institutions.

Keywords: Financial institutions, financial crises, external effects, financial markets

Giriş

İqtisadçılar maliyyə böhranlarının üç əsas növünü fərqləndirirlər: valyuta böhranı (buna pul böhranı da deyirlər), borc böhranı və sistematik bank böhranı. Bəzən bu siyahıya dördüncü də əlavə olunur – “qəfil dayanma” (sudden stop) effekti.

Valyuta böhranı – iqtisadiyyatda xarici valyutaya tələbin kəskin artması nəticəsində yaranan stress vəziyyəti kimi izah edilir. Əlbəttə, hər tələb artımı böhran anlamına gəlmir. Xarici valyutaya “axın” baş verdiyi halda, o zaman 2 valyuta böhranı diaqnozu qoyulur.

Borc böhranı - ölkənin öz xarici və ya daxili borclarını ödəmək iqtidarında olmadığı (və ya ödəmək istəmədiyi) vəziyyəti ifadə edir. Uyğun olaraq, birinci hal xarici borc böhranı, ikincisi isə daxili borc böhranı adlanır. Xarici borc böhranı həm dövlət borcu, həm də özəl sektor borclarının ödənməməsi ilə bağlı ola bilər. Daxili borc böhranı isə, əsasən dövlətin öz daxili fiskal öhdəliklərini yerinə yetirə bilməməsi və ya açıq-aşkar ödəməməsi, borcunu azaltmaq üçün inflyasiya və ya yerli valyutanın ucuzlaşdırılması, həmçinin maliyyə repressiyasının digər formalarından istifadə etməsi kimi izah olunur.

“Qəfil dayanma” effektinə gəlincə, burada söhbət ölkəyə xaricdən kapital axınının qəfil dayanması və bunun iqtisadiyyata – həm maliyyə bazarlarına, həm də birbaşa real sektora – neqativ təsirlərindən gedir. “Qəfil dayanma”nın ilk neqativ təsiri valyuta bazarında hiss olunur ki, bu təsirlər valyuta böhranı əlamətləri ilə üst-üstə düşür. Bu səbəbdən bir çox iqtisadçılar ölkəyə xarici kapital girişlərinin dayanmasının yaratdığı effekti ayrıca böhran növü kimi yox, valyuta böhranının bir forması kimi qeyd edirlər. Ancaq “qəfil dayanma”, digər səbəblərdən ortaya çıxan valyuta böhranlarından fərqli olaraq real sektora daha tez təsir edə bilər.

Həmçinin, nəzəri olaraq, “qəfil dayanma”nın maliyyə və real sektorlarına təsiri ölkəyə gələn xarici investisiyaların hansı hissəsinin maliyyə vəsaiti, hansı hissəsinin avandlıq şəklində olmasından birbaşa asılıdır. Əgər vəsaitlər ölkəyə, əsasən avadanlıq şəklində gətirilsə, “dayanma” ilk növbədə real sektorda buraxılışın həcmənin azalması ilə müşayiət olunacaq, yox əgər pul şəklində gətirilsə, təbii ki, bunun təsiri ilk növbədə valyuta bazarında hiss olunacaq. Təcrübədə “qəfil dayanma”, əsasən valyuta böhranı kimi təzahür etdiyindən (məsələn, 1994-cü ildəki Meksika peso böhranı – digər adı ilə “tekila böhranı”) buradakı təhlillərdə ayrıca böhran tipi kimi nəzərdən keçirilməmişdir.

Maliyyə institutları və bazarları bir-biri ilə sıx bağlı olduğundan bir çox hallarda maliyyə böhranının iki, bəzənsə hətta üç növü də eyni anda müşahidə olunur. Məsələn, valyuta böhranı bank sektorunun balansına mənfi təsir etməklə valyuta-bank, dövlət borcunu (əsasən xarici borcu) kəskin şəkildə artırmaqla valyuta-borc böhranlarına və ya bank sektorunun balansına

və dövlət borcunun 4 dayanıqlılığına eyni vaxtda təsir etməklə valyuta-bank-borc böhranına səbəb ola bilər.

Cədvəl 1. Bank böhranlarının iqtisadi nəticələri (1970-2011-ci illər)

Ölkə qrupları	Böhran itkiləri	Borc yükünün artması	Monetar ekspansiya	Fiskal xərclər	Fiskal xərclər	Böhranın davam etmə müddəti	Banklara likvidlik dəstəyi	QİK* pik səviyyəsi
	ÜDM-in %-i				Maliyyə sistemi aktivlərinin %-i	il	Depozit və xarici öhdəliklərin %-i	Məcmu kreditlərin %-i
Bütün ölkələr	23	12,1	1,7	6,8	12,7	2	9,6	25,0
İEÖ	32	21,4	8,3	3,8	2,1	3	5,7	4,0
Formalaşmada olan bazar ölkələri (FBÖ)	26	9,1	1,3	10	21,4	2	11,1	30,0
İEOÖ	1,6	10,9	1,2	10	18,3	1	12,3	37,5

Mənbə: Luc Laeven and Fabián Valencia “Systemic Banking Crisis Database: An Update”, International Monetary Fund WP /12/163. 2012. P.17.

*Qeyd: QİK – qeyri-işlək kreditləri ifadə edir.

Geridə qalan 40 ildən artıq bir müddətdə baş vermiş bank böhranlarının digər vacib iqtisadi nəticəsi iqtisadiyyatın borc yükünün artması olmuşdur. Burada da ən çox təsirlənən İEÖ olmuşdur. Qeyd olunan dövrdə bank böhranları nəticəsində İEÖ-in borc yükü ÜDM-in 21.4%-i , İEOÖ-də 10.9%-i, FBÖ-də 9.1%-i qədər olmaqla, ümumilikdə bütün bank böhranları müşahidə olunan ölkələrdə ÜDM-in 12.1%-i qədər artmışdır. İnkişaf səviyyəsinə görə müxtəlif ölkə qrupları bank böhranları zamanı istifadə olunan tənzimləmə alətlərinə görə də bir-birindən fərqlənir. Belə ki, bank sektorundakı maliyyə stressini neytrallaşdırmaq üçün İEÖ daha çox monetar genişlənmədən istifadə etdiyi halda, FBÖ və İEOÖ vəziyyəti, əsasən fiskal xərclər vasitəsilə nəzarət altına almağa çalışmışlar. Həmçinin, qeyd olunan ölkə qrupları arasında böhran zamanı banklara likvidlik dəstəyinin həcmində də əhəmiyyətli fərqlər müşahidə olunmuşdur. Böhran zamanı banklara ən az likvidlik dəstəyi İEÖ-də, ən çoxu isə

İEOÖ-də göstərilmişdir. Banklara göstərilən likvidlik dəstəyinin depozit və xarici öhdəliklərə nisbəti İEOÖ-də 12.3%, FBÖ-də 11.1%, İEO-də isə cəmisi 5.7% təşkil etmişdir.

Sözsüz ki, təhlil olunan dövrdə həm əhatə dairəsinə, həm də dərinliyinə görə ən güclü maliyyə böhranı 2008-2009-cu illərdə müşahidə edilən qlobal maliyyə böhranı olmuşdur. Maliyyə sarsıntılarının nəticəsində böhranın episentridə (ABŞ-da) 400-ə yaxın bank müflisləşmişdir. Ümumilikdə böhranın ən kəskin fazasından bugünə qədər keçən dövrdə (2009-2015-ci illərdə) ABŞ-da 488 bank müflis elan olunmuşdur. Təbii ki, sözügedən ölkədə son iki-üç ildə müflisləşmələrin sayı kəskin şəkildə azalmışdır və qeydə alınan iflas faktları daha çox bazarın normal dövrdəki iş mexanizminin nəticəsi kimi ortaya çıxmışdır.

2007-ci ilin ikinci yarısında ABŞ-da başlayan və dünyanın əksər ölkələrində yayılan Qlobal Maliyyə böhranı 2008-2009-cu illərdə ABŞ-da, Avropa və Asiya ölkələrində dərinləşən maliyyə böhranına gətirib çıxarmışdır. Daşınmaz əmlak köpüyünün artan təhlükəsini əvvəlcədən görə bilməmə və dövlətlər arasında qeyri-müəyyənlik qlobal böhranı daha da dərinləşdirdi. Böhranın dərinləşməsi nəticəsində dünyanın qabaqcıl sənaye müəssisələri, avtomobil şirkətləri istehsal həcmi kəskin dərəcədə azaltmış və ya dayandırmışlar, inkişaf etmiş ölkələrin maliyyə-bank sistemlərini sarsıtmış, iri banklar iflasa uğramışlar və bəzi ölkələrdə isə bankların milliləşdirilməsinə səbəb olmuşdur. Böhran qlobal səviyyədə investorlara böyük itkilərlə-trilyon dollarla başa gəldi və milyonlarla iş yerləri itirildi. Qlobal maliyyə böhranının yaratdığı çətinliklər inkişaf etmiş ölkələrin iqtisadiyyatının real sektoruna ciddi təsir göstərməklə, iqtisadi artım templərinin aşağı düşməsinə və nəticə etibarilə dünya iqtisadi artım tempinin enməsinə səbəb olmuşdur.

Bank müflisləşmələri təkcə ABŞ-da yox, digər inkişaf etmiş və inkişaf etməkdə olan ölkələrdə, o cümlədən tranzitiv iqtisadiyyatlarda da müşahidə edilmişdir - böhran, ticarət, maliyyə və psixoloji kanallarla bütün dünya iqtisadiyyatına yayılmışdır. 2009-2015-ci illərdə Rusiyada 385 bankın lisenziyası ləğv olunmuşdur. Onlardan 166-sı son siyasi-iqtisadi çalxantılar dövrünə (2014-2015-ci illərə) təsadüf edir ki, bu həm sanksiyalar, həm də neft qiymətindəki kəskin azalma nəticəsində Rusiya iqtisadiyyatının, eyni zamanda bank sisteminin üzleşdiyi çətinliyin miqyasını ifadə edir.

Gürcüstanda 2008-2009-cu illərdə kommersiya banklarının sayı 22-dən 19- a düşmüş, qlobal böhranın təsiri keçdikdən sonra, 2013-cü ildə ölkədə bankların sayı 21-ə yüksəlmişdir. ABŞ dollarının bahalaşma dalğası və Rusiya iqtisadiyyatındakı böhranın təsiri ilə 2015-ci ildə Gürcüstan bank sistemi müəyyən çətinliklərlə üzleşmişdir. Nəticədə cari ildə Gürcüstanda 2

bankın lisenziyası ləğv edilmişdir və hazırda ölkədə 19 kommersiya bankı fəaliyyət göstərməkdədir.

Qazaxıstanda da bənzər proseslər müşahidə olunmaqdadır. Gürcüstandan fərqli olaraq, Qazaxıstan həm də neftlə zəngin ölkə olduğundan onun iqtisadiyyatı regional böhranın digər amilləri (xüsusilə, Rusiya böhranı) ilə yanaşı, həm də neft qiyməti şokundan da təsirlənmişdir. Cari ildə Qazaxıstanda 1 bankın lisenziyası ləğv edilmiş və kommersiya banklarının sayı 38-dən 37-ə düşmüşdür. Eyni zamanda, digər banklar ciddi likvidlik və kredit riskləri ilə üzləşmişlər.

Azərbaycana gəlincə, burada istər 2008-2009-cu illər qlobal maliyyə böhranı, istərsə də 2014-cü ilin sonuncu rübündən başlayan, hazırda da davam edən proseslər (neft qiymətindəki kəskin azalma, valyuta bazarında turbulens, əsas qeyri-neft ixrac partnyoru, həmçinin ölkəyə pul transfertlərinin başlıca mənbəyi olan Rusiya iqtisadiyyatındakı maliyyə-iqtisadi böhran) bank sistemində müəyyən çətinliklər yaratsa da, ciddi sarsıntılara səbəb olmamışdır.

Bu böhranlı vəziyyətdən Azərbaycan dünya iqtisadiyyatının ayrılmaz hissəsi kimi minimum itkilərlə çıxıb bilmişdir. 2009-cu və 2010-cu illərin sosial-iqtisadi yekunları göstərdi ki, uğurla həyata keçirilən qabaqlayıcı tədbirlər sayəsində Azərbaycan iqtisadiyyatı qlobal böhrana yüksək dayanıqlıq nümayiş etdirərək artım dinamikasını və əldə olunmuş sosial inkişaf səviyyəsini qoruyub saxlamışdır. Ölkədə gerçəkləşdirilən antiböhran siyasəti maliyyə sabitliyinin qorunmasında etibarlı zəmin yaratmışdır. Beynəlxalq Valyuta Fondunun məlumatlarına əsasən, 2009-cu ildə dünya iqtisadiyyatının artımı 1,1 faiz səviyyəsinə enməsi, ticarət dövriyyəsinin isə 11 faizdən çox azalması fonunda Azərbaycanda ümumi daxili məhsulun 9,3 faizlik, iqtisadiyyatımızın 5 faizlik artımı ilk növbədə, həyata keçirilən səmərəli iqtisadi siyasətin nəticəsidir. Böhranlı 2008 -2010-cu illərdə iqtisadiyyatımız 25,8 faiz artmış, son 7 ildə isə ümumi daxili məhsul 3 dəfə artmışdır, bu da ölkə iqtisadiyyatının maliyyə likvidliyi problemləri ilə üzləşmədiyini göstərir. Böhranlı illərə baxmayaraq, 2009-cu ildə əhalinin pul gəlirlərinin artım tempi 10%, 2010-cu ildə isə 13,3 faiz olduğu bir şəraitdə inflyasiya aşağı səviyyədə olmuş, real artım tempi müvafiq olaraq 8,5 və 7,6 faiz təşkil etmişdir. Böhranlı il üçün bu artım inkişaf etmiş və inkişaf etməkdə olan ölkələr arasında fərqli bir göstəricidir. Bir sözlə ölkə İqtisadiyyatı qlobal maliyyə böhranın mənfə təsirlərindən qorunmuş və yüksək valyuta ehtiyatları hesabına maliyyə dayanıqlığı təmin edilmiş, ölkənin makroiqtisadi sabitliyi qorunub saxlanmışdır. MDB ölkələrinin bütün mərkəzi banklarından milli valyutanın dollara qarşı qəti müəyyən edilmiş (fiksasiya edilmiş) məzənnəsini qoruyub saxlamağa tək cə Azərbaycanın Mərkəzi Bankı müyəssər oldu.

Azərbaycan Prezidenti İlham Əliyevin sədrliyi ilə Nazirlər Kabinetinin 2015-ci ilin sosial-iqtisadi inkişafının yekunlarına və qarşıda duran vəzifələrə həsr olunan iclasda göstərdiyi kimi 2015-ci ildə Azərbaycan iqtisadiyyatı inkişaf etmişdir. Bu da çox müsbət haldır. Əlbəttə ki, əvvəlki illərdə olan inkişaf əldə edilməmişdir. Bu da mümkün deyildi. Çünki qeyd etdiyimiz kimi, neftin qiyməti 3-4 dəfə aşağı düşmüşdür. Manatın məzənnəsi devalvasiyaya uğramışdır. Bu da qaçılmaz idi. Çünki neftin qiymətinin 3-- 4 dəfə aşağı düşməsi imkan vermirdi ki, manatın məzənnəsi əvvəlki səviyyədə qalsın”.

Azərbaycanın xarici dünya ilə ticarət əlaqələrinin gedişatı valyuta siyasətində ciddi dəyişiklik edilməsinə zərurət yaratmışdır. Statistik məlumatların təhlili göstərir ki, xarici ticarət əlaqələri mürəkkəb bir şəraitdə cəryan edir. Belə ki, 2011- ci ilin statistikasına əsasən, xarici ticarət dövriyyəsi özündən əvvəlki ilə nisbətən 103,9 təşkil etdiyi halda, 2012- ci ildə 89,3; 2013- cü ildə 106,3; 2014-cü ildə isə 94,1 faiz təşkil etmişdir. İxrac əməliyyatları müvafiq dövrdə 145,3; 96,9; 109,1; 85,4; idxal əməliyyatları isə müvafiq olaraq 88,7; 86,2; 105,1; 98 faiz təşkil etmişdir. 2014- cü ildə ixarc olunan malların içərisində neft- qaz məhsullarının payı 91,97 faiz olmuşdur. Qeyri- neft sektorunun payı isə 8,03 faizdir.

Mərkəzi bankın məlumatlarına görə, tədiyə balansı 2014-cü ildə xarici iqtisadi əməliyyatlarda neft- qaz sektoru üzrə müsbət, qeyri- neft sektoru üzrə isə mənfi saldolmuşdur. Tədiyə balansının ümumi saldosu (ölkənin ehtiyat aktivlərinin dəyişməsi) müsbət 4194,2 milyon dollar olmuşdur.

2015-ci ilin 9 ayı ərzində isə xarici iqtisadi əməliyyatlarda 9141,2 milyon dollar mənfi saldo yaranmışdır. Bütün bunlar xarici ticarət əlaqələrinin mühüm tənzimlənmə vasitəsi kimi valyuta siyasətində dəyişiklik edilməsinə, yəni devalvasiya siyasətinin tətbiq edilməsinə ehtiyac yaratmışdır. Onlarla banklar fəaliyyətini dayandırmışdır. Azərbaycanda 2015-ci il devalvasiyasından sonra bankların sayı yarımçıq azalıb: “Devalvasiyadan öncə ölkədə 44 bank fəaliyyət göstərirdi. Milli valyutanın iki dəfə dəyər itirməsindən sonra onların bir çoxu müflisləşdi. Hazırda Azərbaycanda lisenziyalı 25 bank fəaliyyət göstərir. Mərkəzi Bankın bəyanatlarına baxsaq, qalan bankların kifayət qədər etibarlı olduğuna dair gözlənti var.

Dünyada iqtisadi böhrana səbəb ola biləcək ən böyük faktorlardan biri də pandemiya. Yaxın keçmişdə Covid-19 pandemiyası dünya iqtisadiyyatına da olduqca böyük ziyan vurub. Ölkələrin iqtisadiyyatı böyük tənəzzüllə üz-üzə qalıb. Bir çox ölkənin iqtisadi inkişafı geriləyib, işsizliyin sayı artıb. Koronavirus pandemiyası insanların sağlamlığına təhlükə yaratmaqla yanaşı, tarixin ən böyük iqtisadi böhranını da bizə yaşatmışdır. Bu böhran turizm, geyim, avtomobil sənayesi, xidmət sahəsi, enerji sektoru və digər bir çox sahəyə təsir edib.

Nəticədə aviasiya şirkətlərindən tutmuş geyim istehsalçılarına, enerji şirkətlərinə qədər, bütün sektorlar çətinliklə üzləşib. Artıq bir çox şirkət müflis olduğunu, bir çoxu isə gəlirlərinin azalması səbəbindən işçilərini ixtisar etdiyini açıqlamışdır.

Tarix bizə göstərir ki, böhranlar daim yaşanacaqdır. Bir neçə gün əvvəl, "Silicon Valley Bank"ın (SVB) ardınca Nyu-Yorkda yerləşən Signature Banka da qayyum təyin edilib. "Signature Bank"-in 31 dekabr 2022-ci il tarixinə təxminən 110,4 milyard dollar aktivi və təxminən 88,6 milyard dollar depoziti var və bank ABS Federal Əmanətlərin Sığortalanması Korporasiyasında (FDIC) sığortalıdır.

ABŞ-da "Silicon Vadisi Bankı"nın müflisləşməsinin əsas səbəbi kimi, uçot dərəcəsinin artırılması göstərilir. Son illər ABŞ-da inflyasiya kəskin artıb. Bu durumda isə uçot dərəcəsinə artırmaq mərkəzi bankların tətbiq etdiyi əsas mexanizmdir. Belə olduğu halda da kredit faizləri yüksəlir və iqtisadi aktivlik aşağı düşür.

Faiz dərəcələrinin artması daha çox texnoloji şirkətlərlə işləyən "Silicon Vadisi Bankı"nın bahalı kredit götürmək istəməyən müştərilərinin pula olan ehtiyaclarını ödəmək üçün bankdan öz depozitlərini çıxarmaqla nəticələnib. Beləliklə bank müflis olub.

Azərbaycanda banklar "Silicon Vadisi Bankı" kimi məhdud sektor üzrə fəaliyyət göstərirlər. Başqa sözlə, bankların gəlirlərinin əsas hissəsini xüsusən vətəndaşlara verilən istehlak kredit faizləri təşkil edir. Kredit faizlərinin yüksəlməsi və iqtisadi aktivliyin aşağı düşməsi bankları əsas gəlir pəncərəsindən məhrum edir.

Qeyd edək ki, SVB bu il iflas edən ilk FDIC sığortalı qurum idi. Kaliforniyada yerləşən SVB 21 milyard dollarlıq istiqraz mövqeyini təxminən 1,8 milyard dolla itki ilə bağladıqdan və 2 milyard dollardan çox kapital cəlb edəcəyini elan etdikdən sonra səhm qiyməti 60 faizdən çox düşdü. Bəzi vençur kapitalı investorları şirkətlərə pullarını bankdan çıxarmağı tövsiyə etdikdən sonra bank itirməkdə davam etdiyi üçün onun fəaliyyəti dayandırıldı. FDIC martın 10-da SVB-yə müvəkkil təyin edildiyini açıqlasa da, bu, bazarlarda enişə səbəb oldu və SVB-nin bu il iflas edən ilk FDIC sığortalı qurum olduğu qeyd edildi. SVB-nin iflası 200-ci il qlobal maliyyə böhranından sonra ABŞ-da qeydə alınan ən böyük iflaslarda biri idi.

Bundan başqa, ən böyük iflas 2008-ci il böhranı zamanı Washington Mutual şirkətindən yaşanıb. Martın 13-ü "Signature Bank" üçün oxşar sistem risk vəziyyətini elan edilib.

Cədvəl 2. Azərbaycan Respublikası Mərkəzi Bankının 2015-2023-cü illər uçot faiz dərəcəsi

Tarix	Dəyər
2023	8,75%
2022	7,88%
2021	6,92%
2020	6,89%
2019	9,57%
2018	10,93%
2017	15%
2016	8,7%
2015	3%

Qeyd: Bəzi illərin uçot faiz dərəcəsi aylıq dəyişdiyi üçün illik hesablamada orta dəyər tapılmışdır.

Azərbaycan Respublikası Mərkəzi Bankının İdarə Heyətinin qərarı ilə uçot dərəcəsi 0.25 faiz bəndi artırılaraq 9%-ə, faiz dəhlizinin aşağı həddi 0.5 faiz bəndi artırılaraq 7.5%-ə, faiz dəhlizinin yuxarı həddi isə 0.25 faiz bəndi artırılaraq 10%-ə qaldırılmışdır.

Bu qərar daxili və xarici mühitdə inflyasiya proseslərinə təsir göstərən amillərin dəyişimi və yenilənmiş makroiqtisadi proqnozlar nəzərə alınmaqla verilmişdir.

İdarə Heyətinin pul siyasətinə həsr edilmiş ötən iclasından bəri illik inflyasiya tempi azalmışdır. Mart ayında illik inflyasiya 13.6% təşkil etmişdir ki, bu da ötən ilin sentyabr ayında qeydə alınmış pik səviyyə ilə müqayisədə 2 faiz bəndi aşağıdır. Qlobal iqtisadi aktivliyin azalmasının, əksər ölkələrdə pul siyasətinin sərtləşdirilməsinin və dünya əmtəə qiymətlərində aşağı düşmə meylinin təsiri ilə əsas ticarət tərəfdaşlarında faktiki inflyasiya nisbətən səngimişdir. Dünya Bankının əmtəə bazarları haqqında aprel hesabatına əsasən martda aylıq əsasda enerji qiymətləri 6.3%, qeyri-enerji qiymətləri 2.2% azalmışdır. BMT-nin Ərzaq və Kənd Təsərrüfatı Təşkilatının (FAO) məlumatına görə dünya ərzaq qiymətləri indeksi 2023-cü ilin martında aylıq 2.1% azalmışdır. Tədiyə balansının cari əməliyyatlar hesabının profisitli olması qiymət sabitliyinin əsas lövbəri olan məzənnə sabitliyini

dəstəkləyir. Əsas ixrac əmtələri üzrə dünya qiymətlərinin əlverişli qalması və qeyri neft-qaz ixracının artımı cari əməliyyatlar hesabının ilin sonuna da profisitli olacağını gözləməyə əsas verir. Bu özünü valyuta bazarında da göstərir. Belə ki, 2023-cü ilin 4 ayında valyuta hərəraclarının 97%-də təklif tələbi üstələmişdir. Manatın nominal effektiv məzənnəsinin möhkəmlənməkdə davam etməsi inflyasiyanın xarici amillərinə azaldıcı təsir edir. Manatın nominal effektiv məzənnəsi 2022-ci ildə 8.4%, 2023-cü ilin 4 ayında 4.8% möhkəmlənmişdir. Bununla bərabər, monetar şəraitə dair qəbul edilmiş qərarlar da inflyasiyanın tələb amillərini məhdudlaşdırır.

Qlobal və milli iqtisadiyyatda inflyasiya amillərilə bağlı yüksək qeyri-müəyyənliklər qalır. Faktiki inflyasiya səviyyəsi azalmaya meyil etsə də mart ayında inflyasiya hədəfinin yuxarı həddini 2 dəfədən çox üstələmişdir.

Nəticə

Bütün bu bənzərliklər hazırki dövrün yeni uzun dalğanın ilkin mərhələsi – yüksəliş dövrünün başlanğıcı ola biləcəyini düşünməyə əsas verir. Yəni, son bir neçə ildəki qlobal, regional və lokal xarakterli maliyyə-iqtisadi böhranlar heç də mövcud sistemin çökməsi deyil, əksinə özü-özünü yeniləməsi və yeni yüksəliş dalğası üçün starta hazırlaşması kimi qiymətləndirilə bilər. Yüksəlişin nə dərəcədə uğurlu alınması isə bazarın “yaradıcı məhvetmə” fəaliyyətinin nə qədər az kənar müdaxilə ilə gerçəkləşməsindən asılı olacaq. Ona görə də qarşıdakı illər üzrə bütün mənfi təsirlərin qarşısını almaq üçün Mərkəzi bankın nəzarət və tənzimləmə prioritetləri aşağıda kimi həyata keçirilməlidir :

- Bank sisteminin dayanıqlığının təmin edilməsi
- Kapital və likvidlik tələblərinin Bazel III-ə uyğunlaşdırılması
- Korporativ idarəetmə, risk idarəetməsi və daxili nəzarət funksiyasının gücləndirilməsi
- Nəzarət hesabatlığının təkmilləşdirilməsi, yeni texnoloji imkanların tətbiqi və s.

Ədəbiyyat siyahısı

1. Azərbaycan Respublikasının Konstitusiyası
2. Azərbaycan Respublikasının "Bank Haqqında" qanunu. 04.03.2005
3. Bağırzadə Elşən, "İqtisadi Yazılar". Bakı 2020
4. Bəyalı Ataşov. "Maliyyə bazarları" dərslik. Bakı 2016 6. Z.F.Məmmədov. "Maliyyə bazarının müasir vəziyyəti". Bakı 2014.
5. Hacızadə Elşən. "Dünya iqtisadiyyatı və Azərbaycan". Bakı 2018
6. Məhərrəmov Amil, Aslanov Həbil. "Xarici iqtisadi fəaliyyətin tənzimlənməsi". Bakı 2008
7. K.V.Rudiy "Xarici ölkələrin pul, maliyyə və kredit sistemləri.
8. Charles P, Robert Aliber. Manias, Panikalar və Qəzalar: Maliyyə Böhranlarının Tarixi Tarixi (Wiley İnvestisiya Klassikləri). 2005.
9. Mişkin. "Pul, bank və maliyyə bazarları iqtisadiyyatı
10. <https://az.wikipedia.org/wiki/Maliyy%C9%99>".
11. https://az.wikipedia.org/wiki/1907-ci_il_panikas%C4%B1
12. <https://banker.az/ensiklopedia/bank-panikasi-n%C9%99>
13. <https://teleqraf.com/news/iqtisadiyyat/372096.html>
14. Azərbaycan Respublikası Mərkəzi Bankı. <https://www.cbar.az/>
15. Azərbaycan Respublikasının Dövlət Stistika Komitəsi. www.stat.gov.az

**KESİRLERDE SIRALAMA VE KARŞILAŞTIRMA KONUSUNDA GEOGEBRA
YAZILIMININ AKADEMİK BAŞARIYA ETKİSİ**

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ÖZET

Bu araştırmada İlkokul 4. Sınıf Matematik dersi, kesirlerde sıralama ve karşılaştırma konusunun öğretiminde Millî Eğitim Bakanlığı Talim Terbiye Kurulunun (TTKB) öğretim yöntem teknikleri ve teknolojik uygulama materyali olan Geogebra yazılımı ile yapılan öğretimin, öğrencilerin akademik başarılarına etkisi araştırılmıştır. Araştırmanın modeli ön test- son test kontrol gruplu deneysel araştırma modelidir. Araştırmanın örneklemini 2022-2023 Eğitim-Öğretim yılında Sivas ili Koyulhisar ilçesinde bir ilkokulda 4.Sınıfta eğitim gören 12 öğrenci ve Amasya ili Göynücek ilçesinde bir ilkokulda 4. Sınıfta eğitim gören 12 öğrenci oluşturmaktadır. Örneklem seçiminde araştırmaya hız ve pratiklik kazandırması açısından Kolay Ulaşılabilir Örneklem Yöntemi kullanılmıştır. Her iki gruba araştırma öncesinde Millî Eğitim Bakanlığı'nın yardımcı kaynaklarında bulunan geçerliliği ve güvenilirliği test edilmiş çoktan seçmeli 10 adet sorudan oluşan ön test uygulanmıştır. Ön test sonucunda aritmetik puan ortalaması diğer gruba göre düşük olan grup deney grubu, aritmetik puan ortalaması yüksek olan grup kontrol grubu olarak belirlenmiştir. Kontrol grubunda Millî Eğitim Bakanlığı Talim Terbiye Kurulunun (TTKB) müfredatına uygun olarak ve bu müfredatın yöntem teknikleri kullanılarak öğretim devam etmiştir. Deney grubunda teknolojik uygulama materyali Geogebra yazılımı kullanılarak araştırma yürütülmüştür. Öğretim sonunda ise deney ve kontrol gruplarına son test uygulanmıştır. Ön Test ve Son Testlerden elde edilen verilerin karşılaştırılması için İlişkili Örneklem t- Testi ve Mann Whitney U testi uygulanmıştır. Araştırma verilerinin analizinde SPSS 20.0 istatistik paket programı kullanılmıştır. Araştırmanın sonucunda, Teknolojik Uygulama Materyali Geogebra yazılımı kullanılarak öğretimin yapıldığı deney grubuyla, müfredata uygun olarak öğretimin yapıldığı kontrol grubu başarı puanları arasında deney grubu lehine anlamlı bir fark ortaya çıkmıştır ($p<0,05$). Bu sonuca göre Teknolojik uygulama materyali Geogebra yazılımı kullanılarak yapılan öğretimin öğrencilerin akademik başarılarına olumlu katkıda bulunduğu söylenebilir. Bu materyal ve yazılımların matematik derslerinde daha çok uygulanması önerilebilir.

Anahtar Kelimeler: Matematik, Kesirler, Sıralama, Karşılaştırma, Teknolojik materyal, Geogebra

**EFFECT OF GEOGEBRA SOFTWARE ON STUDENTS' ACADEMIC
ACHIEVEMENT ON ORDERING AND COMPARISON OF FRACTIONS**

ABSTRACT

In this study, the effect of teaching with Geogebra software, which is the teaching method techniques of the Board of Education of the Ministry of National Education (TTKB) and technological application material, on the academic achievement of the students in teaching the 4th-grade mathematics lesson, ordering and comparison in fractions was investigated. The research model is an experimental research model with a pretest-posttest control group. The sample of the research consists of 12 students studying in the 4th grade in a primary school in the Koyulhisar district of Sivas province and 12 students studying in the 4th grade in a primary school in Göynücek district of Amasya province in the 2022-2023 academic year. In the selection of the sample, the Convenience Sampling Method was used in order to provide speed and practicality to the research. Both groups were administered a pre-test consisting of 10 multiple-choice questions whose validity and reliability were tested in the auxiliary resources of the Ministry of National Education before the research. As a result of the pre-test, the group with a lower mean arithmetic score compared to the other group was determined as the experimental group, and the group with a higher mean arithmetic score was determined as the control group. In the control group, teaching continued in accordance with the curriculum of the Board of Education of the Ministry of National Education (TTKB) and using the methods and techniques of this curriculum. In the experimental group, the research was conducted using the technological application material Geogebra software. At the end of the instruction, a post-test was applied to the experimental and control groups. Paired Samples t-test and Mann Whitney U test were applied to compare the data obtained from the pretest and posttest. SPSS 20.0 statistical program was used to analyze the research data. As a result of the research, there was a significant difference in favor of the experimental group between the achievement scores of the experimental group, which was taught using the Technological Application Material Geogebra software, and the control group, which was taught in accordance with the curriculum ($p < 0.05$). According to this result, it can be said that teaching using the technological application material Geogebra software contributed positively to students' academic achievement. It can be suggested that these materials and software should be applied more in mathematics lessons.

Keywords: Mathematics, Fractions, Ordering, Comparison, Technological material, Geogebra

1. GİRİŞ

Matematik; insanların dünyayı anlamasına ve belirli bir dil aracılığıyla kendilerini ifade etmesine yarayan güçlü bir araçtır. Günlük hayatta karşılaşılan problemleri çözmek ve daha verimli bir şekilde kaynakları kullanmak için matematiksel yöntemlere ihtiyaç duyulmaktadır. Ünlü matematikçi David Hilbert, 1930 yılında Paris'te yaptığı bir konuşmada matematiği "bilimin kraliçesi" olarak nitelendirmiştir (Hilbert, Mantık ve Aritmetiğin Temelleri Üzerine, 1934). Ayrıca matematik; fizik, kimya, mühendislik, ekonomi gibi birçok alanda önemli bir rol üstlenmektedir. Bu bağlamda matematiği tek başına bir bilim dalı olarak görmek yerine diğer bilimlerle dünyanın anlaşılmasına yarayan güçlü bir araç olarak görmek daha yerinde olacaktır.

Musk (2019) matematiğin evrensel bir dil olduğunu ve farklı varlıklarla bile iletişim kurmanın yolunu sağlayabileceğini ifade etmiştir. Günümüz bilim ve teknoloji dünyasında da matematiğin yeri oldukça önemlidir. Matematik ve teknolojinin birbirleriyle yakından ilişkili olduğu artık kabul edilen bir gerçektir (Sarıtış, 2020, s. 64). Matematik, bilim ve teknolojinin ilerlemesinde temel bir araç olarak kullanılmaktadır. Özellikle yapay zekâ, veri bilimi, kriptografi, nümerik analiz gibi alanlarda matematiksel modellerin geliştirilmesi, problem çözüme ve yeni teknolojilerin keşfedilmesinde büyük bir rol oynamaktadır.

Teknoloji günümüzde hayatın vazgeçilmez bir parçası haline gelmiştir. İnsanlar artık iletişim kurmak, bilgiye erişmek, günlük işlerini halletmek, eğlenmek, alışveriş yapmak gibi birçok günlük aktivitelerini teknoloji sayesinde gerçekleştirmektedirler. Bu bağlamda eğitimin de teknolojiden uzak kalması, eğitimde teknolojinin yer almaması, günümüzde eğitimin gereksinimleri açısından yetersiz kalmasına yol açabilir. Teknolojinin hızla ilerlemesi, eğitimde de dönüşümü zorunlu hale getirmiştir. Artık eğitimde teknolojinin kullanımı sadece bir tercih değil, kaçınılmaz bir gerekliliktir (Çetin & Karataş, 2020). Teknolojinin kullanımı eğitim sürecini daha etkili, verimli ve keyifli hale getirerek öğrencilerin öğrenme sürecine daha fazla katılımını sağlayabilir. Bu nedenle, eğitimde teknoloji kullanımı artarak devam etmektedir ve günümüzde dijital araçlarla desteklenen eğitim de giderek yaygınlaşmaktadır.

Bu araçların eğitimde kullanımı öğrencilerin yaparak ve yaşayarak öğrenmelerine olanak sağlamaktadır. Güngören ve Çakıroğlu'nun (2020) belirttiği gibi, dijital araçlar öğrencilerin öğrenme sürecinde daha aktif ve etkili olmalarına yardımcı olur (Yeşilyurt, 2021). Öğretmenler de dijital araçlar sayesinde öğrencilerin öğrenme düzeylerini ve ihtiyaçlarını

daha iyi anlayabilir, bu doğrultuda ders planlarını ve öğretim yöntemlerini daha etkili bir şekilde oluşturabilirler (Karal & Kokoc, 2021; Yüksel, Yılmaz & Yeşilyurt 2022).

Bahsedilen dijital araçlardan eğitimde matematik öğretiminde sıklıkla kullanılan araçlardan biri de Geogebra'dır. İlk olarak 2001 yılında Avusturyalı matematik öğretmeni Markus Hohenwarter tarafından geliştirilmiştir (Özdemir, 2019). Geogebra, matematik öğretmenlerinin ve öğrencilerinin matematik problemlerini çözmelerine ve matematiksel kavramları keşfetmelerine yardımcı olmak için kullanılır (Koçak, 2015). Geogebra yazılımı etkileşimli etkinlikleriyle matematik öğretiminde öğrenciler ve öğretmenler tarafından tercih edilmektedir. Günümüzde hemen hemen her sınıfta kullanılan etkileşimli tahtalar sayesinde bu tür yazılımlar sayesinde matematik öğretimi başta olmak üzere tüm disiplinlerde bu yazılımlar kullanılmaktadır.

Matematik dersi ilkökul öğrencilerinin zorlandıkları derslerin başında gelmektedir. Cai & Wang (2018) yaptıkları araştırmada öğrencilerin matematiksel düşünme becerileri konusunda sorun yaşadıklarını, problem çözme stratejilerinde güçlük çektiklerini, matematiksel kavramların öğrenilmesi konusunda da zorlandıklarını göstermişlerdir. Bu çalışmada, ilkökul 4. sınıf matematik dersinin kesirler ünitesinde yer alan "Paydaları eşit olan en fazla üç kesri karşılaştır" kazanımının öğretiminde Geogebra yazılımının kullanılmasının öğrencilerin akademik başarılarına etkisi araştırılmıştır.

1.1 Problem Durumu

Matematiğin doğası gereği soyut kavramlar içermesi nedeniyle, ilkökul öğrencilerinin matematik derslerinde bazı konularda zorlanmaları yaygın bir durumdur. Bu zorlukların başında kesirler konusu gelmektedir. Bu konunun zorluğu, kesirleri soyut kavramlar olarak anlamlandırma ve gerçek hayat problemleriyle ilişkilendirme zorluğundan kaynaklanmaktadır. İlkökul öğrencilerinin kesirleri anlamaları için somut materyallerle desteklenen ve görsel öğeler içeren öğretim yöntemleri, artık birçok matematik uygulamasında kullanılan etkileşimli yazılımlar ve diğer teknolojik araçlar sayesinde daha etkili bir şekilde sunulabilmektedir. Bu nedenle, teknoloji temelli öğrenme yöntemleri, kesirler gibi soyut konuları öğretmek için özellikle yararlı olabilir. Kesirlerde sıralama ve karşılaştırma öğretiminde öğrencilerin yaşadığı güçlükler bu çalışmanın problemini oluşturmaktadır.

Problem Cümlesi: Kesirlerin öğretiminde Geogebra yazılımı kullanılmasının öğrencilerin akademik başarılarına etkisi var mıdır?

1.2 Alt Problemler

Çalışmada araştırılacak alt problemler şu şekildedir:

Deney ve kontrol grubunda bulunan öğrencilerin ön testten aldıkları puan ortalamaları arasında istatistiksel olarak anlamlı bir fark var mıdır?

Deney ve kontrol grubunda bulunan öğrencilerin son testten aldıkları puan ortalamaları arasında istatistiksel olarak anlamlı bir fark var mıdır?

1.3 Araştırmanın Amacı

Bu araştırma, İlkokul 4. Sınıf Matematik dersi Kesirler konusunda yer alan "Paydaları eşit olan en fazla üç kesri karşılaştırır" kazanımının öğretiminde Geogebra yazılımının kullanılmasının öğrencilerin akademik başarılarına etkisini incelemek amacı ile yapılmıştır. Geogebra yazılımında yer alan etkileşimli öğrenci çalışmaları, testler, sorular ve konu anlatımlarından faydalanılarak öğrencilerin ilgili konuyla alakalı akademik başarılarındaki değişim incelenecektir.

1.4 Araştırmanın Önemi

Kesirler, matematik öğreniminde oldukça önemli bir konudur ve özellikle ilkokul 4. sınıf öğrencileri için öğrenilmesi gereken temel matematik konularından biridir. Bu nedenle, kesirlerin öğretiminde kullanılan yöntemler ve araçlar, öğrencilerin matematik başarılarını etkileyebilir.

Bu bağlamda, Geogebra yazılımı gibi görsel ve etkileşimli araçların kullanımı, matematik öğreniminde önemli bir yer tutar. Geogebra, matematik öğreniminde öğrencilerin kesirleri daha iyi anlamalarına ve öğrenmelerine yardımcı olabilecek bir araçtır. Öğrenciler, Geogebra ile interaktif bir şekilde kesirleri inceleyebilir, görsel olarak görebilir ve bu sayede kesirleri daha iyi kavrayabilirler.

1.5 Sınırlılıklar

Araştırma İlkokul 4. Sınıf düzeyinde matematik dersinde yer alan kesirler konusunun bir kazanımı ile sınırlıdır. Araştırma 2022-2023 Eğitim Öğretim yılında Sivas ili Koyulhisar ilçesinde bir devlet okulunda bulunan 12 öğrenci ve Amasya ili Göynücek ilçesinde bir devlet okulunda bulunan 12 öğrenci ile sınırlıdır. Araştırma ön-test ve son-test ile sınırlıdır.

2.YÖNTEM

Bu bölümde araştırmanın modeli, evren ve örnekleme, veri toplama aracı, verilerin toplanma süreci ve verilerin analizi yer almaktadır.

2.1 Araştırma Modeli

Bu araştırma nicel araştırma yöntemlerinden Ön Test- Son Test kontrol gruplu yarı deneysel araştırma modeli kullanılarak yürütülmüştür. Ön test-son test kontrol gruplu yarı deneysel araştırma modeli, araştırmacıların bir değişkenin sebep-sonuç ilişkisini belirlemek amacıyla kullandığı bir araştırma modelidir (Sarıçam & İlhan, 2016). Araştırmacılar tarafından seçkisiz atama yöntemiyle seçilen şubelerden ön test puanı daha yüksek olan kontrol grubu, ön test puanı düşük olan grup deney grubu olarak belirlenmiştir. Deney grubunda konu anlatımı derslikte bulunan etkileşimli tahtadan Geogebra desteği ile yapılmış, öğrenciler derste aktif olarak görev almışlardır. Kontrol grubunda Millî Eğitim Bakanlığı Talim Terbiye Kurulunun müfredatına uygun şekilde öğretim yapılmıştır. Araştırma süreci Tablo 1’de kısaca özetlenmiştir.

Tablo 1. Araştırma Süreci

Gruplar	Öğretim Öncesi	Öğretim Yöntemi	Öğretim Sonrası
Deney Grubu N=12	Kesirler Başarı Testi (Ön Test)	Geogebra destekli öğretim	Kesirler Başarı Testi (Son Test)
Kontrol Grubu N=12	Kesirler Başarı Testi (Ön Test)	Mevcut Müfredatın gerektirdiği şekilde öğretim	Kesirler Başarı Testi (Son Test)

2.2 Araştırmanın Örnekleme

Araştırmanın çalışma grubunu, 2022-2023 Eğitim-Öğretim yılında Sivas ili Koyulhisar ilçesinde bir devlet okulunda bulunan 12 4.sınıf öğrencisi ve Amasya ili Göynücek ilçesinde bir devlet okulunda bulunan 12 4. Sınıf öğrencisi oluşturmaktadır. Örneklem seçiminde araştırmaya hız ve pratiklik kazandırması açısından Kolay ulaşılabilir örnekleme yöntemi kullanılmıştır. Araştırmaya katılan öğrencilerin demografik özellikleri Tablo 2’de verilmiştir.

Tablo 2. Öğrencilerin Demografik Özellikleri

	Deney Grubu		Kontrol Grubu		Tümü		
	N	%	N	%	N	%	
Cinsiyet	Kız	3	25	6	50	9	37,5
	Erkek	9	75	6	50	15	62,5
	Toplam	12	100	12	100	24	100

Araştırmaya katılan öğrencilerin tamamı 4. Sınıfta eğitim görmektedir.

2.3 Veri Toplama Aracı

Araştırmada veri toplama aracı olarak 2022-2023 Eğitim-Öğretim yılında kullanılan Millî Eğitim Bakanlığı tarafından öğrencilere dağıtılmış matematik ders kitabı ve MEB yardımcı kaynaklar kitaplarından, “Paydaları eşit olan en fazla üç kesri karşılaştır” kazanımına uygun sorulardan oluşturulmuş 10 soruluk “Kesirler Başarı Testi” kullanılmıştır. Araştırmada kullanılan ön test ve son test aynı testlerdir. Testler deney ve kontrol gruplarında araştırmacılar tarafından uygulanmıştır.

2.4 Verilerin Analizi

Araştırmada toplanan verilerin analizinde SPSS 20.0 istatistik paket programı kullanılmıştır. Ön test ve son test yoluyla elde edilen veriler Mann Whitney U testi kullanılarak analiz edilmiştir. Mann Whitney U testi, parametrik olmayan bir testtir ve normal dağılmayan veriler için kullanılır. Bu test, iki bağımsız örneklem arasındaki farkın anlamlı olup olmadığını belirlemek için kullanılır (Mann & Whitney, 1947). Örneklem sayısı 30’un altında olduğunda, Mann Whitney U testi t-testine göre daha uygun olabilir, çünkü t-testi normal dağılım varsayımına dayanır. Mann Whitney U testi ise sadece örneklem dağılımlarının aynı şekil ve yayılıma sahip olduğunu varsayar. Bu nedenle, örneklem sayısı az olduğunda veya normal dağılım varsayımı sağlanmadığında Mann Whitney U testi daha güvenilir sonuçlar verebilir (Conover, 1999). Test istatistiği, iki örneklem arasındaki sıraların farkını belirleyerek hesaplanır ve ayrıca U olarak adlandırılır. Eğer test istatistiği, kritik değerden büyükse, fark anlamlı kabul edilir (Wilcoxon, 1945).

3. BULGULAR

Bu bölümde araştırmanın amacına yönelik elde edilen bulgular tablo şeklinde gösterilmiş ve bu tablolara göre yorumlanmıştır.

Deney ve kontrol grubunda bulunan öğrencilerin ön test ve son testlerden adlıkları puanların aritmetik ortalama ve standart sapma değerleri Tablo 3’de verilmiştir.

Tablo 3. Deney ve Kontrol Grubu Ön Test ve Son Test Puan Ortalama ve Standart Sapma Değerleri

Kesirler Başarı Testi	Ön test		Son Test	
	\bar{X}	S	\bar{X}	S
Deney Grubu	45,75	24,85	64,08	18,52
Kontrol Grubu	45,83	14,19	54,66	14,52

Tablo 3 incelendiğinde Birinci gruptaki öğrencilerinin Kesirler Başarı Testi (ön test) puanları ortalaması 45,75 olarak, ikinci gruptaki öğrencilerin Kesirler Başarı Testi (ön test) puanları ortalaması 45,83 olarak hesaplanmıştır. Grupların ön test puan ortalamaları birbirine yakın olarak bulunmuştur. Ön test puanı yüksek olan grup kontrol grubu, ön test puanı düşük olan grup deney grubu olarak belirlenmiştir.

“Deney ve kontrol grubunda bulunan öğrencilerin ön testten aldıkları puan ortalamaları arasında istatistiksel olarak anlamlı bir fark var mıdır?” sorusu için Mann Whitney U testi sonuçları Tablo 4’de verilmiştir.

Tablo 4. Deney ve Kontrol Grubu Öğrencilerinin Ön Test Puanlarına Ait Mann Whitney U Testi Sonuçları

Puan	Gruplar	N	$\bar{X}_{\text{sıra}}$	$\sum_{\text{sıra}}$	U	z	p
Ön Test	Deney	12	12,54	150,50	72,500	-,301	,764
	Kontrol	12	13,42	174,50			
	Toplam	24					

Tablo 4 incelendiğinde deney ve kontrol grubu öğrencilerinin Ön test puanlarının anlamlı düzeyde farklılaşmadığı belirlenmiştir. (U= 72,500; P>,05). Bu sonuç deney ve kontrol gruplarının öğretim süreci öncesinde ön bilgileri açısından istatistiksel olarak anlamlı bir fark olmadığını ortaya koymaktadır.

“Deney ve kontrol grubunda bulunan öğrencilerin son testten aldıkları puan ortalamaları arasında istatistiksel olarak anlamlı bir fark var mıdır?” sorusu için Mann Whitney U testi sonuçları Tablo 5’de verilmiştir.

Tablo 5. Deney ve Kontrol Grubu Öğrencilerinin Son Test Puanlarına Ait Mann Whitney U Testi Sonuçları

Puan	Gruplar	N	$\bar{X}_{\text{sıra}}$	$\sum_{\text{sıra}}$	U	z	p
Ön Test	Deney	12	14,42	173,00	49,000	-1,329	,184
	Kontrol	12	10,58	127,00			
	Toplam	24					

Tablo 5 incelendiğinde deney ve kontrol grubu öğrencilerinin Son test puanlarının anlamlı düzeyde farklılaşmadığı belirlenmiştir. (U= 49,000; P>,05). Deney ve kontrol grubu son test puanları arasında anlamlı fark olmamasına rağmen deney grubu öğrencilerinin kesirler başarı testinden aldıkları puan ortalamasının (64,08), kontrol grubu öğrencilerinin kesirler başarı

testinden aldıkları puan ortalamasından (54,66) yüksek olduğu söylenebilir. Bu durum Geogebra destekli öğretimin akademik başarıya pozitif yönde etkisini göstermektedir.

TARTIŞMA VE SONUÇ

Bu araştırmada İlkokul 4. Sınıf Matematik dersi kesirler konusunun öğretiminde Geogebra yazılımının öğrencilerin akademik başarılarına etkisi incelenmiştir. Deney ve Kontrol grupları, ön test ve son test puanları arasında anlamlı bir fark bulunamamıştır. Buna rağmen ön test sonucu daha düşük olan deney grubunun son test puan ortalamasının (64,08), kontrol grubu puan ortalamasından (54,66) daha yüksek olduğu görülmektedir. Bu durum Geogebra desteğiyle yapılan öğretimin öğrencilerin akademik başarısını artırdığını açıklamaktadır. Geogebra yazılımının öğrencilerin akademik başarısına olumlu etkisini destekleyen bulgulara literatürde rastlanmaktadır. (Chen ve diğerleri, 2016; Işık ve diğerleri, 2021; Aydın, 2017; Göktürk & Başar, 2015)

Teknoloji destekli matematik dersleri, öğrencilere farklı öğrenme stillerine uygun çeşitli öğrenme materyalleri sunar. Örneğin, matematiksel kavramları görselleştirmek için interaktif simülasyonlar, videolar ve animasyonlar kullanılabilir. Bu materyaller, öğrencilerin soyut matematik kavramlarını daha iyi anlamalarını ve bağlantılar kurmalarını sağlar. Teknoloji destekli öğretimin öğrencilerin akademik başarısına olumlu etkileyen çalışmalar ilgili literatürde mevcuttur (Ünal & Yeşilyurt, 2021; Akar & Yeşilyurt, 2020; Turhan & Yeşilyurt, 2020).

Araştırmadan elde edilen sonuçlara göre araştırmacılara, eğitimcilere ve öğretmenlere şu önerilerde bulunulabilir:

1. Matematik öğretmenlerinin, Geogebra yazılımını kullanarak öğrencilerin kesirler konusundaki sıralama ve karşılaştırma becerilerini geliştirmeleri önerilir.
2. Geogebra yazılımının, matematik öğretmenleri tarafından derslerde aktif olarak kullanılması ve öğrencilerin interaktif olarak katılımının sağlanması önerilir.
3. Öğrencilere, Geogebra yazılımının kullanımı konusunda yeterli eğitim verilmesi ve yazılımın doğru bir şekilde kullanılması konusunda destek sağlanması önerilir.
4. Geogebra yazılımının öğretim materyalleri ve etkinlikleri geliştirmek için kullanılması önerilir.
5. Öğrencilerin, Geogebra yazılımını kullanarak kendi kendine öğrenme süreçlerini geliştirmeleri için desteklenmeleri önerilir.
6. Benzer araştırmaların yapılması ve farklı öğretim materyalleriyle karşılaştırmalı çalışmaların yapılması önerilir.

KAYNAKÇA

- Akar, Z., & Yeşilyurt, M. (2020). Teknoloji Destekli Öğrenme Yönteminin Maddenin Özellikleri Konusunda Özel Öğrenme Güçlüğü Yaşayan Öğrencilerin Akademik Başarısına Etkisi. 2nd International Young Researchers Student Congress.
- Aydın, A. (2017). Geogebra Kullanımının Ortaokul Öğrencilerinin Matematik Başarısına Etkisi. *Eğitimde ve Psikolojide Ölçme ve Değerlendirme Dergisi*, 8(2), 255-266. <https://doi.org/10.21031/epod.320972>
- Cai, J. ve Wang, Q. (2018). İlkokul öğrencilerinin matematiksel düşünme ve problem çözme zorlukları. Onuncu Uluslararası Matematik Eğitimi ve Toplum Konferansı Bildirileri (Cilt 1, ss. 239-247).
- Chen, C., Cheng, W., & Chang, C. (2016). Cebirde Dinamik Matematik Yazılımının Öğrenci Başarısına Etkisi: Bir Meta-Analiz. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(6), 1697-1711. <https://doi.org/10.12973/eurasia.2016.02306a>
- Conover, W. J. (1999). Parametrik Olmayan İstatistikler Uygulamaları (3. baskı). Wiley Yayınevi.
- Çetin, S. ve Karataş, İ. (2020). Eğitimde Teknoloji Kullanımı: Yeni Eğitim Teknolojileri ve Trendler. *The Journal of Academic Social Science Studies*, 78, 613-625.
- Gökkurt, B., & Başar, M. (2015). Geogebra Destekli Matematik Öğretiminin Lise Öğrencilerinin Geometri Başarısına Etkisi. *The Journal of Academic Social Science Studies*, 32, 251-269. <https://doi.org/10.9761/JASSS2491>
- Güngören, Ö. ve Çakıroğlu, Ü. (2020). İlköğretim öğrencilerinin STEM becerilerinin belirlenmesinde dijital araçların kullanımı. *Kastamonu Eğitim Dergisi*, 28(5), 1909-1922.
- Hilbert, David. "Mantık ve Aritmetiğin Temelleri Üzerine." Jean van Heijenoort (ed.), Frege'den Gödel'e: Matematiksel Mantığın Kaynakları, 1879-1931. Çev. H. Alper Sevgen. İstanbul: Yapı Kredi Yayınları, 2008. 111-116.
- Işık, C., Taşkın, Ö., Bozkurt, E. & Şahin, E. (2021). Geogebra'nın İlkokul Öğrencilerinin Matematik Başarısına Etkisi: Randomize Kontrollü Bir Çalışma. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, 21(1), 18-28. <https://doi.org/10.17240/aibuefd.2021.21.72103>
- Karal, H., & Kokoc, M. (2021). Dijital Teknolojilerin Eğitime Uygulanması ve Öğrenci Başarısına Etkisi. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*, (29), 61-72.)
- Koçak, Ö. (2015). Geogebra yazılımının matematik öğretiminde kullanımı ve öğrencilerin başarısına etkisi. *Kuramsal Eğitimbilim Dergisi*, 8(3), 278-297.
- Mann, H.B., & Whitney, D.R. (1947). "İki Rastgele Değişken Arasında Hangisinin Stokastik Olarak Daha Büyük Olduğuna İlişkin Bir Test Üzerine". *The Annals of Mathematical Statistics*, 18, 50-60. <https://doi.org/10.1214/aoms/1177730491>
- Musk, E. (2019, 23 Ekim). Elon Musk Yapay Zeka ve Düzenlemeye İhtiyaç Duyulması Hakkında Konuşuyor [Video dosyası]. YouTube. <https://www.youtube.com/watch?v=SMOQfJAx9HQ>
- Özdemir, S. (2019). Geogebra yazılımının ilköğretim matematik eğitimindeki kullanımına ilişkin öğretmen görüşleri. *Uluslararası Eğitim Programları ve Öğretim Çalışmaları Dergisi*, 9(18), 187-202.
- Sarıçam, H., & İlhan, M. (2016). Araştırma Yöntemleri: Kavramlar, İlkeler, Uygulamalar. Ankara: Anı Yayıncılık.
- Sarıtaş, M. (2020). Matematik ve Teknoloji İlişkisi. *Sosyal Bilimler Dergisi*, 3(6), 64-75.

- Turhan, S., & Yeşilyurt, M. (2020). Teknolojik Materyal İle Gerçekleştirilen Kesir Öğretiminin Özel Öğrenme Güçlüğü Olan Öğrencilerin Başarısı Üzerine Etkisi. 2nd International Young Researchers Student Congress, Bursa.
- Ünal, Y., & Yeşilyurt, M. (2021). İlkokulda Teknoloji Destekli Bölme İşlemi. 3. Uluslararası Fen, Matematik, Girişimcilik ve Teknoloji Eğitimi Kongresi.
- Wilcoxon, F. (1945). "Sıralama Yöntemleriyle Bireysel Karşılaştırmalar". *Biometrics Bulletin*, 1, 80-83. <https://doi.org/10.2307/3001968>
- Yesilyurt, M. (2021). Meta-Analysis of the Effect of Technologies on Primary School, *Journal of Primary Education*, 3(2), 26- 41. <https://doi.org/10.52105/temelegitim.3.2.3>
- Yüksel R, Yılmaz M & Yeşilyurt M (2022). Eğitsel Oyunun Başarıya Etkisinin Meta Analizi/ Meta-Analysis of The Effect of Educational Game on Achievement, 2st-International Congress on Modern Sciences Tashkent Chemical-Technological Institute.

**KESİRLERLE TOPLAMA VE ÇIKARMA İŞLEMİNDE TEKNOLOJİK
MATERYALİN İLKOKUL 4. SINIF ÖĞRENCİ BAŞARISINA ETKİSİ**

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ÖZET

Bu çalışmada ilkokul 4. sınıf matematik dersi paydası eşit olan kesirlerle toplama ve çıkarma işlemlerinin öğretiminde Milli Eğitim Talim Terbiye Kurulunun (TTKB) yöntem teknikleri ve Web 2.0 araçlarının öğrenci başarısına etkileri incelenmiştir. Araştırmanın modeli ön test–son test kontrol gruplu deneysel araştırma deseni olarak tasarlanmıştır. Araştırmanın örneklemini 2022-2023 Eğitim-Öğretim yılında Amasya ili Suluova ilçesinde olan bir ilkokuldaki 4. sınıfta bulunan 27 öğrenci ve Kocaeli ili Gebze ilçesinde olan bir ilkokuldaki 4. Sınıfta bulunan 27 öğrenci oluşturmaktadır. Örneklem kolay ulaşılabilir örnekleme yöntemiyle belirlenmiştir. Çalışma, Milli Eğitim Talim Terbiye Kurulu tarafından hazırlanan müfredata uygun yöntem ve tekniklerin kullanıldığı kontrol grubu ve Web 2.0 araçlarıyla öğretimin uygulandığı deney grubu olmak üzere 2 grup ile yürütülmüştür. Deney ve kontrol gruplarına araştırmacılar tarafından hazırlanan ve Milli Eğitim Bakanlığı'nın güvenilirlik geçerliliği test edilmiş açık uçlu beş sorudan oluşan ön test ve son testler uygulanmıştır. Ön test ve son testlerden elde edilen verilerin karşılaştırılması için ve veri analiz için Microsoft Excel 2017'de t-testi kullanılmıştır. Araştırma sonucunda, Web 2.0 araçları ile öğretimin matematik dersi kesirlerde toplama ve çıkarma işlemi öğretiminde öğrencilerin başarısına anlamlı etkisi olduğu saptanmıştır. Bu yöntemin öğrenci başarısı üzerine etkilerine bakıldığında istatistiki olarak anlamlı bir fark çıkmıştır ($p<0.05$). Elde edilen bulgulara göre Web2.0 araçları ile öğretimin öğrenci başarı puanlarını olumlu yönde etkilediği söylenebilir. Matematik dersi kesirler ünitesinin öğretilmesinde Web2.0 araçlarıyla öğretim yönteminin daha fazla kullanılması önerilebilir.

Anahtar Kelimeler: Kesirlerde toplama ve çıkarma, teknolojik materyal, Web 2.0 araçları.

**THE EFFECT OF TECHNOLOGICAL MATERIAL ON THE SUCCESS OF
PRIMARY SCHOOL 4TH GRADE STUDENTS IN THE PROCESS OF ADDITION
AND SUBTRACTION WITH FRACTIONS**

ABSTRACT

In this study, the methods and techniques of the National Education Board of Education (TTKB) and the effects of Web 2.0 tools on student achievement in the teaching of addition and subtraction operations with fractions with equal denominators in primary school 4th grade mathematics lesson were examined. The research model was designed as an experimental research design with pretest-posttest control group. The sample of the study consists of 27 students in the 4th grade of a primary school in the Suluova district of Amasya province in the 2022-2023 academic year and 27 students in the 4th grade in a primary school in the Gebze district of Kocaeli province. The samples were determined by the easily accessible sampling method. The study was carried out with two groups, the control group, in which methods and techniques suitable for the curriculum prepared by the National Education Board of Education and Discipline were used, and the experimental group, in which teaching with Web 2.0 tools was used. Pre-test and post-tests consisting of five open-ended questions prepared by the researchers and tested by the Ministry of National Education were applied to the experimental and control groups. Microsoft Excel 2017 t-Test was used to compare the data obtained from the pre-test and post-test. As a result of the research, it was determined that teaching with Web 2.0 tools had a significant effect on the success of students in teaching addition and subtraction in fractions. Considering the effects of this method on student achievement, there was a statistically significant difference ($p < 0.05$). According to the findings, it can be said that teaching with Web2.0 tools affects student achievement scores positively. It can be suggested that the teaching method with Web2.0 tools should be used more in teaching the units of fractions of the mathematics lesson.

Keywords: Addition and subtraction in fractions, technological material, Web 2.0 tools.

1.GİRİŞ

Dünyadaki teknolojik gelişmeler her alanda olduğu gibi eğitim ve öğretim alanını da etkilemektedir. Teknoloji alanındaki değişimler, öğretim anlayışındaki değişimlere neden olup günümüz öğretiminde yeni teknik ve yöntemlerin kullanımını gerektirmektedir (Alakoç, 2003:1). Eğitimin her alanında olduğu gibi matematik öğretiminde de bilişim teknolojilerindeki gelişmelerin yansımalarını yoğun bir şekilde görmekteyiz (Karal ve Abdüsselam, 2009). Matematik öğretiminde teknolojinin kullanılması konulara somut yaşantılar kazandırarak, öğrencilerin soyut ve sembolik yaklaşımı içeren başarılar edinmesini sağlamaktadır. (Flores 2002; akt:Tatar, Kağızmanlı ve Akkaya, 2013; Yeşilyurt, 2021).

Matematik gündelik hayatın hemen her alanında karşımıza çıktığından, günlük hayatta matematiği uygulayabilme ihtiyacı önem kazanmaktadır. Matematik birçok bilimin temeli olduğu ve diğer birçok bilimle ilişkili olduğu için bilim ve teknolojiye gelişebilmek matematikte başarılı bireyler yetiştirmeye bağlıdır. Çünkü sürekli bir değişim ve gelişim içinde olduğumuz bu yüzyılda, matematikten daha iyi anlayan ve matematikle uğraşanlar geleceğe yön vermede etkin rol alacaklardır (MEB, 2005; Yüksel, Yılmaz & Yeşilyurt 2022). Matematik soyut içerikli bir ders olduğundan matematik kavramların öğretiminde ve öğrenmesinde zorluklar yaşanmaktadır. Öğrenciler matematik dersini başaramayacaklarını düşündüklerinden matematik dersi için kaygı düzeyleri genel itibari ile yüksektir. Matematik öğretiminde kullanılan yöntemler ve araçlar bunun sebepleri arasındadır (Bulut, 1994; Baki, 1996; Kemertaş, 1997; akt: Akın ve Canan, 2007:2).

Teknolojik alanlardaki değişim ve gelişimler matematik öğretimini ve öğrenimini kolaylaştıracak, somutlaştıracak ve başarıyı artıracak çeşitli araç-gereç, yazılım ve programlarla bizi buluşturmaktadır. Bilgisayar, akıllı tahta, Web 2.0 araçları ve eğitim bilişim ağı (EBA) bu teknolojik araçlardan bazılarıdır. Bu teknolojik araçlar, matematik dersini zengin görsel ve etkileşimli içerikleri ile somutlaştırarak öğrencilerin matematik kavramlarını daha kolay anlamasına ve kalıcı öğrenme gerçekleştirmesine katkı sağlamaktadır (Ünal & Yeşilyurt, 2021; Turhan & Yeşilyurt, 2020).

Matematik öğretiminde amaç bilgiyi üretebilen, uygulayabilen ve günlük hayata entegre ederek kullanabilen matematiksel düşünme yeteneğine sahipler bireyler yetiştirmektir. Bu amaçla öğrencileri süreçte aktif kılan, onları düşünme ve problem çözme becerilerini kazanmaya yönlendirecek öğretim uygulanmalıdır. Bu çalışmada 4.sınıf öğrencilerine matematik dersi kesirler konusu kazanımlarından biri olan ‘‘Paydası eşit olan kesirlerde

toplama ve çıkarma işlemi yapar.” kazanımı Web 2.0 araçlarıyla desteklenmiş yöntemle öğretim yaparak teknolojik materyalin ders başarısına etkisine bakılmıştır.

1.1 PROBLEM CÜMLESİ

Matematik kavram ve kazanımlarının soyut olması kavramların öğretilmesi ve öğrenilmesini zorlaştırmaktadır. Kesirler konusu soyut bir konu olduğu için sadece ders kitaplarına bağlı kalarak ve geleneksel öğretim yöntemleriyle öğretilmesi, öğrencilerde konuyu tam kavrayamama ve düşük başarı gösterilmesine neden olmaktadır. Kesirler konusunun tam olarak kavranamamasından kaynaklanan yüksek başarı gösterilememesi bu araştırmanın problemini oluşturmaktadır.

Problem Cümlesi:

İlkokul 4.sınıf öğrencilerine kesirlerde toplama ve çıkarma işleminde teknolojik materyalle öğretim yönteminin ders başarısına etkisi nedir?

1.2 ALT PROBLEMLER

1. Teknolojik materyalle öğretimin öğrenci motivasyonuna etkisi nedir?
2. Teknolojik materyalle öğretiminin öğrencinin derste aktifleşmesine etkisi nedir?
3. Teknolojik materyalle desteklenmiş öğretim yönteminin etkili öğretim açısından önemi nedir?
4. Matematik dersinde teknolojik materyalle desteklenmiş öğretim yönteminin ders başarısına etkisi nedir?
5. Derslerde teknolojik materyallerin kullanılmasının öğrenme düzeyine etkisi nedir?

1.3 ARAŞTIRMANIN AMACI

Bu araştırmanın amacı; 4.sınıf öğrencilerinde, matematik kazanımlarından “Paydası eşit olan kesirlerle toplama ve çıkarma işlemi yapar.” kazanımını teknolojik materyallerle desteklenmiş öğretim yöntemiyle öğretim yaparak teknolojik materyallerin ders başarısına etkisini incelemektir.

1.4 ARAŞTIRMANIN ÖNEMİ

Matematikteki soyut kavramlardan biri de kesirler konusudur. Kesirler konusunun öğretiminde geleneksel yöntemle ders kitabının işlenmesi öğrencilerin konuyu anlamasını zorlaştırmaktadır. Öğrenciler soyut kavram olarak kesirler konusunu zihninde

canlandıramamakta ve bilgilerin kalıcı olmasını sağlayamamaktadır. Gelişim dönemleri düşünüldüğünde ilkokul 4.sınıf öğrencileri somut işlemler döneminde olduğu için soyut kavramları öğrenmekte zorlanmaktadır. Öğrenciler bu zorlanmalar sonucunda derse karşı ilgisiz olabilmekte hatta derse karşı olumsuz tutum geliştirebilmektedir. Matematik öğretiminde öğrencinin dersi sevmesi, ilgi göstermesi ve olumlu tutum göstermesinde öğretmenlere büyük roller düşmektedir. Öğretmenin konuyu öğrenci gelişim seviyesine göre somutlaştırması ve uygun öğretim yöntemini kullanması ders başarısını artırmada oldukça önemlidir. Kesirlerde toplama ve çıkarma işlemlerinin öğretilmesinde teknolojik materyallerin kullanılmasının ders başarısının artıracağı düşünülmektedir.

1.5 ARAŞTIRMANIN SINIRLILIKLARI

1. Bu çalışma Amasya ili Suluova ilçesinde olan bir ilkokuldaki 4. sınıfta bulunan 27 öğrenci ve Kocaeli ili Gebze ilçesinde olan bir ilkokuldaki 4. Sınıfta bulunan 27 öğrenci ile sınırlıdır.
2. Bu çalışma ‘‘Paydası eşit olan kesirlerle toplama ve çıkarma işlemi yapar.’’ Kazanımıyla sınırlıdır.
3. Bu çalışma ön test ve son test uygulamasıyla sınırlıdır.

2. YÖNTEM

2.1 ARAŞTIRMA DESENİ

Bu araştırma bir nicel araştırmadır. Yarı deneysel araştırma türüdür ve yarı deneysel desen kullanılmıştır. Araştırmanın modeli ön test–son test kontrol gruplu deneysel araştırma deseni olarak tasarlanmıştır. Bu modelde iki grup bulunmaktadır. Bu gruplardan biri deney, diğeri kontrol grubu olarak kullanılmıştır.

Çalışmada araştırmanın amacına uygun olarak 34 tane ilkokul 4.sınıf öğrencisiyle çalışılmıştır. Her iki gruba önce ön test uygulanmış, bu testin sonucuna göre deney ve kontrol grubu belirlenmiştir. Deney grubuna teknolojik materyal destekli öğretim yapılmış, kontrol grubuna Milli Eğitim Talim Terbiye Kurulu tarafından hazırlanan ders kitaplarında uygun görülen yöntemlerle öğretim yapılmıştır. Yapılan eğitimlerden sonra son test uygulanmış ve öğrencilerin konuyla ilgili öğrenme düzeyleri araştırılmıştır.

2.2 ARAŞTIRMANIN ÖRNEKLEMİ

Araştırmanın örneklemini 2022-2023 Eğitim-Öğretim yılında Amasya ili Suluova ilçesinde olan bir ilkokuldaki 4. sınıfta bulunan 27 öğrenci ve Kocaeli ili Gebze ilçesinde olan bir ilkokuldaki 4. Sınıfta bulunan 27 öğrenci oluşturmaktadır.

2.2.1. Deney Grubu

Çalışmanın deney grubunu 2022-2023 Eğitim-Öğretim yılı Kocaeli ili Gebze ilçesinde olan bir ilkokuldaki 4. Sınıfta bulunan 27 öğrenci oluşturmaktadır.

2.2.2. Kontrol Grubu

Çalışmanın kontrol grubunu 2022-2023 Eğitim-Öğretim yılında Amasya ili Suluova ilçesinde olan bir ilkokuldaki 4. sınıfta bulunan 27 öğrenci oluşturmaktadır.

2.3 VERİ TOPLAMA ARAÇLARI

Araştırmanın verileri araştırmacılar tarafından hazırlanan ve Milli Eğitim Bakanlığı tarafından güvenilirlik geçerliliği test edilmiş açık uçlu beş sorudan oluşan ön test ve son test ile elde edilmiştir. Veri toplama aracında kesirler konusu ‘‘Paydaları eşit kesirlerle toplama ve çıkarma işlemi yapar.’’ kazanımıyla ilgili 5 tane açık uçlu soru bulunmaktadır. Çalışmada uygulanan ön test ve son testteki soru maddeleri aynıdır.

2.4. VERİLERİN TOPLANMASI

Hazırlanan veri toplama aracı belirtilen gruptaki 4.sınıf öğrencilerine 1 ders saati süresince uygulanmıştır. Verilerin daha sağlıklı ve güvenilir bir şekilde toplanması için araştırmacılar veri toplama sürecine bizzat katılmışlardır.

2.5. VERİLERİN ANALİZİ

Uygulanan eğitimler sonucunda ön test ve son test ile elde edilen veriler Microsoft Excel 2017’de t-testi kullanılarak analiz edilmiştir.

3. BULGULAR

Veriler analiz edildikten sonra t-Testi sonuçları elde edilmiştir. Elde edilen bu veriler aşağıda sunulmuştur.

	Gruplar				
	Kontrol Grubu		Deney Grubu		Anlamlılık
	\bar{x}	SS	\bar{x}	SS	P
Ön Test	83,70	16,67	74,81	13,11	0,116000643
Son Test	86,66	14,67	90,37	11,59	0,007755559

Çizelge 1. Kontrol Grubu-Deney Grubu t-test Karşılaştırması

3.1 ÖN TEST BULGULARI

“Paydaları eşit kesirlerle toplama ve çıkarma işlemi yapar.” kazanımını, teknolojik materyallerle desteklenmiş yöntemle öğretim yaparak ders başarısına etkisini ölçmek için kazanımı öğretmeden önce ön test uygulanmıştır. Uygulanan ön testin sonucu çizelge 2’de gösterilmiştir.

Çizelge 2. Ön Test t-test Bulguları

t-Test: Ortalamalar İçin İki Örnek		
	DENEY GRUBU	KONTROL GRUBU
Ortalama	74,81	83,70
Standart sapma	13,11	16,67
Gözlem	27	27
Pearson Korelasyonu	0,302165312	
Öngörülen Ortalama Farkı	0	
Df	26	
t Stat	-2,590304503	
P(Anlamlılık)	0,116000643	
t Kritik tek-uçlu	1,70561792	

Çizelgeye göre öğrenciye “Paydaları eşit kesirlerle toplama ve çıkarma işlemi yapar.” kazanımı kazandırılmadan önce öğrencilerde kazanım hakkında bir hazırbulunuşluklarının olduğu ortaya çıkmıştır.

3.2 SON TEST BULGULARI

“Paydaları eşit kesirlerle toplama ve çıkarma işlemi yapar.” kazanımını, teknolojik materyallerle desteklenmiş yöntemle öğretim yaparak ders başarısına etkisini ölçmek için

çalışma tamamlandıktan sonra öğrencilere son test uygulanmıştır. Uygulanan son testin sonucu çizelge 3’de gösterilmiştir.

Çizelge 3. Son Test t-test Bulguları

t-Test: Ortalamalar İçin İki Örnek		
	DENEY GRUBU	KONTROL GRUBU
Ortalama	90,37	86,66
Standart sapma	11,59	14,67
Gözlem	27	27
Pearson Korelasyonu	0,301328776	
Öngörülen Ortalama Farkı	0	
df	26	
t Stat	1,223803846	
P(Anlamlılık)	0,007755559	
t Kritik tek-uçlu	1,70561792	

Analiz sonucunda son teste ait p değeri 0,007 çıkmıştır. Son test p değeri 0,05’ten küçük olduğu için eğitim verildikten sonra deney grubu ve kontrol grubu arasında anlamlı bir fark olduğu görülmüştür. Diğer verilerle birlikte sonucu incelediğimizde teknolojik materyallerle desteklenmiş yöntemle eğitiminin, geleneksel yöntem eğitimine göre daha iyi sonuçlar verdiği ifade edilebilir.

4. SONUÇ, TARTIŞMA ve ÖNERİLER

4.1 SONUÇ VE TARTIŞMA

Araştırma bulguları incelendiğinde teknolojik materyalle desteklenmiş öğretim uygulamalarının uygulandığı deney grubunun, düz anlatım yönteminin uygulandığı kontrol grubunun son test akademik başarı test puanları arasındaki farkın p değeri 0,05’den küçük olduğu görülmüş ve sonuçların deney grubu lehine istatistiksel olarak anlamlı olduğu bulunmuştur.

Araştırmanın alt problemlerine ait sonuçlar ve tartışma aşağıda aktarılmıştır:

1. Teknolojik materyalle desteklenmiş öğretimin öğrenciyi derste aktif kıldığı için öğrenci motivasyonunu arttırdığı görülmüştür.
2. Teknolojiyle öğretim öğrencide istek ve merak uyandırdığı için öğrencinin derse katılımını artırmıştır. Derse katılım öğrencinin dersten keyif almasını da sağladığı için

öğrencilerin motivasyonları artmış ve teknolojiyle öğretimin hem öğretmen hem de öğrenci üzerinde pozitif etkilerinin olduğu görülmüştür.

3. Teknolojinin derste kullanımının dersi anlamakta zorluk çeken öğrencilerin öğrenme hızını artırdığı gözlemlenmiştir.

4. Teknolojik materyalle öğretim ile öğretilen konu akılda daha kalıcı olmaktadır. Bilgiler öğrencilerin zihninde daha çok anlamlandırılmaktadır.

5. Derste teknolojinin kullanılması öğrenmeyi kolaylaştırmaktadır. Öğrenmekte güçlük çeken öğrencilerin bile dersi daha kolay anlamasını sağlamaktadır.

4.2 ÖNERİLER

Araştırmadan elde edilen sonuçlara göre aşağıdaki önerilerde bulunulabilir:

Araştırmadan elde edilen sonuçlara göre “Paydaları eşit kesirlerle toplama ve çıkarma işlemi yapar.” kazanımı için teknolojik materyalle öğretim yapılan öğrencilerin akademik başarısının yükseldiği görülmüştür. Sınıf içerisinde, öğretim yaparken kalıcılığı sağlamak için öğretmenler, teknolojiyi takip etmeli ve sınıfta uygulama yapmalıdırlar. Derse karşı ilgisiz ve dersi öğrenmekte güçlük çeken öğrencileri simülasyonlardaki eğlenceli etkinlikler ve oyunlarla derse çekilmesi sağlanabilir. Kazanımların somutlaştırılması, oyun ve etkinliklerle desteklenmesi öğrencilerin eğitimde aktif rol alması, tüm derslerde olduğu gibi matematik eğitiminde de kullanılmalıdır.

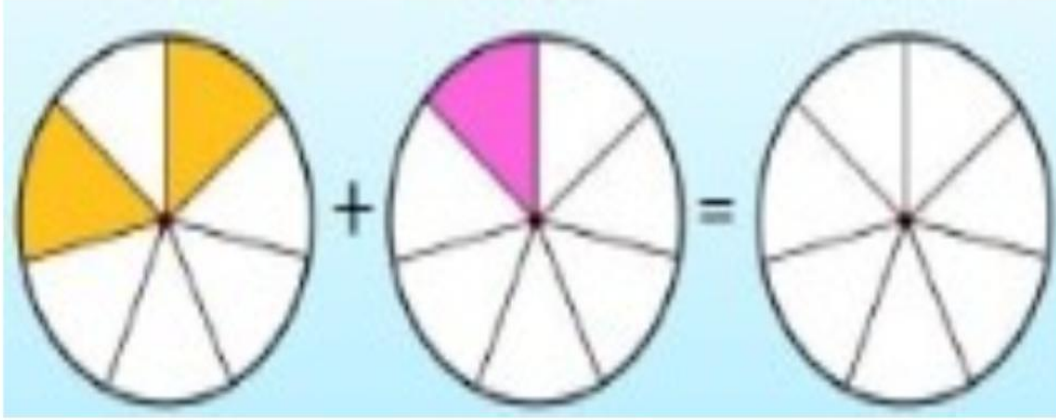
KAYNAKÇA

- Akın, Y. ve Cancan, M. (2007). Matematik Öğretiminde Problem Çözümüne Yönelik Öğrenci Görüşleri Analizi, KKEFDI/OKKEF, Sayı:16:2.
- Alakoç, Z. (2003). Matematik Öğretiminde Teknolojik Modern Öğretim Yaklaşımları, The Turkish Online Journal of Educational Technology-TOJET ISSN: 1303-6521. 2(1): 43-49.
- Baki, A. (1996). Matematik Öğretiminde Bilgisayar Her şey midir? Hacettepe Eğitim Fakültesi Dergisi, Sayı:12, ss.135-143.
- Karal, H. ve Abdüsselam, M. (2009). Matematik Derslerinde Kullanılabilecek Bir Öğretim Yazılımı Geliştirme Çalışması, Sakarya Üniversitesi Eğitim Fakültesi Dergisi, Sayı:18.
- Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı, 2005. Matematik Dersi Öğretim Programı ve Kılavuzu (9 - 12. sınıflar).
- Tatar, E., Kağızmanlı, T.B. ve Akkaya, A.(2013). Türkiye'deki teknolojik destekli matematik araştırmaların içerik analizi. Buca Eğitim Fakültesi Dergisi, 35.
- Turhan, S., & Yeşilyurt, M. (2020). Teknolojik Materyal İle Gerçekleştirilen Kesir Öğretiminin Özel Öğrenme Güçlüğü Olan Öğrencilerin Başarısı Üzerine Etkisi. 2nd International Young Researchers Student Congress, Bursa.
- Ünal, Y., & Yeşilyurt, M. (2021). İlkokulda Teknoloji Destekli Bölme İşlemi. 3. Uluslararası Fen, Matematik, Girişimcilik ve Teknoloji Eğitimi Kongresi.
- Yesilyurt, M. (2021). Meta-Analysis of the Effect of Technologies on Primary School, Journal of Primary Education, 3(2), 26- 41. <https://doi.org/10.52105/temelegitim.3.2.3>
- Yüksel R, Yılmaz M & Yeşilyurt M (2022). Eğitsel Oyunun Başarıya Etkisinin Meta Analizi/ Meta-Analysis of The Effect of Educational Game on Achievement, 2st-International Congress on Modern Sciences Tashkent Chemical-Technological Institute.

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A 7 Bölü 3

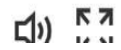
B 3 Bölü 7

C 5 Bölü 7

D 4 Bölü 7

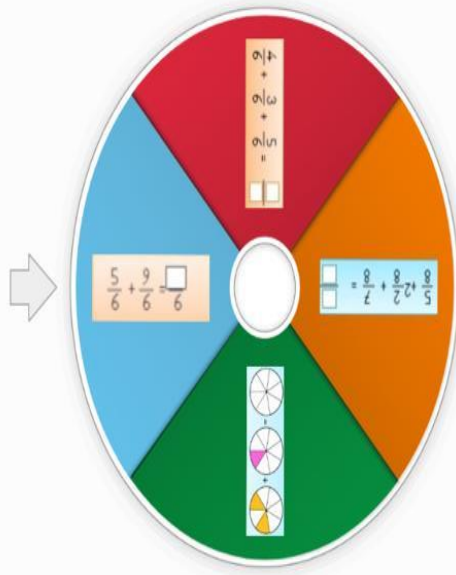


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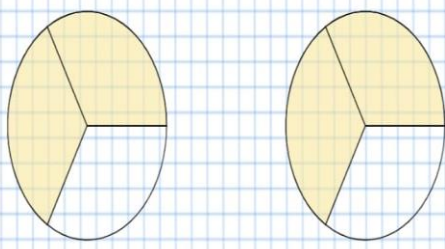
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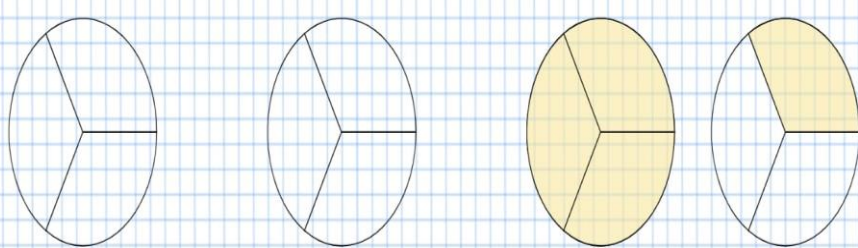


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$$\frac{2}{3} + \frac{2}{3} =$$

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**THE EFFECT OF GENDER STRUCTURE AND FEMALE EMPLOYMENT ON
ORAL AND MAXILLOFACIAL SURGERY AND ORTHODONTIC TREATMENTS**

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ABSTRACT

In this retrospective descriptive study, it was aimed to examine the relationship between oral and maxillofacial surgery and orthodontic treatments and gender structure in Turkey since 2002. The datasets of Turkey from 2002 to 2020, were examined from the datasets of TÜİK National Health Indicators, Turkish Dentists Association and Public Hospitals Association. Dependent variables in the study were taken as the number of applicants for oral and maxillofacial surgery and orthodontic treatment. The independent variables were defined as the number of dentists, the number of dental applications, male participation in healthcare and female participation in healthcare. The rate of female employment in Turkey from the World Bank Country Reports and the year variables were used as control variables. A horizontal course was observed with a low upward trend until 2012. In 2013 and 2017, there was a sharp increase in oral and maxillofacial surgery operations in Turkey. Spearman's rho correlation analysis showed that the number of oral and maxillofacial surgery operations and the percentage of male participation in health services ($r=0.901$; $p<0.01$), the percentage of female participation ($r=0.941$; $p<0.01$) and the female employment rate (0.870 ; $p<0.01$) contribution was statistically significant. The contribution of the number of orthodontic treatments and the percentage of male participation in health services ($r=0.672$; $p<0.01$), the percentage of female participation ($r=0.770$; $p<0.01$) and the female employment rate (0.842 ; $p<0.01$) were statistically significant. Male participation in health services ($B=111809.72$; $p<0.01$), female participation ($B=-238574.84$; $p<0.01$) and female employment rate ($B=-400725.59$; $p<0.05$) had significant contribution on the number of oral and maxillofacial surgery operations. However, the effect of all three variables on orthodontic treatments was not statistically insignificant ($p>0.05$). The effect of employment on women's participation in health services has an impact on the increase in the number of operations in oral and maxillofacial surgery.

Keywords: Oral and maxillofacial surgery, orthodontics, gender

1. Introduction

Oral health is an important issue that affects both the quality of life of individuals, as well as nutrition and other diseases. Although its mortality and morbidity is not high like other health services, orthodontic and maxillofacial surgery procedures in oral and dental health may cause undesirable results in the long run, which also affect other health conditions of individuals (Dickson-Swift and Crocombe, 2022; Poirier et al, 2022; Poudel et al, 2022; Petersen et al, 2020). In this respect, it is possible to state that jaw surgery and orthodontic treatments have an important place in terms of individuals' quality of life and public health.

There are factors that affect the health treatment processes of jaw surgery and orthodontic treatments, but it is necessary to focus on some factors that affect the level of health in the social sense. Among these, the gender structure and especially the participation rates of women and men in employment and the level of women's use of health services are important. Although women's participation in social life and their inclusion in the social security system are encouraged on the one hand, the health services provided should also be examined according to gender balance in this process (Amoah et al, 2022; Sfeatcu et al, 2022; Wang et al, 2020; de Silva et al, 2016). In this respect, the level of benefit of men and women from jaw surgery and orthodontic treatments is important.

Although the effects of men and women, or more generally, gender, have been examined in studies in the fields of maxillofacial surgery and orthodontics, no study has been found examining gender structure and female employment in the social context. Therefore, in this study, it was aimed to examine the effects of participation in health services in terms of gender and female employment rates on maxillofacial surgery and orthodontic treatments.

2. Methods

The research was designed in descriptive scanning model. In this method, the researcher can make inferences on a specific subject by using the available qualitative and quantitative data. In the descriptive survey model, the researcher does not interfere with the current situation and describes the situation as it is (Karasar, 2012). In this context, in this study, it was aimed to describe the effect of gender structure and employment on maxillofacial surgery and orthodontic treatments.

In the research, the data sets of Turkey from 2002 to 2020, which is the most recent year, were examined from the datasets of the Turkish Statistical Institute National Health Indicators, the Association of Dentists of Turkey and the Public Hospitals Association. Dependent variables

in the study were taken as the number of patients who applied for maxillofacial surgery and orthodontic treatment. The independent variables were chosen as the number of dentists, the number of dental applications, male participation in healthcare and female participation in healthcare. The rate of female employment in Turkey from the World Bank Country Reports and the year variables were used as control variables (Employment to population ratio, 15+, female (%)) (national estimate).

Parity analysis, Spearman's rho correlation analysis and Generalized Linear Model (Logit) analysis were used to analyze the data. All analyzes were performed in SPSS 25.0 for Windows, with 95% confidence interval and 0.05 significance level.

3. Results

According to the change in the number of operations for maxillofacial surgery over time, a horizontal course was observed with a low upward trend until 2012. There was a sharp increase in maxillofacial surgery operations in Turkey in 2013 and 2017 (Figure 1).

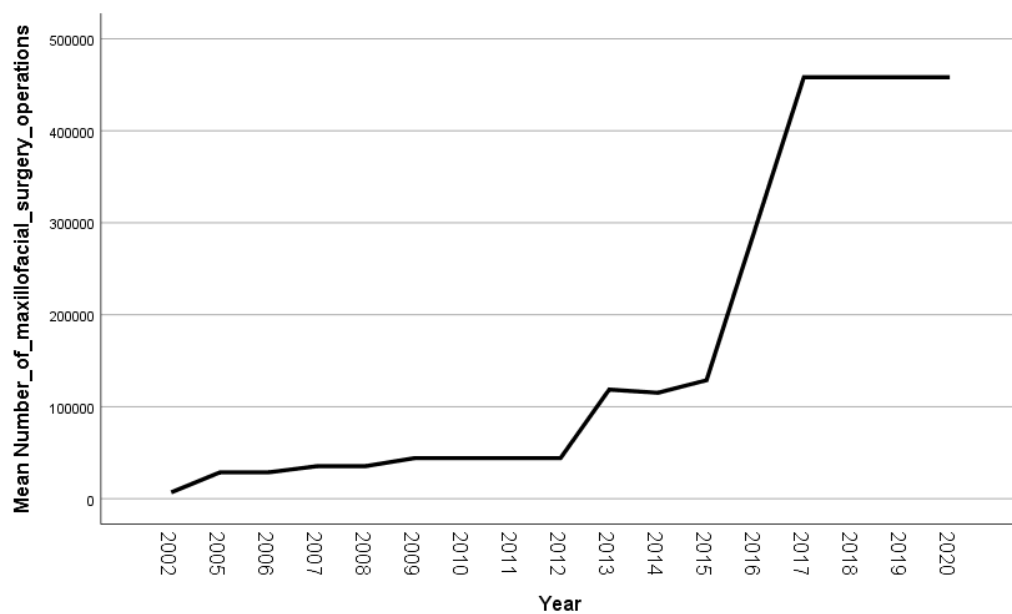


Figure 1. Change in the number of maxillofacial surgery operations in Turkey by years

Although there was an increasing trend in orthodontic treatment over the years, there was a decrease in 2014 and 2018. Although there was a serious decrease in 2017 compared to the previous year, there has been an increase since 2002 in general (Figure 2).

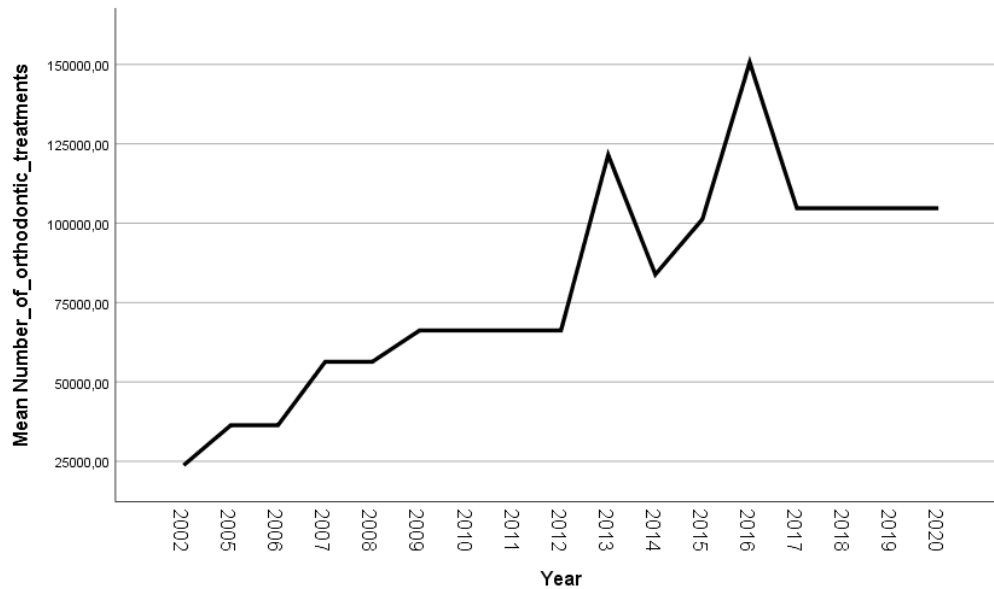


Figure 2. Change in the number of orthodontic treatments in Turkey by years

According to the results of Spearman's rho correlation analysis, the percentage of male participation in health services ($r=0.901$; $p<0.01$), the percentage of female participation ($r=0.941$; $p<0.01$) and the contribution of female employment rate (0.870 ; $p<0.01$) with the parameter of the number of jaw surgery operations were statistically significant. The relationship between the number of orthodontic treatments parameter and the percentage of male participation in health services ($r=0.672$; $p<0.01$), the percentage of female participation ($r=0.770$; $p<0.01$) and the contribution of female employment rate (0.842 ; $p<0.01$) was statistically significant (Table 1).

Table 1. Spearman's rho correlation analysis results for the relationship between the number of maxillofacial surgery operations and the number of orthodontic patients and research variables

	Number of jaw surgery operations		Number of orthodontic patients	
	r	p	r	p
Number of dentist applications	0.354	0.559	0.354	0.559
Number of dentists	0.707	0.182	0.707	0.182
Percentage of male participation in health services	0.901**	0.000	0.672**	0.012
Percentage of female participation in health services	0.941**	0.000	0.770**	0.002
Female employment rate	0.870**	0.000	0.842**	0.000

**p<0.01

According to the results of the Generalized Linear Model (Logit) analysis for the effect of female and male healthcare participation and female employment on the number of jaw surgery operations and orthodontic patients, The effects of male participation in healthcare services on the number of jaw surgery operations (B=111809.72; p<0.01), female participation (B=-238574.84; p<0.01) and female employment rate (B=-400725.59; p<0.05) were statistically significant. However, the effect of all three variables on orthodontic treatments was not statistically significant (Table 2).

Table 2. Results of the Generalized Linear Model (Logit) analysis for the effect of female and male health care participation and female employment on the number of maxillofacial surgery operations and orthodontic patients

Parameters	B	Std. Error	95% Wald Confidence Interval		Hypothesis tests	
			Minimum	Maximum	Wald X ²	p
Number of maxillofacial surgery patients						
(Intercept)	-107273215.59	22480482.26	-151334151.18	-63212280.01	22.77	0.000
Percentage of male participation in health services	111809.72	29577.04	53839.79	169779.65	14.29	0.000
Percentage of female participation in health services	-238574.84	49322.11	-335244.39	-141905.29	23.40	0.000
Female employment rate	-400725.59	149575.03	-693887.26	-107563.91	7.18	0.007
Year	58936.68	10122.16	39097.60	78775.76	33.90	0.000
Percentage of female participation in health services* Female employment rate	4632.36	1768.38	1166.40	8098.32	6.86	0.009
(Scale)	1252137671.64	491128801.64	580474796.71	2700976437.96		
Number of orthodontic treatments						
(Intercept)						
Percentage of male participation in health services	-13011447.99	10746596.59	-34074390.26	8051494.29	1.47	0.226
Percentage of female participation in health services	-324.07	14139.04	-28036.09	27387.94	0.01	0.982
Female employment rate	8693.01	23577.99	-37519.02	54905.03	0.14	0.712
Year	47985.91	71503.03	-92157.45	188129.26	0.45	0.502
Percentage of female participation in health services* Female employment rate	6082.63	4838.81	-3401.27	15566.53	1.58	0.209
(Scale)	-495.33	845.36	-2152.20	1161.54	0.34	0.558
	286142737.48	112234415.55	132652064.65	617236274.69		

4. Discussion

In this study, the effect of women's and men's participation in health services and women's employment on the number of jaw surgery and orthodontic treatments for women and men were examined. The number of dentist applications and the number of dentists were taken as control variables in the study.

According to the results of the correlation analysis, the effects of women's and men's participation in health services and employment of women on both the number of maxillofacial surgery and the number of orthodontics were statistically significant and high. However, correlation analysis coefficients showed that all three parameters had a higher contribution on maxillofacial surgery. In the internal evaluation, the effect of female participation in the number of maxillofacial surgeries was higher than the male participation in health services. The same was true for orthodontics, and women's participation in health care had a higher impact on orthodontic treatment. However, in multivariate analysis, while participation in maxillofacial surgery had a significant effect on women's participation in health care and employment, the same was not accepted for orthodontics.

5. Conclusion

The results show that women's participation in health services significantly affects their oral and dental health. The effect of employment on women's participation in health services has an impact on the increase in the number of operations in oral and maxillofacial surgery. For this reason, in order to increase the level of oral health and increase the quality of life of individuals, women's participation in the health system should be ensured on the one hand, and on the other hand, studies should be carried out to reach the female population who could not enter the employment structure.

References

- Amoah PA, Boateng MO, Koduah AO, Acheampong PR. Interplay of health literacy, healthcare access and health behaviors with oral health status among older persons. *Front Public Health*. 2022;10:997987. Published 2022 Dec 8. doi:10.3389/fpubh.2022.997987
- de Silva AM, Hegde S, Akudo Nwagbara B, et al. WITHDRAWN: Community-based population-level interventions for promoting child oral health. *Cochrane Database Syst Rev*. 2016;12(12):CD009837. Published 2016 Dec 22. doi:10.1002/14651858.CD009837.pub3
- Dickson-Swift V, Crocombe L. Missed opportunities for improving oral health in rural Victoria: The role of municipal public health planning in improving oral health. *Health Promot J Austr*. 2022;33(2):509-518. doi:10.1002/hpja.525
- Karasar, N. Bilimsel Araştırma Yöntemi. Ankara: Bilim Kitap Kırtasiye Yayınevi, 2012.
- Petersen PE, Baez RJ, Ogawa H. Global application of oral disease prevention and health promotion as measured 10 years after the 2007 World Health Assembly statement on oral health. *Community Dent Oral Epidemiol*. 2020;48(4):338-348. doi:10.1111/cdoe.12538
- Poirier BF, Hedges J, Smithers LG, Moskos M, Jamieson LM. Child-, Family-, and Community-Level Facilitators for Promoting Oral Health Practices among Indigenous Children. *Int J Environ Res Public Health*. 2022;19(3):1150. Published 2022 Jan 20. doi:10.3390/ijerph19031150
- Poudel P, Rawal LB, Kong A, et al. Oral Health Knowledge, Attitudes and Practices of People Living with Diabetes in South Asia: A Scoping Review. *Int J Environ Res Public Health*. 2022;19(21):13851. Published 2022 Oct 25. doi:10.3390/ijerph192113851
- Sfeatcu R, Balgiu BA, Mihai C, Petre A, Pantea M, Tribus L. Gender Differences in Oral Health: Self-Reported Attitudes, Values, Behaviours and Literacy among Romanian Adults. *J Pers Med*. 2022;12(10):1603. Published 2022 Sep 29. doi:10.3390/jpm12101603
- Wang L, Ren J, Fiscella KA, et al. Interprofessional collaboration and smartphone use as promising strategies to improve prenatal oral health care utilization among US underserved women: results from a qualitative study. *BMC Oral Health*. 2020;20(1):333. Published 2020 Nov 23. doi:10.1186/s12903-020-01327-9

GEBELERDE BEL AĞRISI, YAŞAM KALİTESİ DÜZEYİNİN İNCELENMESİ

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Özet

Amaç: Bu çalışmanın amacı gebe kadınlarda bel ağrısı ve yaşam kalitesinin incelenmesidir.

Gereç ve Yöntem: Bu çalışmaya 152 gebe ve 52 asemptomatik gebe olmayan kadın dahil edildi. Kadınların sosyodemografik özellikleri demografik bilgi formu ile kaydedildi. Kadınların Ağrı şiddeti VAS ile yaşam kaliteleri Kısa Form 36 (SF-36) ile değerlendirildi.

Bulgular: Çalışmaya katılan bireylerin yaş ortalamaları 28.95 ± 5.5 yılıdır. Yaşam kaliteleri incelemeleri sonucu fiziksel fonksiyona bağlı rol kısıtlılığı, emosyonel sorunlara bağlı rol kısıtlılığı, ağrı ve genel sağlık alt başlıklarında gruplar arasında istatistiksel olarak anlamlı değişimler gözlemlendi. Gebe kadınların bel ağrılarında ise fark görülmedi ($p>0.05$).

Sonuçlar: Gebe kadınlarda yaşam kalitesi ve bel ağrısını incelemeyi amaçlayan bu çalışmada gebelikle birlikte gebelerin yaşam kalitelerinin azaldığı, bel ağrılarında ise fark olmadığı bulundu. Gebenin iyi olma halinin pek çok parametre tarafından etkilenmektedir. Bu nedenle gebelikte gebenin yaşam kalitesini etkileyen diğer faktörlerinde incelenerek daha geniş popülasyonda çalışmalar yapılması önerilmektedir.

Anahtar kelimeler: Gebelik, bel ağrısı, yaşam kalitesi

EXAMINATION OF LOW BACK PAIN AND QUALITY OF LIFE LEVEL IN
PREGNANT WOMEN

Abstract

Objectives: The aim of study is to investigate the changes on low back pain and quality of life in pregnant women.

Materials and methods: This study included 152 pregnant women and 52 asymptomatic non-pregnant women. Sociodemographic characteristics of women were recorded by demographic information form. Pain severity was evaluated with VAS and quality of life was evaluated with Short Form 36 (SF-36).

Results: The mean age of the study participants was 28.95 ± 5.5 years. . As a result of quality of life analyzes, statistically significant changes were observed between the groups in terms of role limitation due to physical function, role limitation due to emotional problems, pain and general health. No difference was observed in low back pain of pregnant women ($p>0.05$).

Discussion: In this study, which aimed to examine quality of life and low back pain in pregnant women, it was found that the quality of life of pregnant women decreased with pregnancy, while there was no difference in low back pain. The well-being of pregnant women is affected by many parameters. Therefore, it is recommended that other factors affecting the quality of life of pregnant women during pregnancy should be examined and studies should be conducted in a larger population.

Keywords: Pregnancy, quality of life, low back pain

GİRİŞ

Fetüsün büyüme ve gelişimini kapsayan süre olarak bilinen gebelik son menstruel siklusun ilk gününden itibaren 37-42 haftalık süreyi kapsamaktadır. Ortalama 40 hafta süren gebelik dönemindeki kadında anatomik, fizyolojik ve psikolojik yönden birçok değişiklik görülür (Tan EK, 2013). Gebelikte vücut fizyolojik bir karmaşaya sahiptir. Gebenin vücudunda büyük oranda fizyolojik bir stres oluşmaktadır (Longo 2018). Gebeliğin kadınlar üzerindeki etkileri fizyolojik, anatomik, psikolojik ve postür yönünden görülmektedir. Gebe kadınlarda meydana gelen farklılaşmalar gebelik sırasında ve sonrasında pek çok problem yaşanmasına neden olmaktadır. Özellikle oluşan postür değişimlerinin sonucu olduğu düşünülen bel ağrısı, pelvik kuşak ağrısı, alt ekstremitelerde meydana gelen problemler ve üriner inkontinans gibi pek çok semptom görülmektedir (Okanishi vd. 2012).

Gebelikte bel ağrısının etiyojisi çok faktörlüdür ve sıklıkla biyomekanik, hormonal ve vasküler değişikliklerle ilişkilidir. Hamilelikte bel ağrısı için bildirilen risk faktörleri: annenin yaşı, sosyoekonomik sınıf, hamilelikten önce veya önceki gebeliklerde bel ağrısı varlığı, ağır işlerde çalışma, doğum sayısı, vücut kitle indeksi, ailede bel ağrısı öyküsü, hipermobilité tanısı ve ailede hipermobilité öyküsüdür (Mota, 2015). Gebelikte görülen bel ağrısının etiyojisi ve patogenezi net olarak açıklanamamış olsa bile bunun multifaktöriyel olduğu varsayılmaktadır (Kokic IS, 2017). Gebelik sırasında yaygın olarak görülen bel ağrısı, gebelerin yaklaşık olarak yarısını etkilemektedir (Sehmbi H, 2017).

Yaşam kalitesi, bireyin yaşamı olumsuz veya olumlu öznel değerlendirmesine atıfta bulunan çok boyutlu bir kavram olarak tanımlanır (Lui, 2019). Bu kavram bireyin fiziksel sağlığı, psikolojik durumu, kişisel inançları, sosyal ilişkileri ve bu sosyal ilişkilerin çevrenin belirgin özellikleriyle ilişkisinden etkilendiği geniş bir aralığa sahiptir (World Health Organizaton 1998). Sağlıkla ilişkili yaşam kalitesinde düşüş ve depresyonun sık rastlanabileceği dönemlerden biri gebeliktir (Tendais vd. 2011). Çalışmalar, kadınların yaşam kalitesinin gebelik sırasında gebelik öncesine göre önemli ölçüde daha düşük olduğunu ortaya koymuştur. Bu düşüşün başlıca sebepleri, kadınların gebelik döneminde fiziksel, psikolojik ve sosyal sorunlar yaşamalarıdır. Gebelikte değişen beden algısı, muskuloskeletal yapılarıdaki değişim ve buna bağlı oluşan ağrı öyküsü, gebelik komplikasyonları, gebenin yeni sosyal bir role adapte olması vs. pek çok faktör bireylerin sağlıkla ilişkili yaşam kalitesini olumsuz etkilemektedir (Calou vd. 2014, Ünver ve Aylaz 2017). Ayrıca ilerleyen gebelikle birlikte sağlıkla ilişkili yaşam kalitesinde düşüş miktarının artabileceği bildirilmiştir (Da Costa vd. 2010, Chang vd. 2014).

GEREÇ VE YÖNTEM

Gebelik süresince vücutta meydana gelen değişikliklerden; yaşam kalitesi ve bel ağrısını incelemeyi amaçlayan bu çalışmaya gebe ve gebe olmayan asemptomatik kadınlar arasından dahil edilme kriterlerine uygun ve gönüllü bireyler dahil edildi. çalışma grubu çalışmaya dahil edilme kriterleri 18 yaşından büyük olmak, okuma-yazma bilmek, araştırmaya katılmaya gönüllü olmak ve gebe olmak olarak belirlendi. çalışma dışı tutulma kriterleri ise çoğul gebelik, iskli gebelikler (preeklamsi, gestasyonel diyabet, intrauterin gelişme geriliği, kronik rahatsızlığı bulunmak, lumbal disk hernisine sahip olmak, ölçümler sırasında aktif üst solunum yolu enfeksiyonu geçiriyor olmak ve sigara kullanmak olarak belirlendi. Çalışmada birinci trimesterde 49 gebe kadın (Grup 1), ikinci trimesterde 51 gebe kadın (Grup 2), üçüncü trimesterde 52 gebe kadın(Grup 3) ile gebe olmayan semptomatik 52 kadın(Grup 4-kontrol) olmak üzere toplamda 204 birey analiz edildi.

Çalışmaya katılan bireylerin sosyo-demografik bilgilerini ve tıbbi özgeçmişlerini incelemek için Değerlendirme Formu oluşturuldu. Bu formun kapsamında ad-soyad, meslek, yaş, boy, ağırlık, medeni hal, öğrenim durumu, gebelik haftası, gebelik öncesi kilo ve diğer parametrelere ait veriler kaydedildi. Ağrı şiddeti Vizüel Analog Skalası (VAS) ile değerlendirildi yaşam kalitesini değerlendirmek için ise Kısa Form 36 (SF-36) ölçeği kullanıldı.

Ağrının Değerlendirilmesi

Ağrının değerlendirmesinde kullanılan farklı ölçekler arasında duyarlılığı ve güvenilirliği en iyi olan ölçümlerden biri olan VAS literatürde sıklıkla kullanılmaktadır (Ferreira-Valente vd. 2011). Tek maddelik bir ölçek olan VAS ta 10 cm lik bir çizgi bulunmaktadır. Bu çizginin başlangıcında 0 'ağrı yok' yönergesi ve çizginin sonunda ise 10 'en kötü ağrı' yönergesi bulunmaktadır. Katılımcılardan ağrılarına karşılık gelen kısmı işaretlemeleri sözel yönerge ile anlatılmaktadır. İşaretlenen noktanın 0 noktasına uzaklığı ölçülerek skor hesaplanır. Yüksek değer yoğun ağrı şiddetini temsil etmektedir (Hawker vd. 2011).

Yaşam Kalitesinin Değerlendirilmesi

Yaşam kalitesini değerlendirmede Kısa form SF -36 anketi kullanılmıştır. Ware ve ark. tarafından 1992 yılında geliştirilen bu ölçek yaşam kalitesini değerlendirmek için sıkça kullanılmaktadır. Test 36 maddeden oluşmakta ve 8 farklı boyutu değerlendirmektedir. Sosyal fonksiyon (2), fiziksel fonksiyon (10), fiziksel sorunlara bağlı oluşan rol kısıtlılığı (4), emosyonel sorunlara bağlı oluşan rol kısıtlılığı (3), mental sağlık (5), enerji (4), ağrı (2) ve sağlığın genel algılanması (5) testin alt boyutlarıdır. Değerlendirmeler çoğunlukla Likert tipi

4. ve 5. sorular ise evet/hayır şeklinde yanıtlanmaktadır. Testin cevapları son 4 haftayı kapsayıcı yöndedir. Skorlama 0-100 arası değer almakta ve 0 kötü sağlık durumunu, 100 ise iyi sağlık durumunu bildirmektedir.

İstatistiksel Analiz

Veriler SPSS 25.0 (IBM SPSS Statistics 25 software (Armonk,NY: IBM Corp.) paket programıyla analiz edilmiştir. Sürekli değişkenler ortalama \pm standart sapma, ortanca (en küçük-en büyük değerler) ve kategorik değişkenler sayı ve yüzde olarak ifade edilmiştir. Verilerin normal dağılıma uygunluğu Shapiro-Wilk testi ile incelenmiştir. Parametrik test varsayımları sağlandığında bağımsız grup farklılıklarının karşılaştırılmasında Tek Yönlü Varyans Analizi kullanılmıştır. Tüm analizlerde $p<0,05$ istatistiksel olarak anlamlı kabul edilmiştir.

BULGULAR

Çalışmaya birinci trimesterde 49, ikinci trimesterde 51, üçüncü trimesterde 52 gebe kadın ile asemptomatik 52 gönüllü kadın dahil edildi. Çalışmaya katılan kişilerin VKİ değerleri incelendiğinde 4 grup arasında istatistiksel olarak anlamlı fark olmadığı görüldü ($p>0.05$). Üçüncü grupta bulunan kişilerin VKİ değerleri diğer gruplarda bulunan kişilere göre anlamlı şekilde yüksek bulundu ($p<0.05$) Bireylerin demografik özelliklerine ilişkin veriler Tablo .1' de gösterildi.. Bel ağrısı şiddeti gruplar arasında karşılaştırıldığında istatistiksel olarak anlamlı bir fark olmadığı görüldü ($p> 0.05$) (Tablo 2). Çalışmaya katılan kişilerin sosyal fonksiyon değerlerin 4 grup arasındaki farklılıkları incelendiğinde; Fiziksel fonksiyon incelemelerinde, kontrol grubundaki kişilerin değerlerinin diğer 3 grupta bulunan kişilere göre anlamlı şekilde yüksek olduğu ayrıca 1. gruptaki kişilerin değerlerinin de 3. gruptaki kişilere göre anlamlı şekilde yüksek olduğu görüldü ($p< 0.005$) (Tablo 3).

Tablo1. Kadınların Demografik Özellikleri

		Grup 1	Grup 2	Grup 3	Kontrol	P
Yaş	A.O ± S.S	29.57± 6.03	29.31± 4.97	27.35 ± 5.61	29.61 ± 5.2	0.085 (X ² = 6.624)
	Med (min-maks)	29 (18-45)	29 (18-37)	26.5 (18-42)	28 (20-41)	
Boy (cm)	A.O ± S.S	160.27± 6.08	160.57 ± 5.63	160.1 ± 5.91	159.94± 5.03	0.968 (X ² = 0.259)
	Med (min-maks)	160(145-178)	160 (150-176)	160 (150-172)	160(150-172)	
Kilo (kg)	A.O ± S.S	65.12 ± 12.9	67.14± 11.42	74.58± 13.9	68.2 ± 16.79	0.003* (X ² = 14.102) (1-3, 2-3, 3-K)
	Med (min-maks)	62 (42-95)	65 (45-100)	70.5 (50-113)	65 (44-130)	
Vki (kg/cm²)	A.O ± S.S	25.29 ± 4.37	26.05 ± 4.24	29.04 ± 4.81	26.7 ± 6.71	0.001* (X ² = 16.176) 1-3, 2-3, 3-K)
	Med (min-maks)	(kg/cm ²) 25.39(16.41 - 33.26)	25.24 (18.49- 36.73)	28.32 (19.49-41.51)	25.59 (18.49-51.42)	

Tablo 2. Bel ağrısı şiddetinin gruplar arası karşılaştırılması

		Grup 1	Grup 2	Grup 3	Kontrol	P
Bel Ağrısı Şiddeti	A.O ± S.S	4.55± 1.69	6.33 ± 2.45	5.24 ± 1.83	-	0.128 (X ² =4.111)
	Med (min- maks)	4 (3-7)	7 (2-9)	5 (2-8)	-	

Tablo 3. Sf-36 Yaşam Kalitesi ölçeğinin gruplar arası karşılaştırılması

		Grup 1	Grup 2	Grup 3	Kontrol	p
Fiziksel Fonksiyon	A.O ± S.S	59.1 ± 31.33	49.69 ± 28.89	34.33 ± 27.48	83.65 ± 24.28	0.0001*($\chi^2=61.337$) (1-K, 2-K, 3-K, 1-3)
	Med (min-maks)	60 (0-100)	55 (0-100)	25 (0-100)	97.5 (0-100)	
Fiziksel Fonksiyona Bağlı Rol Kısıtlılığı	A.O ± S.S	59.55 ± 42.19	32.35 ± 41.02	14.9 ± 32.94	87.21 ± 29.78	0.0001*($\chi^2=74.917$) (1-K, 2-K, 3-K, 1-3, 1-2)
	Med (min-maks)	75 (0-100)	0 (0-100)	0 (0-100)	100 (0-100)	
Emosyonel Sorunlara Bağlı Rol Kısıtlılığı	A.O ± S.S	60.86 ± 45.86	32.02 ± 43.71	14.88 ± 33.54	84.62 ± 36.43	0.0001*($\chi^2=64.061$) (2-K, 3-K, 1-3, 1-2)
	Med (min-maks)	100 (0-100)	0 (0-100)	0 (0-100)	100 (0-100)	
Emosyonel Fonksiyon	A.O ± S.S	56.18 ± 22.94	52.86 ± 21.75	49.52 ± 23.44	60.25 ± 22.6	0.106 ($\chi^2=6.12$)
	Med (min-maks)	50 (10-100)	50 (5-100)	50 (0-100)	57.5 (5-100)	
Enerji- Canlılık	A.O ± S.S	57.9 ± 22.87	63.61 ± 24.23	62.15 ± 27.4	60.42 ± 22.8	0.792 ($\chi^2=1.039$)
	Med (min-maks)	60 (3-100)	60 (16-100)	60 (0-100)	56 (20-100)	
Sosyal Fonksiyon	A.O ± S.S	66.31 ± 26.57	67.53 ± 22.9	58.6 ± 23.14	64.63 ± 25.73	0.327($\chi^2=3.449$)
	Med (min-maks)	63 (8-100)	63 (0-100)	63 (0-100)	63 (0-100)	
Ağrı	A.O ± S.S	75.41 ± 20.57	67.22 ± 21.8	57.54 ± 21.38	71.04 ± 20.96	0.0001*($\chi^2= 20.244$) (1-3, 3-K)
	Med (min-maks)	78 (0-100)	68 (10-100)	56.5 (10-100)	69 (23-100)	
Sağlığın Genel Algılanması	A.O ± S.S	65.61 ± 16.54	67.63 ± 15.53	59.94 ± 14.8	61.83 ± 15.44	0.008*($\chi^2=11.921$) (2-3)
	Med (min-maks)	70 (20-95)	70 (10-90)	60 (30-94)	65 (25-90)	

TARTIŞMA

Gebe kadınlarda yaşam kalitesi ve bel ağrısını incelemeyi amaçlayan bu çalışmada gebelikle birlikte gebelerin yaşam kalitelerinin azaldığı, bel ağrılarında ise fark olmadığı bulundu. Gebeliklerinin 13. ve 36. haftaları arasında olan 139 kadın ile yürütülen bu kesitsel bir çalışmada bel ağrısı ve yaşam kalitesi arasındaki ilişki incelenmiştir. Bel ağrısı Roland Morris Engellilik Anketi ile, yaşam kalitesi WHOQOL-Bref anketi ile değerlendirilmiştir. Bel ağrısı ve yaşam kalitesi anketleri arasında anlamlı korelasyon bulunmuştur. Gebelik haftaları ve bel ağrısı anketi arasında da anlamlı korelasyon bulunmuştur (Ibanez G, 2017).

Gebelikte yaşam kalitesi skorlarını trimesterlere göre inceleyen bir çalışmada gebenin yaşından bağımsız olarak en düşük genel sağlık skoru üçüncü trimesterde elde edilirken, en yüksek skorun ise ikinci trimesterde olduğu bildirilmiştir. Bu bulgular bizim çalışmamızdan elde edilen genel sağlık alt başlığına ait skorlar ile uyum göstermektedir (Rofé vd. 1993). Gebelik trimesterlerinde görülen genel sağlık alt başlığındaki bu dağılımın gebenin yaşadığı fizyolojik değişimlerden kaynaklandığı görüşü öne sürülmüştür. Çalışmamızda ikinci

trimester gebelerde lumbal ağrı şiddetinin emosyonel fonksiyon ve emosyonel iyilik hali üzerinde olumsuz etkisi olduğu sonucuna varıldı.

218 gebe kadın üzerinde yapılan bu çalışmada, gebelik sırasında bel ağrısı olan ve olmayan kadınların yaşam kalitelerini karşılaştırmak amaçlanmıştır. Yaşam kalitesi Kısa Form-12 anketi ile değerlendirilmiştir. Çalışmaya dahil edilen 218 gebe kadından 137'si bel ağrısı bildirmiştir. Bel ağrısı grubunda ortalama ağrı yoğunluğu, 0-10 aralığında numerik skala ile değerlendirilmiş 5.04 ± 1.73 olarak bulunmuştur. Bel ağrısı olan kadın grubu ile bel ağrısı olmayan kadın grubu arasında ruh sağlığı, fiziksel sağlık ve sosyal ilişkiler alanlarında anlamlı bir yaşam kalitesi farkı bulunmuştur. Ruh sağlığı ve sosyal ilişkiler boyutlarının, fiziksel puanlardan daha fazla etkilendiği görülmüştür (Lima, 2017).

Bireysel farklılıkların etkisini ortadan kaldırmak için gebelerin gebeliğin birinci trimesterinden itibaren takip edilmesi ve postpartum dönemde de farklı zamanlarda ölçümlerin tekrarlanması bireylerde oluşan farklılığı daha iyi yansıtabileceğini düşünüyoruz. Gebenin iyi olma halinin pek çok parametre tarafından etkilenmektedir. Bu nedenle gebelikte gebenin yaşam kalitesini etkileyen diğer faktörlerinde incelenerek daha geniş popülasyonda çalışmalar yapılması önerilmektedir.

KAYNAKLAR

- Fleischman AR, Oinuma M, Clark SL. Rethinking the definition of ‘term pregnancy’. *Obstetrics & Gynecology* 2010; 116 (1): 136–39.
- Rubin R. Maternal tasks in pregnancy,” *Journal Of Advanced Nursing* 1976; 1: 367–76.
- Tan EK, Tan EL. Alterations in physiology and anatomy during pregnancy. *Best practice research Clinical obstetrics & gynaecology*. 2013;27(6):791-802.
- Longo L, "Maternal Physiology of Pregnancy" *The rise of fetal and neonatal physiology*, Springer, California, 2018, s 217-80.
- Okanishi N, Kito N, Akiyama M, Yamamoto M. Spinal curvature and characteristics of postural change in pregnant women.” *Acta Obstetricia et Gynecologica*
- Mota, M. J., Cardoso, M., Carvalho, A., Marques, A., Sá-Couto, P., & Demain, S. (2015). Women's experiences of low back pain during pregnancy. *Journal of back and musculoskeletal rehabilitation*, 28(2), 351-357.
- Barakat, R., & Perales, M. (2015). Pregnancy, physical activity, functional capacity and adaptations to exercise. *Current Women's Health Reviews*, 11(1), 13-18.
- Kokic IS, Ivanisevic M, Uremovic M, Kokic T, Pisot R, Simunic B. Effect of therapeutic exercises on pregnancy-related low back pain and pelvic girdle pain: secondary analysis of a randomized controlled trial. *Journal of rehabilitation medicine*. 2017;49(3):251-7.
- Sehmbi H, D'Souza R, Bhatia A. Low Back Pain in Pregnancy: Investigations, Management, and Role of Neuraxial Analgesia and Anaesthesia: A Systematic Review. *Gynecol Obstet -Invest*. 2017;82(5):417-436. doi: 10.1159/000471764. Epub 2017 May 18. PMID: 28514779.
- Liu, N., Gou, W. H., Wang, J., Chen, D. D., Sun, W. J., Guo, P. P., ... & Zhang, W. (2019). Effects of exercise on pregnant women’s quality of life: A systematic review. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 242, 170-177.
- World Health Organizaton. WHOQOL: measuring quality of life.” *Psychol Med* 1998; 28 (3): 551–58.
- Tendais I, Figueiredo B, Mota J, Conde A. Physical activity, health-related quality of life and depression during pregnancy. *Cadernos de Saude Publica* 2011; 27: 219–28.
- Da Costa D, Dritsa M, Verreault N, Balaa C, Kudzman J, Khalifé S. Sleep problems and depressed mood negatively impact health-related quality of life during pregnancy. *Archives of Women’s Mental Health* 2010; 13 (3): 249–57.
- Calou CGP, Pinheiro AKB, Castro RCMB, Oliveira MF, Aquino PS, Antezana PJ. Health related quality of life pregnant women and associated factors: an integrative review. *Helath* 2014; 6: 2375-2387.
- Ferreira-Valente MA, Pais-Ribeiro JL, Jensen MP. Validity of four pain intensity rating scales. *Pain* 2011; 152 (10): 2399–2404.
- Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: visual analog scale for pain (VAS pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire(MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care and Research* 2011; 63 (11): 240–52.

- Gladys I, Amel K, Jean François R, Sam R, Jacky N, Nour B, Sarah R and Julie Back Pain during Pregnancy and Quality of Life of Pregnant Women Research Article -(2017) Volume 7,1.
- Rofé Y, Blittner M, Lewin I. 1993. Emotional experiences during the three trimesters of pregnancy. *Journal of Clinical Psychology* 1993; 49 (1): 3–12.
- Ana Carolina do Nascimento Lima, Flavio Boechat de Oliveira Gabriela Pereira Avolio Giselly Dias da Silva Paula Soares da Silva Rodrigo Gomes de Souza Vale. Prevalence of low back pain and interference with quality of life of pregnant women *Rev. dor* 18 (02), Apr-Jun 2017 • <https://doi.org/10.5935/1806-0013.20170024>.

**INVESTIGATION OF SILICONE INSULATOR SURFACE RESISTANCE BY
USING EMPIRICAL MODE DECOMPOSITION METHOD**

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ABSTRACT

Silicone insulators have widely usage area in electrical high voltage transmission systems. This insulator protects the conductive parts of the systems from excessive electrical discharges. However, during its service life, electrical, thermal and mechanic stresses result in surface degradation with tracking. Insulation resistance of surface loss its durability against especially excessive electrical stress. Tracking occurs on the surface of silicone insulator. As a result of continuous discharges on the surface, carbonized pathways are formed. Insulation resistance is so reduced that carbon particles can break off from the material surface and cause erosion. In this case, power outages may occur and may cause financial losses. In order to prevent these losses, the formation of traces on the surface should be followed carefully. In order to examine the surface distortion, the insulating material is tested with the Inclined Plane Test setup. As a result of this test, an important evaluation is made about the durability of the material. In this study, 6 silicon insulators with the same properties were tested in the IPT plane. Although this test was carried out in accordance with the IEC 60587 standard, leakage current signals flowing from the material surface were also recorded. Although the waveform of the current is sinusoidal, it contains too many disturbances and peaks. By analyzing these points correctly, the resistance loss of the material surface can be measured dynamically. In this study, leakage current signals were analyzed by Empirical Mode Decomposition method. Modes were observed more smoothly in the EMD decomposition of the sample that lasted longer under extreme electric field stress.

Keywords: Silicone insulators, IPT test, surface resistance, leakage current, EMD method.

1. INTRODUCTION

Dynamically monitoring the dielectric performance of solid insulators used in high voltage insulation systems is essential for uninterrupted electrical energy. The surfaces of solid insulators under electrical, thermal, mechanical and environmental stress lose their dielectric resistance over time [1-3]. Trackings occur in a solid insulator that gradually loses its surface hydrophobes [4-5]. These traces consist of the formation of dry bands on the surface by electrical discharges that occur as a result of ionization along the surface [6-7]. These dry paths consist of the complete evaporation of moisture and water vapor on the surface due to the electrical arc [8-9]. Carbon traces begin to form on the gradually drying surface and decrease as the surface resistance decreases. After a certain moment, carbonized particles begin to break off from the surface, that is, erosion occurs. After erosion has occurred, completely conductive zones are formed in some parts of the solid insulator. Therefore, electrical energy may be interrupted due to the electrical arcing of the conductive areas. In this case, especially industrial organizations that benefit from energy suffer financially. Therefore, the surface tracking formations of solid insulators should be analyzed thoroughly. Many different types of solid insulators are used in electrical energy transmission distribution systems. Glass, ceramic, porcelain, polyurethane, polyethylene, cross-linked polyethylene and silicone are the most commonly used solid insulators. Glass, ceramic and porcelain insulators were the first used insulators. However, as the technology developed, the use of silicon insulators became widespread [10]. Silicon insulators are used as high voltage insulators due to some of their superior properties;

- long term on outdoor use,
- exhibits high acid resistance,
- a long lifetime even on use in serious pollution areas,
- their light weight,
- low installation cost,
- easy handling compared to porcelain and glass insulators all over the world.

There are many academic studies examining the surface resistances of silicon insulators, the use of which is increasing day by day. Arshad A. et. al. investigates the surface resistance of silicone rubber sheets under polluted and dry band conditions [11]. The experiments were performed on silicone rubber sheets with different thicknesses, and the surface resistance was measured using the two-point DC method. The pollution level was simulated by applying a uniform layer of sodium chloride (NaCl) on the surface of the sheets, while the dry band

condition was created by a needle point electrode. The results show that the surface resistance of silicone rubber sheets increases significantly under both polluted and dry band conditions. The increase in surface resistance is more significant for thinner sheets. The authors also observed that the surface resistance increases with the pollution level and the duration of the dry band condition. Under polluted conditions, the surface resistance of the sheets increases from $10^{11} \Omega/\text{sq.}$ to $10^{14} \Omega/\text{sq.}$ as the pollution level increases from 0 to $1 \text{ mg}/\text{cm}^2$. Similarly, under dry band conditions, the surface resistance increases from $10^{11} \Omega/\text{sq.}$ to $10^{13} \Omega/\text{sq.}$ as the duration of the dry band increases from 0 to 24 hours. The authors concluded that the increase in surface resistance of silicone rubber sheets under polluted and dry band conditions can significantly affect the insulation performance of high voltage equipment. Therefore, it is essential to consider the effects of pollution and dry band conditions when designing and maintaining high voltage equipment.

Morteza Ghayedi and et. all investigated a dynamic theoretical and experimental model for AC flashover of silicone rubber insulators under fan-shaped and longitudinal pollution [12]. The experiments were conducted on silicone rubber insulators with different lengths and diameters, and the pollution was simulated using a uniform layer of sodium chloride (NaCl) and kaolin particles. The authors found that the AC flashover voltage of the silicone rubber insulator decreases significantly under polluted conditions. The decrease in flashover voltage is more significant for longer insulators and under fan-shaped pollution. The experimental results were in good agreement with the theoretical model, which was based on the Weibull distribution and the creeping discharge model. Under fan-shaped pollution, the AC flashover voltage of the insulator decreased from 48 kV to 8 kV for a 300 mm long insulator. Similarly, under longitudinal pollution, the AC flashover voltage decreased from 54 kV to 19 kV for a 300 mm long insulator. The authors also observed that the insulators under fan-shaped pollution were more susceptible to flashover than those under longitudinal pollution. The authors concluded that the proposed theoretical and experimental models can provide a better understanding of the AC flashover behavior of silicone rubber insulators under polluted conditions. The models can be used to optimize the design and maintenance of high voltage equipment and improve the reliability of power systems.

As can be seen, there are very detailed studies on measuring the surface resistivity of silicon insulators. However, leakage current signals passing through the surface were not recorded in these studies. In this study, pure silicones were exposed to high tensile stress in an inclined plane test (IPT) setup. The experiments were carried out in accordance with the IEC 60587

standard and the leakage current signals flowing on the surface of the silicon insulator during the experiment were collected on a resistor. The obtained leakage current signals were first analyzed with classical methods. Then, the current signal is decomposed by the Empirical Mode Decomposition (EMD) method, which is a new method. In the results obtained, it has been seen that the EMD method provides a successful evaluation opportunity in monitoring the surface resistances of silicone insulators.

2. EXPERIMENTAL SET-UP AND PROCEDURE

In order to measure the surface resistivity of silicon insulators, an IPT test setup was established within the scope of the IEC 60587 standard [13]. In this experimental setup, silicon insulator is placed between two electrodes at an angle of 45 degrees. All these placements and the dimensions of the electrodes are explained in detail in the standard content. Accordingly, electrolyte liquid flow, called polluting liquid, was provided to the silicon insulator surface through the high voltage electrode through an 8-layer filter. Electrolyte liquid is used to simulate adverse environmental conditions in a laboratory environment. The electrolyte liquid contains $0.1 \pm 0.002\%$ NH_4Cl (Ammonium Chloride) and $0.2 \pm 0.002\%$ Triton-X100 materials. The electrolyte liquid flows onto the sample surface at a rate of 36 ml/h. During the liquid flow, electrical arcs occur between the high voltage electrode and the ground electrode. In order to obtain high voltage a voltage transformer with 220/10000 V turn ratio and 1 kVA apparent power is used by supplying with the help of variac between 0-220 V. According to the standard, constant tracking voltage method is used. So, the high voltage value of 4,5 kV is applied to the silicone surface during the 6 hours. The schematic representation of the experimental setup is shown in Figure 1.

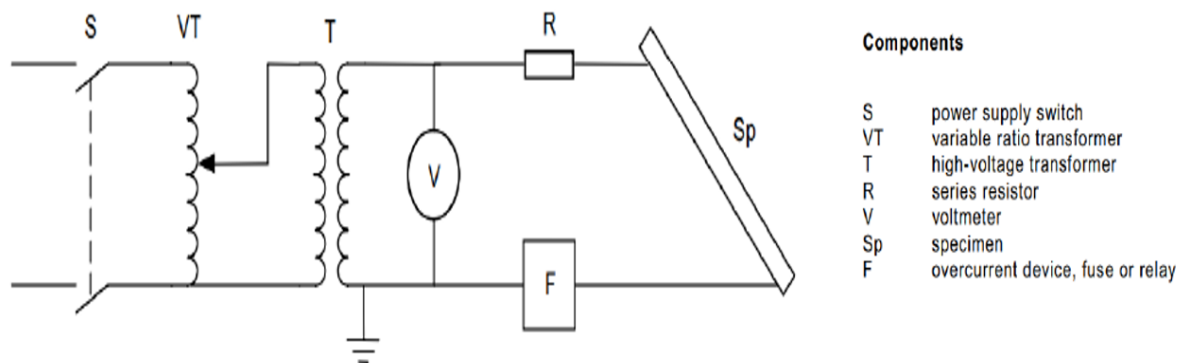


Figure 14. Schematic Representation of the Experimental Setup

It is important to monitor and evaluate the leakage current signals passing through the surface in order to better analyze the surface discharges of the silicon material. In the experimental

studies in the literature, only the surface resistance was examined within the scope of the standard. In this study, leakage current signals were recorded with a Fluke 190-504S oscilloscope over a 94 k Ω and 200 W resistor connected to the ground electrode.

3. RESULTS and DISCUSSIONS

3.1. Leakage Current Analysis

In the experimental study, a total of 10 pure/neat silicone insulators were tested. Among these insulators, the samples that lasted the longest and lasted the shortest were selected for analysis. The sample most resistant to the high electric field arc remained intact for 6 hours. On the other hand, the weakest specimen lasted only 30 minutes and serious erosions occurred on its surface. In Figure 2, the leakage current signal waveform of the intact sample is given.

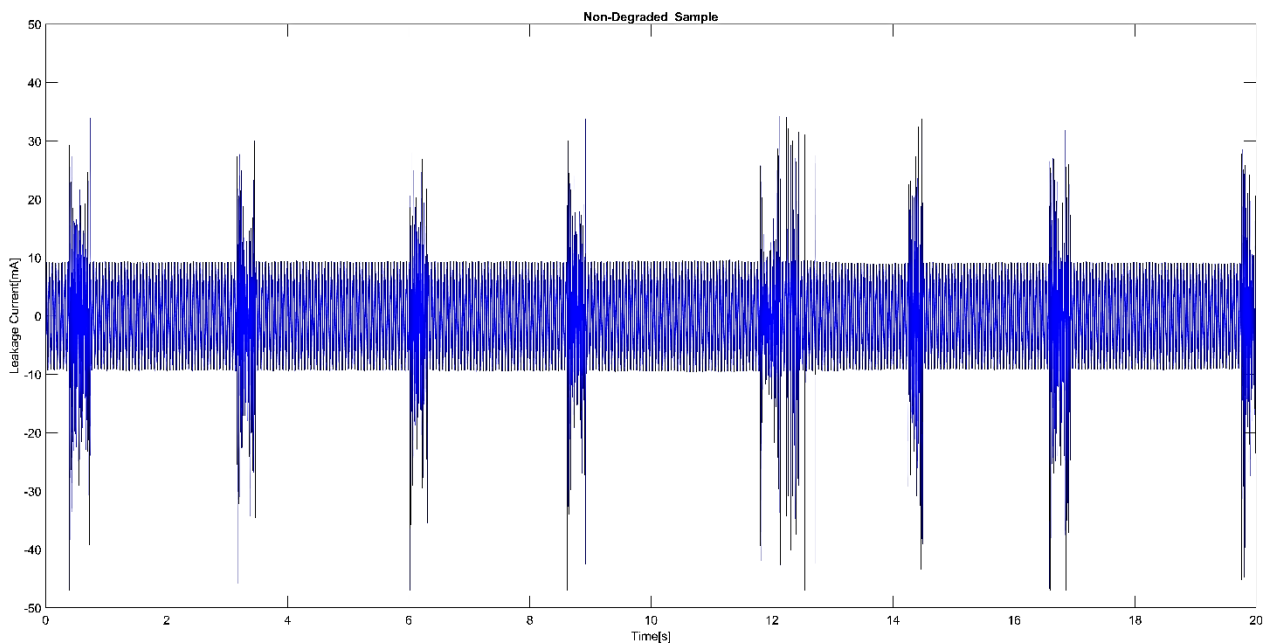


Figure 15. Leakage Current Signal of Non-Degraded Sample

As can be clearly seen from Figure 2, there are no disturbing points on the leakage current signal of the non-degraded sample. The peaks experienced at some points are actually caused by the electrical arc that occurs during the flow of the electrolyte liquid over the surface. Although this electrical arc caused stress on the surface, it did not cause complete breakdown. In Figure 3, the time dependent leakage current waveform of the degraded sample is given.

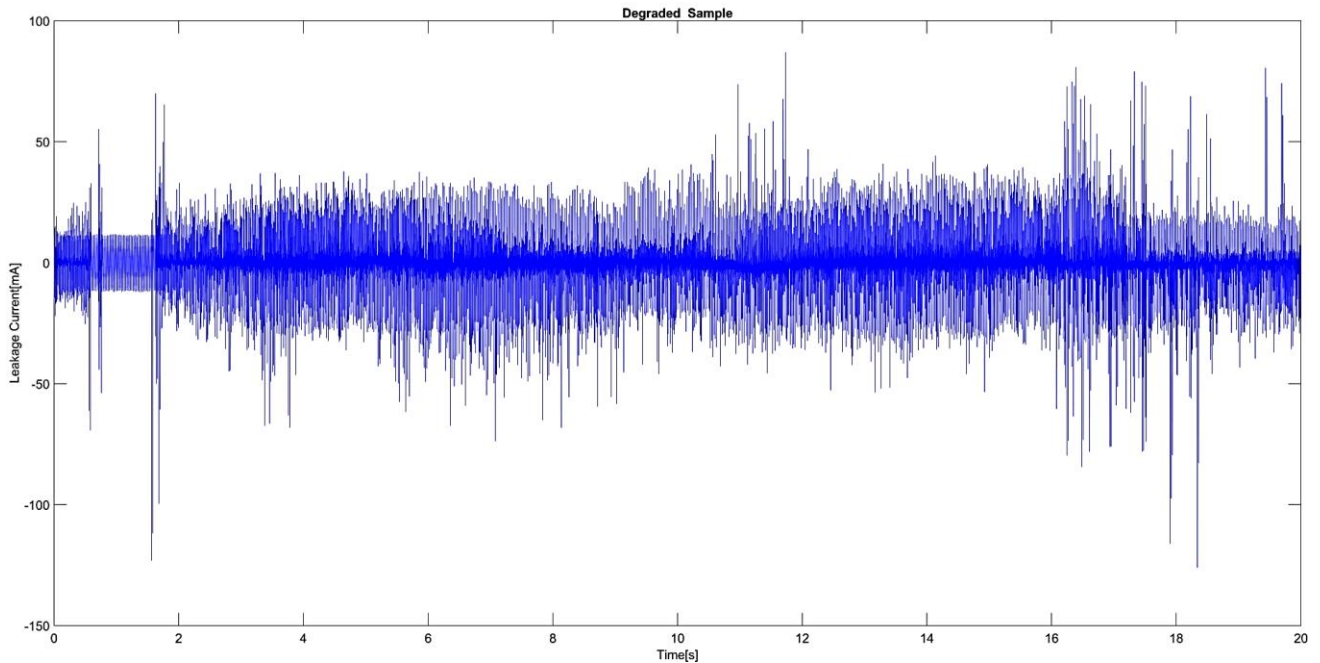


Figure 16. Leakage Current Signal of Degraded Sample

The current signal of the degraded sample has a very different structure from the pure sinusoidal form. In addition, the amplitude value of the current has reached approximately 80 mA levels and is approximately 8 times higher than the non-degraded sample at this value. According to the IEC 60587 standard, it is stated that the material starts to deteriorate when a current of more than 60 mA is passed through a sample. However, this value must be seen for 2 seconds or longer. Although the current value in the deteriorated sample exceeded the maximum level, 2 seconds were not exceeded. In this case, an evaluation with additional analysis methods is required.

3.2. Noise Frequency and Partial Discharge Analysis

Signals found outside the natural frequency in a waveform are called noise. By analyzing these noises, information can be obtained about the resistance of an insulator to high voltage stress from the current waveform. Any point that disrupts the sine waveform is likely to produce noise. These noisy spots produced actually show that there are forcing effects on the insulator whose signal is being measured. The amount of noise in the current waveform passing through the surfaces of solid dielectric materials with poor insulation performance is always higher. However, the frequencies at which these noises are concentrated should be well analyzed. The noises between 0-8 kHz frequency range are examined in the scope of this study. The noise graphs of non-degraded and degraded silicone specimens are shown Figure 4 and Figure 5, respectively.

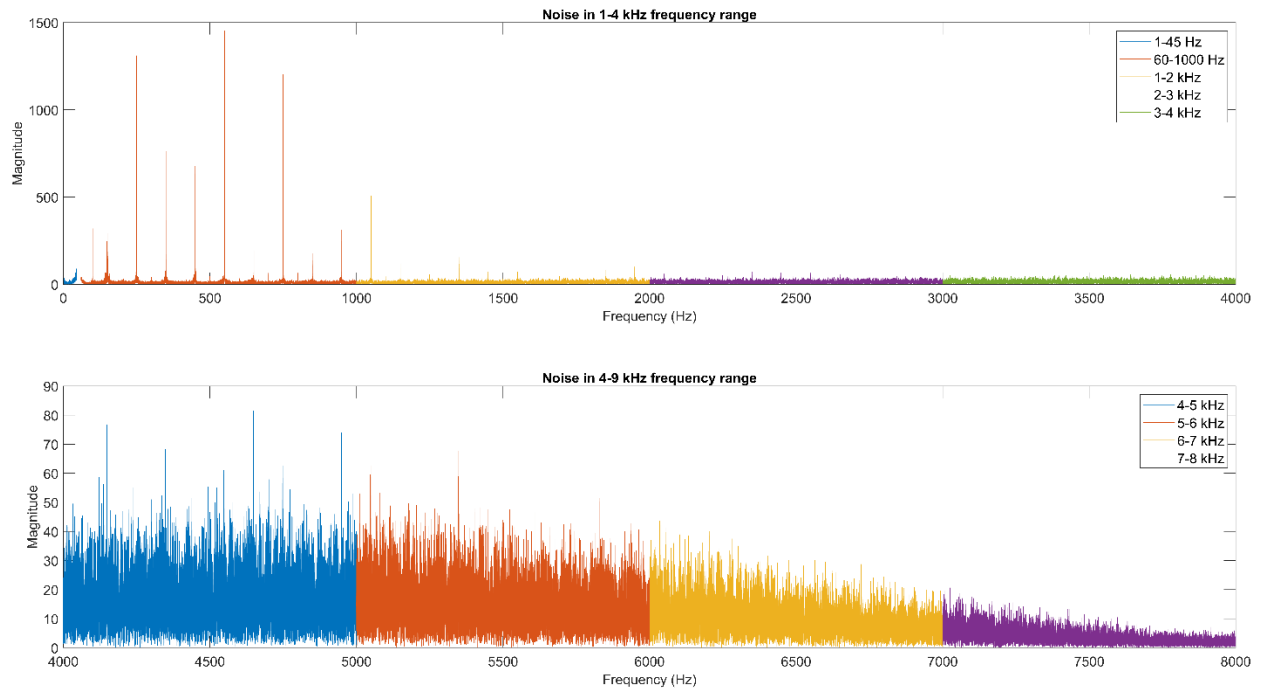


Figure 17. Noises of Non-Degraded Sample between 0-8 kHz

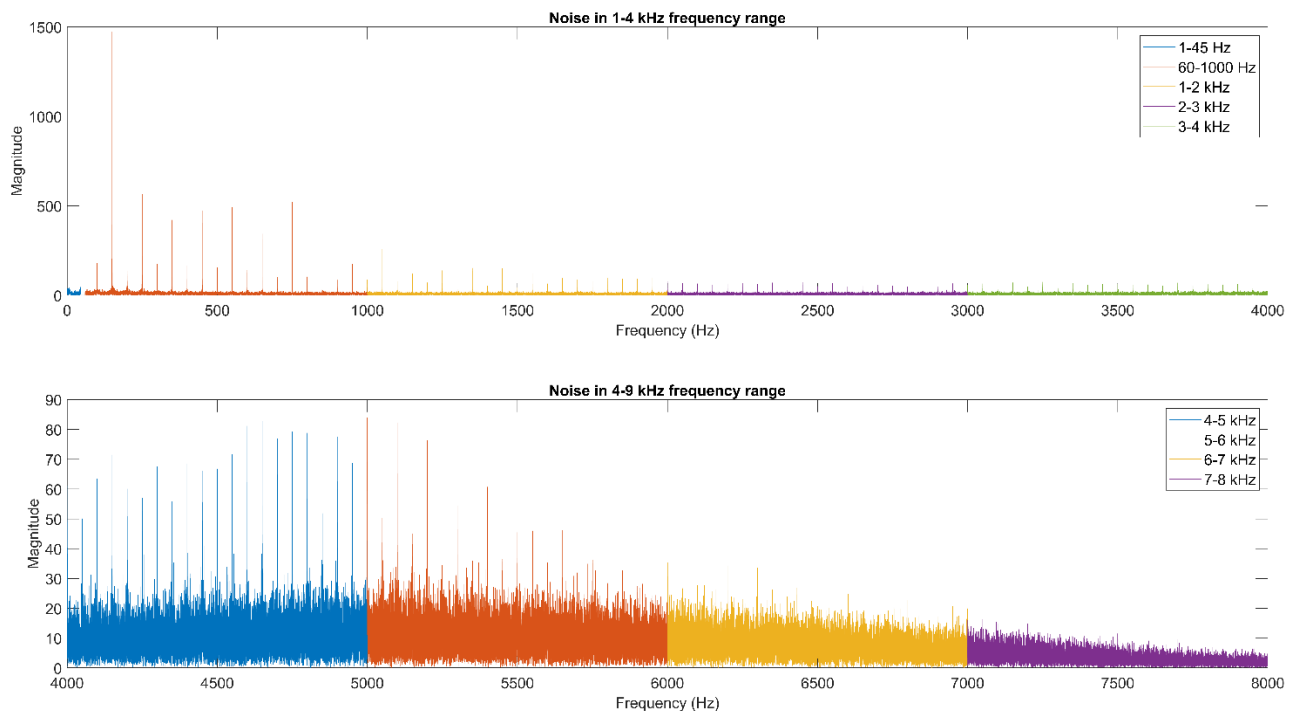


Figure 18. Noises of Degraded Sample between 0-8 kHz

As it can be seen Figure 4 that the highest noises are observed between 0-1200 Hz. Especially at 550 Hz, the noise reached its peak. Noises generally occurred at single (not double) frequency values. It is seen that the amplitude values of the noises are relatively low at very high frequency values. When it comes to examine of degraded sample for noise analysis, more pulse-shaped noise is seen at high frequencies. These pulses show that the sample surface is

much less resistant to arc. Especially the pulses between 4 kHz-5.5 kHz continued regularly. Such a situation was not observed in the non-degraded sample. Noise analysis alone is not sufficient for evaluation. At the same time, partial discharge analysis should be done.

Partial discharges are known as incomplete electrical discharges in the material. In this type of electrical discharges, the amount of charge is not high enough to cause total breakdown. However, the presence of partial discharges can give information about whether there is a problem in the material content. Having too many partial discharges in an insulator does not mean that the dielectric resistance is low. Therefore, all measurements need to be evaluated in a combined way. In some cases, the very low resistance insulator breakdown suddenly without sufficient partial discharge. Therefore, leakage current, noises in different frequency bands and partial discharges should be analyzed together. In addition, test termination criteria within the scope of the standard followed in the experiment should be considered. In Figure 6, the partial discharge patterns of most durable silicone sample are demonstrated.

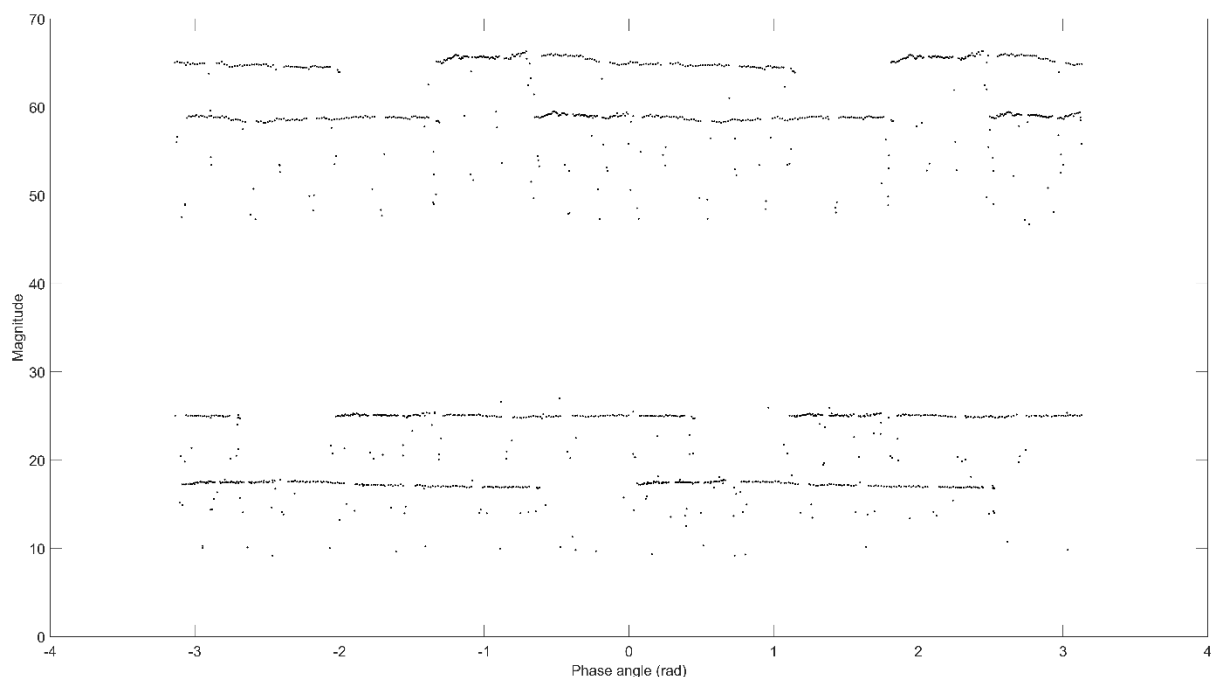


Figure 19. Partial Discharge Patterns of Most Durable Specimen

Partial discharges in the sample with high surface resistance showed a regular flow in certain places. The regularity of these partial discharges actually shows that the surface resistance remains stable. If partial discharges had accumulated excessively at a certain point, then the process of electrical complete breakdown would have accelerated. However, in order to make an accurate comparison, the partial discharge patterns of the electrically degraded sample need to be analyzed. Partial discharge patterns of weakest specimen are illustrated in Figure 7.

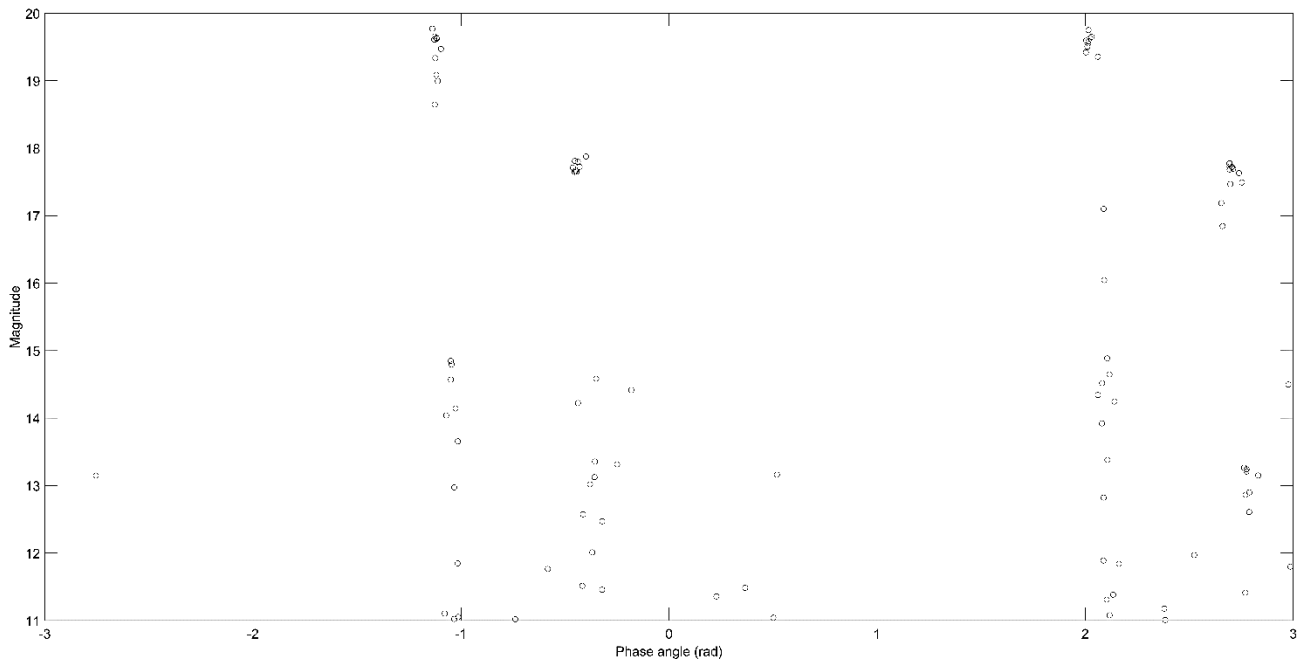


Figure 20. Partial Discharge Patterns of Weakest Specimen

Partial discharges are directly proportional to the amount of charge. Therefore, the increased charge amount can result in increment of the number of partial discharges. Although the amount of current passing through the deteriorated material is high, it is difficult to interpret those partial discharges are less common. It is therefore essential to make an assessment with noises and leakage current. The analyzes made so far consist of classical methods, and each of them alone could not reveal a clear dielectric behavior. However, surface resistance conditions can be interpreted by means of a combined evaluation or analysis with a different method.

3.3. Empirical Mode Decomposition Application

In the EMD method, after the peaks in the upper and lower parts of the signal are detected, upper and lower curvatures are produced to make cubic interpolation at these points [14]. After calculating automatically, the average between the two curvatures, a signal with amplitude and modulation is extracted as a result of many cycles for IMF calculation. An $x(t)$ signal is decomposed according to equation 1 in the EMD method afterwards [15].

$$x(t) = \sum_{k=0}^K c_k(t) + r(t) \quad (1)$$

$c_k(t)$ denotes the amplitude and frequency modulated signal, and $r(t)$ shows the residual value as a result of the decomposition. $c_k(t)$ is a quantity dependent on the phase angle (equation 2).

$$c_k(t) = a_k(t) \cdot \cos(\phi_k(t)) \quad (2)$$

$a_k(t)$ represents the instantaneous positive amplitude magnitude of the frequency-dependent signal resulting from modulation, and, $\phi_k(t)$ is the instantaneous phase. Since a frequency-dependent decomposition is carried out, the instantaneous frequency value $w_k(t)$ is much smaller than the instantaneous phase value, but it is obtained from the time-dependent derivation of this phase value. EMD decomposition continues until the residual value become a monotonic function. No more IMFs are produced after this state is reached. The termination criterion for the predefined threshold value is determined by the normalized standard difference (NSD) (equation 3).

$$NSD = \sum_{j=1}^R \frac{|b_{k-1}(t) - b_k(t)|^2}{b_j^2(t)} \quad (3)$$

Where $b_k(t)$ represents the IMF values at each step. When performing a signal decomposition in the EMD method, it is mandatory to have a stopping criterion based on interpolation. This situation has a built that constantly renews itself. The EMD application of non-degraded sample is shown in Figure 8.

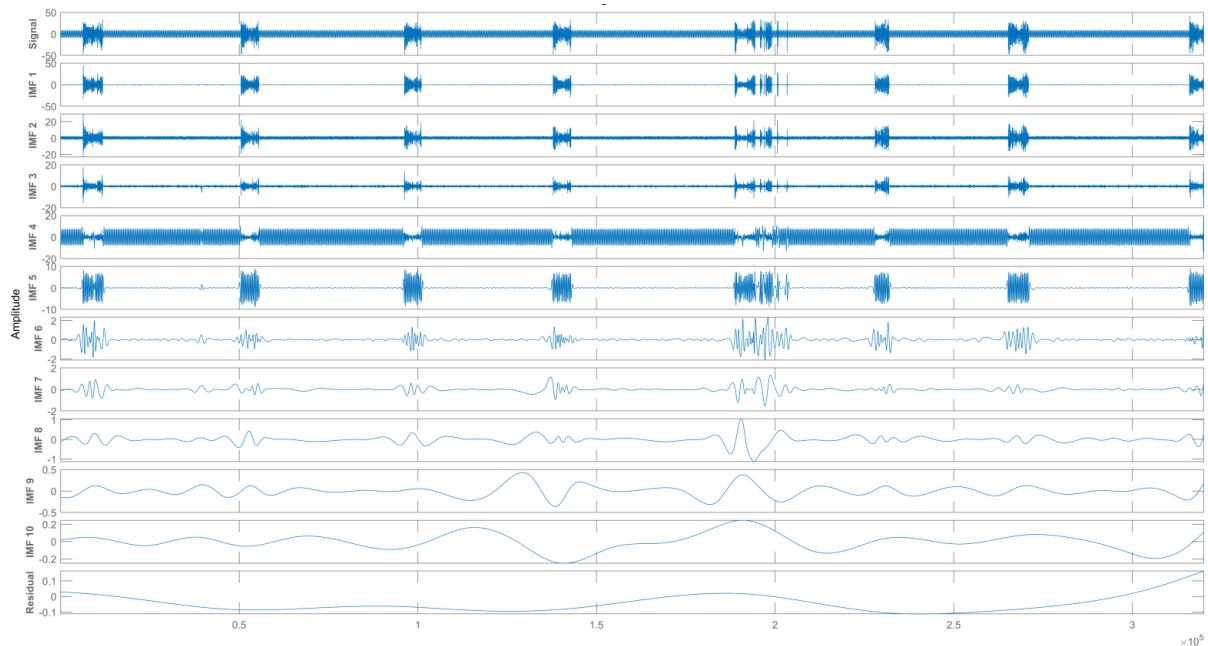


Figure 21. Leakage Current Signal Decomposition of Non-Degraded Specimen with EMD Method
 When the leakage current signal of the non-degraded sample is decomposed by EMD, the waveforms in the modes IMF 1- IMF 6 show similarity to each other. The intense and peaked points of the signal actually show the moments when the electrolyte liquid flows across the surface. This fact proves how valid the method is for a correct analysis. Starting from IMF 7 mode, the signal is well decomposed. Earlier and more decomposition of a signal is one of the

indicators of high dielectric performance of the material concerned. The superiority of the EMD method can be demonstrated by making a comparison with the degraded sample (Figure 9).

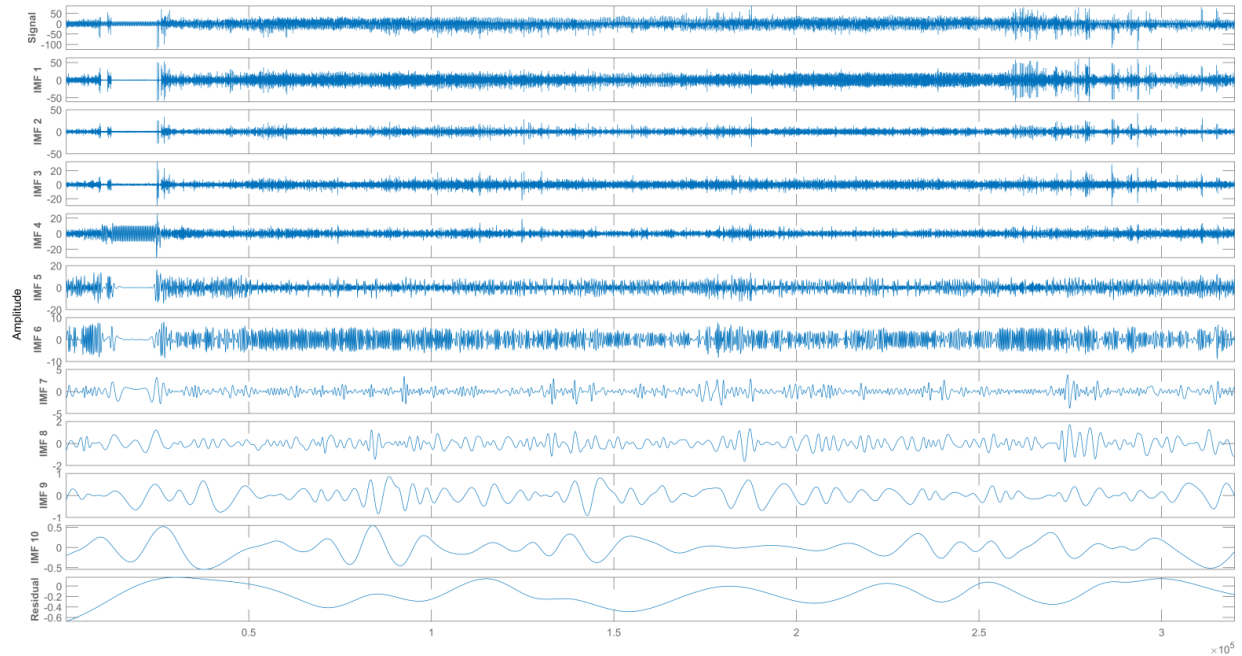


Figure 22. Leakage Current Signal Decomposition of Degraded Specimen with EMD Method
As can be clearly seen in the Figure 9, the residual signal has a more distinct waveform than the intact sample. Relatively more dissociated signals are seen in IMF 9 and IMF 10 modes. The fact that the signal is not decoupled at lower modes indicates that the leakage current has a disruptive and high amplitude waveform. Thus, the instantaneous examination of the leakage current signal, even for a short time, by dynamically decomposing it with the EMD method, will give important information about the surface resistance of the material. In addition, more detailed information can be obtained by evaluating at the power spectral densities (PSD) of the modes. The PSD signals of each modes of non-degraded sample EMD application are shown in Figure 10. Also, the PSDs belongs to weakest sample are shown in Figure 11.

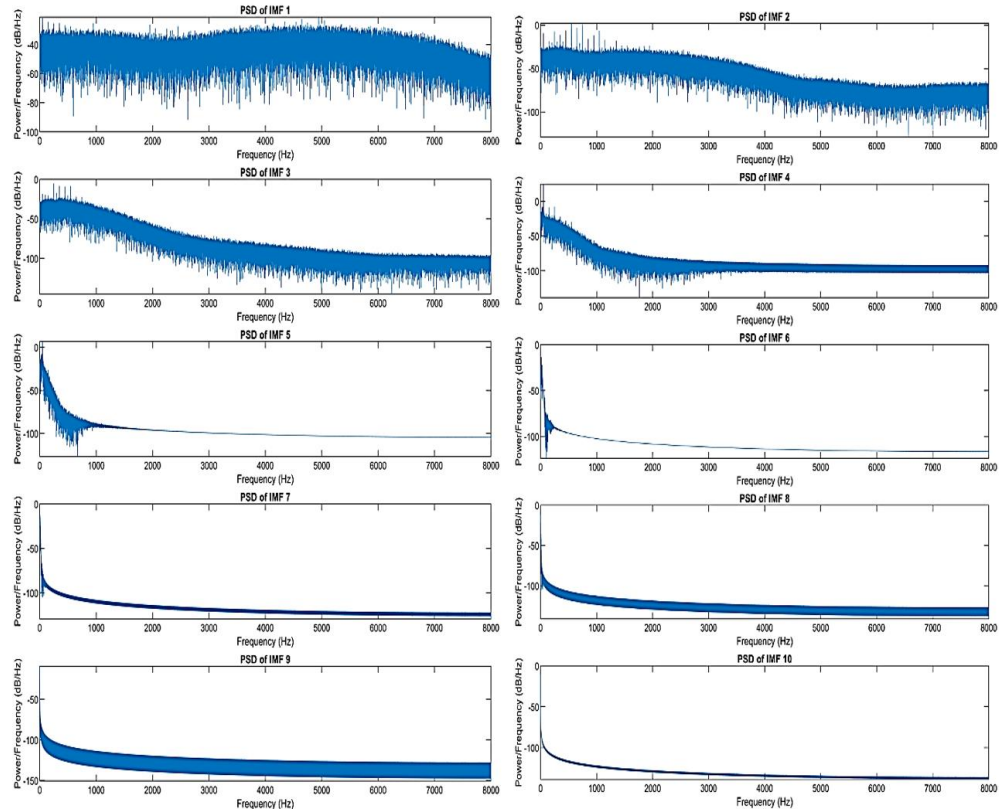


Figure 23. Power Spectral Densities of IMFs for Non-Degraded Sample

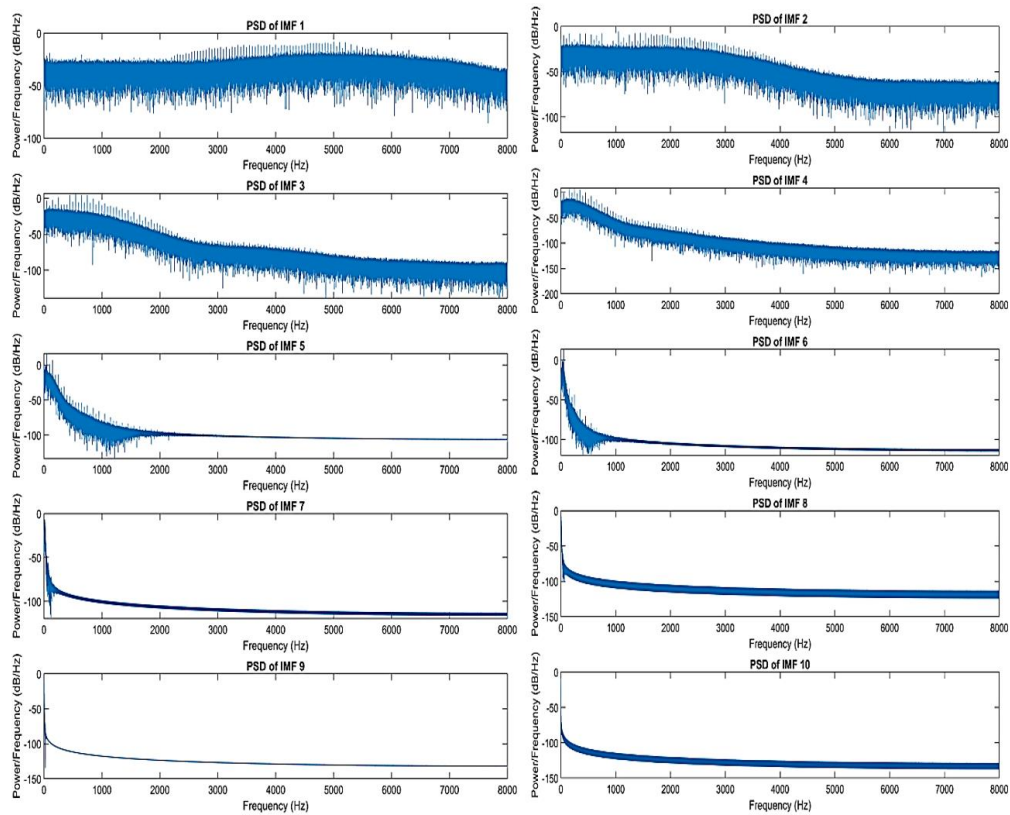


Figure 24. Power Spectral Densities of IMFs for Degraded Sample

A Power Spectral Density (PSD) is a measure of the power content of the signal versus frequency. A PSD is typically used to characterize broadband random signals. The amplitude of the PSD is normalized with the spectral resolution used to digitize the signal. In the non-degraded sample, the PSD value was generally measured higher at low modes. The important thing here is to measure the lowest powers in the highest mode. Also, by making a comparison with the degraded silicon sample, it can be analyzed how much information the PSDs give about the dielectric behavior.

In the deteriorated sample, a narrower PSD signal appears in IMF 6 and IMF 9 modes. In contrast, IMF 4, IMF 5 and IMF 10 have slightly more power-intensity signals. The main thing to note here is that the PSD signal of the IMF 10 mode has a slightly larger amplitude and waveform for the distorted silicon sample. This indicates that the signal is not fully decoupled in the latest mode. Thus, an analysis can be made about the dielectric resistance of the material, especially by looking at the PSD signal of the last mode.

4. CONCLUSIONS

Measuring and evaluating the surface resistance of silicon insulators, which are frequently used in high voltage systems, is important in terms of providing sustainable energy. In this study, leakage current signals passing through the surface of silicon insulators subjected to IPT test were analyzed. The waveform of the leakage current signal is distorted, indicating that there is a problem with the surface resistance. However, this alone is not enough. Therefore, noises in different frequency bands are analyzed. In addition, surface partial discharge patterns were also evaluated. These methods stand out as classical evaluation methods in the literature. An analysis of material surface resistance can be made by making a combined evaluation of these methods. However, many methods complicate correct analysis of surface insulator durability. Therefore, there is a need to analyze the surface resistance of silicone material with a new and precise method. The EMD method allows us to perform a more accurate surface resistance analysis by decomposing a signal into lower frequency modes. Accordingly, the different characteristics of the intrinsic modes and the delayed completion of the weathering stand out as a feature of a material with low surface resistance. Thanks to the EMD method applied to the leakage current signals obtained as a result of the experimental study, the fact that the signal waveforms of the residual and IMF 10 modes are less frequent and weak indicates strong surface resistance.

REFERENCES

- [1] Z. Li and B. Du, "Polymeric insulation for high-voltage dc extruded cables: challenges and development directions," in *IEEE Electrical Insulation Magazine*, vol. 34, no. 6, pp. 30-43, November-December 2018, doi: 10.1109/MEI.2018.8507715.
- [2] A. Hedir, O. Jbara, M. Moudoud, F. Slimani, S. Rondot and F. Bellabas, "Behaviour of Cross-linked Polyethylene Used as High Voltage Power Cables Insulation Due to Environmental Constraints," 2018 International Conference on Electrical Sciences and Technologies in Maghreb (CISTEM), Algiers, Algeria, 2018, pp. 1-4, doi: 10.1109/CISTEM.2018.8613596.
- [3] Khan, Hidayatullah, Amin, Muhammad and Ahmad, Ayaz. "Characteristics of Silicone Composites for High Voltage Insulations" *REVIEWS ON ADVANCED MATERIALS SCIENCE*, vol. 56, no. 1, 2018, pp. 91-123. <https://doi.org/10.1515/rams-2018-0040>.
- [4] Hidayatullah Khan, Atif Mahmood, Israr Ullah, Muhammad Amin, M. Tariq Nazir, "Hydrophobic, dielectric and water immersion performance of 9000 h multi-stresses aged silicone rubber composites for high voltage outdoor insulation", *Engineering Failure Analysis*, Volume 122, 2021, 105223, ISSN 1350-6307, <https://doi.org/10.1016/j.engfailanal.2021.105223>.
- [5] M. Akbar, R. Ullah, and S. Alam, "Aging of silicone rubber-based composite insulators under multi-stressed conditions: an overview," *Materials Research Express*, vol. 6, no. 12, article no. 1250E1, 2019, doi: 10.1088/2053-1591/ab3f0d.
- [6] M. Ghouse Shaik and V. Karuppaiyan, "Effect of Ageing on the Tracking Characteristics of High-Temperature Vulcanized Silicone Rubber Hybrid Composites for High Voltage Insulation," *Materials*, vol. 13, no. 10, p. 2242, May 2020, doi: 10.3390/ma13102242. [Online]. Available: <http://dx.doi.org/10.3390/ma13102242>.
- [7] H. Khan, M. Amin, A. Ahmad and M. Yasin, "Water immersion/liquid permeation resistance analysis of micro/nano-SiO₂ filled silicone rubber and epoxy composites for high voltage insulation applications," 2018 15th International Bhurban Conference on Applied Sciences and Technology (IBCAST), Islamabad, Pakistan, 2018, pp. 16-21, doi: 10.1109/IBCAST.2018.8312178.
- [8] M. Z. Saleem and M. Akbar, "Review of the Performance of High-Voltage Composite Insulators," *Polymers*, vol. 14, no. 3, p. 431, Jan. 2022, doi: 10.3390/polym14030431. [Online]. Available: <http://dx.doi.org/10.3390/polym14030431>.
- [9] Khan, H., Amin, M., Ahmad, A., and Yasin, M., "Investigation of electrical, tracking/erosion, and water absorption resistance properties of ATH-SiO₂-reinforced RTV-SiR composites for high-voltage insulations." *Journal of Elastomers & Plastics*, 2018, 50(6), 501-519.
- [10] Rashid, A., Amin, M., Ali, M., and Khattak, A., "Aging exploration of long term multistressed HTV-silicone rubber/silica/alumina composites for high voltage insulation", 2018, *Materials Research Express*, 5(9), 095301.
- [11] Arshad, Nekahi, A., McMeekin, S.G. et al. "Measurement of surface resistance of silicone rubber sheets under polluted and dry band conditions", *Electrical Engineering* vol.100, 1729–1738 (2018). <https://doi.org/10.1007/s00202-017-0652-x>.
- [12] M. Ghayedi, R. Shariatinasab, and M. Mirzaie, "AC flashover dynamic theoretical and experimental model under fan-shaped and longitudinal pollution on silicone rubber insulator," *Electrical Power Systems, Polymers*, vol. 14, pp. 2519, 2022, doi: 10.1049/smt2.12072.

- [13] A. R. Verma and B. S. Reddy, "Tracking and erosion resistance of LSR and HTV silicon rubber samples under acid rain conditions," in *IEEE Transactions on Dielectrics and Electrical Insulation*, vol. 25, no. 1, pp. 46-52, Feb. 2018, doi: 10.1109/TDEI.2018.006672.
- [14] U. Maji and S. Pal, "Empirical mode decomposition vs. variational mode decomposition on ECG signal processing: A comparative study," in *2016 International Conference on Advances in Computing, Communications and Informatics, ICACCI 2016*, Sep. 2016, pp. 1129–1134, doi: 10.1109/ICACCI.2016.7732196.
- [15] N. U. Rehman and H. Aftab, "Multivariate Variational Mode Decomposition," *IEEE Trans. Signal Process.*, vol. 67, no. 23, pp. 6039–6052, Dec. 2019, doi: 10.1109/TSP.2019.2951223.

ESTETİK RESTORASYONLARDA GÜNCEL PARAMETRELER

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ÖZET

Gülüş tasarımı, bir bütün olarak güzel bir gülümseme yaratabilen birçok bilimsel ve sanatsal ilkeyi ifade eder. Bu ilkeler, hastalardan toplanan veriler, teşhis modelleri, bilimsel ölçümler ve temel sanatsal güzellik kavramları aracılığıyla oluşturulmuştur. Dolayısıyla, iyi bir gülüş tasarımı, estetik ve fonksiyonel bir bütün oluşturmak için yüzün geri kalanıyla doğal ve zahmetsizce bütünleşir. Estetik restorasyonlarda güncel parametrelere baktığımızda; yüz kompozisyonu içeriğindeki gözbebekleri hattı ve dudaklar değerlendirilir. Dental kompozisyon ayrıca değerlendirilir ve bu kapsamda diş bileşenleri ve yumuşak doku bileşenlerine bakılır. Diş bileşenlerinde; orta hat, insizal uzunluklar, diş ebatları, zenith noktaları, aksiyal eğimler, interdental kontaklar, insizal embraşurlar, cinsiyet, yaş, kişilik, simetri ve denge olarak bakılır. Yumuşak doku bileşenlerinde ise diş eti sağlığı, diş eti seviyeleri ve uyumları, interdental embraşurlar ve gülümseme çizgisi olarak bakılır. Bu parametreler temel estetik kurallardır ve gülüş tasarımlarının temelini oluşturur. Ancak son yıllarda estetik beklentinin artmasıyla birlikte hastanın kişiliği de göz önünde bulundurularak kişiye özel gülüş tasarımları yapılmaktadır. Bu makalenin amacı son 5 yıl içerisinde yapılan gülüş tasarımlarının incelenerek güncel parametrelerin değerlendirilmesidir.

Anahtar Kelimeler: Estetik restorasyonlar; Gülüş tasarımı; Estetik parametreler

GİRİŞ

Gülüş tasarımı, bir bütün olarak güzel bir gülümseme yaratabilen birçok bilimsel ve sanatsal ilkeyi ifade eder. Bu ilkeler, hastalardan toplanan veriler, teşhis modelleri, bilimsel ölçümler ve temel sanatsal güzellik kavramları aracılığıyla oluşturulmuştur¹. Diş estetiğinde temel amaç; doğal orantılı, birbirleriyle bir harmoni içinde olan dişler ve etrafındaki diş eti, dudak gibi dokularla uyumdur. Yüz oranlarıyla belli bir orantıyı takip etmelidir. Tabii olarak bu harmoni estetik, fonksiyonel ve doğal olmalıdır. Gülüş tasarımı gülüşün sınıflandırılmasıyla beraber, sınıflandırmaya müdahil parametreler olan kas çekişleri, dudak konumu, dişlerin dizilimi, diş eti yapı konum ve görünürlüğü, yüz şeklini içerir². Bu derleme son 5 yıl içinde kabul görmüş gülüş tasarımlarının güncel parametrelerini içermektedir.

ARAŞTIRMA VE BULGULAR

Son yıllarda kullanılan dijital gülüş tasarımı estetik teşhis yeteneklerini güçlendirebilir, tedavi aşamaları boyunca öngörülebilir bir sistem oluşturmuştur³. İdeal gülüş tasarımı için⁴

Gülüşün Sınıflandırılması

1.) Komissür gülümseme:

- En yaygın desen
- Nüfusun çoğunluğunda görülür
- Komissürün ortalama hareket yönü 40 derecedir.
- Gülümseme hareketlerinin yönü heliks-scalp birleşimine yöneliktir.

2.) Karmaşık gülümseme:

- Gülümsemede, Levator Labii Superioris'in baskınlığı mevcuttur.
- Tipik olarak, diş etinin şeklini taklit eden üst dudak

3.) Cuspid gülüşü:

- Nüfusun az bir kısmında gözlenir.
- Paralel köşeli bir görünüm
- Gülümsemenin temel özellikleri güçlü kas çekmesi ve alt dudağın aşağı ve geriye doğru çekilmesidir

Gülümseme Sırasında Diş, Diş eti ve Mukozanın Durumu(solomon,99)

- **Diş gülüşü (Düşük Gülüş):**Yalnızca maksiller ön dişlerin dudak yüzeyinin açığa çıkarılması

➤ **Dişeti gülüşü / Papilla gülüşü (Ortalama Gülüş):** Dişlerin dudak yüzeyinin ve interdental papilla/diş etinin açığa çıkması.

➤ **Mukoza gülüşü (Yüksek Gülüş):** Dişlerin dudak yüzeyinin, interdental papillanın, serbest marjinal dişetin ve labial ve bukkal mukozanın açığa çıkarılması.

ESTETİK GÜLÜŞÜN PARAMETRELERİ

Gülüş tasarımı fasiyal ve dental kompozisyonunu ikisini birden içerir⁵

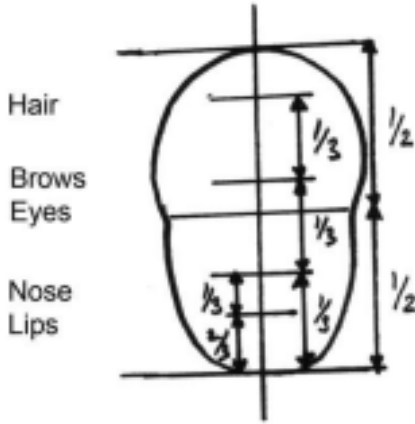
Yüz kompozisyonu

1. **Gözbebekleri hattı:** Yüzün orta hattına dik ve oklüzal düzleme paralel olmalıdır.

2. **Dudaklar:** Dudaklar gülüş tasarımının sınırlarını oluşturduğu için önemlidir.

1. Horizontal bakış

▪ Yüzün genişliği beş göz genişliği kadar olmalıdır.



2. Vertikal

▪ Yüz yüksekliği alından kaş çizgisine, kaş çizgisinden burun tabanına ve burun tabanından çene tabanına kadar üç eşit parçaya bölünür

▪ Tam yüz, gözler orta hat olmak üzere iki bölüme ayrılmıştır.

Önden bakıldığında yüzün temel şekli aşağıdakilerden biri olabilir:

1. Kare
2. Açılı
3. Kare açılı
4. oval

Dental Kompozisyon

Gülüş tasarımının önemli parametreleri^{6,7}

1. Diş bileşenleri

a) Diş orta hattı

- b) İnsizal uzunluklar
- c) Diş boyutları
- d) Zenith noktaları
- e) Aksiyal eğimler
- f) İnterdental kontaklar
- g) İnsizal embrasür
- h) Cinsiyet, kişilik ve yaş
- i) Simetri ve denge

2. Yumuşak doku bileşenleri

- a) Diş eti sağlığı
- b) Diş eti seviyeleri ve uyumu
- c) interdental embrasür
- d) Gülümseme çizgisi

Gülüş Tasarımının Diş Bileşenleri

Diş orta hattı

Orta hat, İnsizal düzleme dik ve yüzün orta hattına paralel olmalıdır.

1. Kabul edilebilecek maksimum tutarsızlık 2 mm olabilir
2. Orta hat, gözbebekleri hattına diktir.
3. Burnun orta hattı, alın, çene, filtrum, gözbebekleri arası düzlem gibi çeşitli anatomik işaretler değerlendirme için kılavuz olarak kullanılabilir⁸
4. Dudak filtrumu, bu anatomik kılavuz direklerin en doğru olanlarından biridir. Filtrumun merkezi cupid yayı merkezidir ve merkezler arasındaki papilla ile eşleşmelidir.

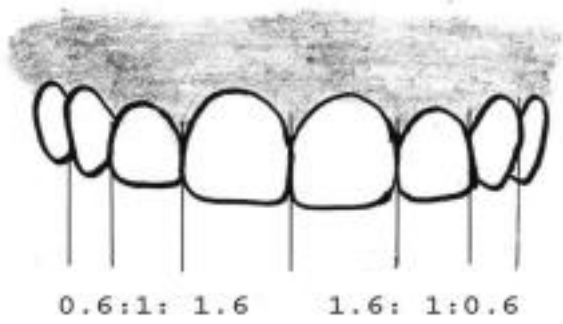
Cupid yayı; aşk tanrısı Eros'un yayı anlamına gelir ve üst dudağın ortası ve hemen üstünde burna uzanan aralıktaki çıkıntıyı ifade eder. Hem kadınlarda hem erkeklerde makbul olan çekici görünen çıkıntının belirgin olmasıdır.

Maksiller insizal kenar pozisyonu gülümseme oluşturmada en önemli parametredir.

Genç bir bireyde ağız rahat ve hafif açık durumdayken maksiller orta kesici dişin 3.5 mm'lik kısmı görünmelidir. Yaş ilerledikçe kas tonusundaki azalma dişlerin daha az görünmesine neden olur.

Estetik bir gülümsemede doğru orantıları oluşturmak için çeşitli parametreler:

- 1.) **Altın Oran:** Yüzden bakıldığında her bir ön dişin genişliği komşu dişin genişliğinin %60'ıdır (matematiksel oran 1.6:1:0.6)⁹



2.)**Tekrarlayan Estetik Diş Oranı** Yüz açısından bakıldığında ardışık genişlik oranı, orta hattan arkaya doğru hareket ettikçe sabit kalmalıdır

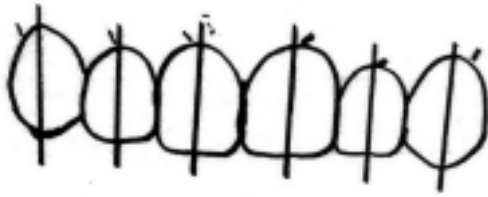
Bukkal koridor

Ağız köşeleri ile maksiller dişlerin bukkal yüzeyleri arasında gülümseme oluşumu sırasında görülen karanlık boşluğu ifade eder. Gülümsemenin genişliği ve maksiller ark,

2. Yüz kaslarının tonusu,
3. Üst küçük azı dişlerinin labiyal yüzeyinin konumlandırılması,
4. Köpek dişlerinin özellikle distal yüz hattı açısındaki çıkıntısı
5. Küçük azı dişleri ile altı ön diş arasındaki değer farkı.

Zenith noktaları

Zenith noktaları, servikal diş kenarının en apikal pozisyonudur. Dişin merkezinden aşağıya doğru çizilen vertikal çizginin biraz distalinde yer alır.¹⁰



Diş eğimleri

Santralden köpek dişine doğru, sonraki her bir ön dişin mezial eğiminde doğal, progresif bir artış olmalıdır.

Cinsiyet, Yaş ve Kişilik

Maksiller dişlerin uzunluğu, şekli ve pozisyonundaki küçük farklılıklar, karakterizasyonu mümkün kılar.¹¹

•**Yaş**–Maksiller orta kesici diş

Genç dişler: Aşınmış kesici kenar, belirgin kesici kenar kaplaması, düşük kroma ve yüksek değer

Yaşlı dişler: Daha kısa; bu nedenle daha az gülümseme görüntüsü, minimum insizal embrasür, yüksek kroma ve düşük değer

•**Cinsiyet**–Maksiller kesici dişler

Kadın formu: yuvarlak pürüzsüz, yumuşak narin

Erkek formu: küboidal, sert kuvvetli

•**Kişilik**–maksiller köpek

Agresif: sivri uçlu uzun

Pasif, yumuşak: küt, yuvarlak, kısa sivri form.

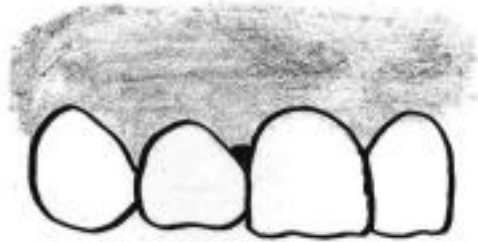
Simetri ve Denge

•**Statik simetri:** Ayna görüntüsü, üst orta kesici dişler

•**Dinamik simetri:** Birbirine çok benzeyen fakat aynı olmayan iki nesne. Lateral ve köpek dişlerinde mükemmel kusurlarla şekillendirme daha canlı, dinamik, yegane ve doğal bir gülümseme sağlar.

İnterdental embrasür (servikal embrasür)-

Ağız boşluğunun koyuluğu, diş eti ile temas alanı arasındaki interproksimal üçgende görünmemelidir.¹²



Gülümseme Hattı

Gülümseme çizgisi, maksiller ön dişlerin kesici kenarları boyunca uzanan ve gülümserken alt dudağın üst kenarının eğriliğini taklit etmesi gereken hayali bir çizgiyi ifade eder. Ters gülümseme çizgisi veya ters gülümseme çizgisi, insizal düzlem boyunca santraller köpek dişlerinden daha kısa görüldüğünde oluşur.



SONUÇ

Bu derleme son yıllarda kabul görmüş ideal gülüş tasarımının güncel parametrelerini başlıklar altında anlatmıştır. Doğal, benzersiz, estetik, fonksiyonel bir gülümsemeyi elde etmek için kullanılması gereken güncel parametreler bir bütün olarak ele alınmıştır ve kullanılma iş akışı anlatılmıştır.

KAYNAKÇA

- [1]. Chu SJ, Tan JH, Stappert CF, Tarnow DP. Gingival zenith position and levels of the maxillary anterior dentition. *J Esthet Resto*
- [2]. Bhuvaneshwaran M. Principles of smile design. *Journal of conservative dentistry*. 2010;13(4):225-232.
- [3]. Khan R., Samant P.S., Razdan A., Chauhan R. Smile designing. *International Journal of Current Research*, 10, (05), 68989-68991.
- [4]. Z. Jafri, et al. Digital Smile Design-An innovative tool in aesthetic dentistry. *Journal of Oral Biology and Craniofacial Research* 10 (2020) 194–198
- [5]. Christian Coachman, Marcelo AC. Digital smile design: a tool for treatment planning and communication in esthetic dentistry. *Winter 2014;29:102-116*.
- [6]. Lavere AM. Denture tooth selection: An analysis of the natural maxillary central incisor compared to the length and width of the face. Part *International Journal Prosthetic Dentistry* 1992; 67: 661-3.
- [7]. Bukhary SM, Gill DS, Tredwin CJ, Moles DR. The influence of varying maxillary lateral incisor dimensions on perceived esthetic smile. *Brazil Dental Journal* 2007; 203: 687-93.
- [8]. Pound E. Personalized denture procedures. *Dentist Manual*. Denar Corp. 1973.
- [9]. Bloom DR, Padayachy JN. Increasing occusal vertical dimension – Why, When, How. *Br Dent J* 2006;200:251-6.
- [10]. Levin EI. Dental esthetics and Golden proportion. *J Prosthet Dent* 1978;40:244.
- [11]. Moore T, Southard KA, Casco JS, Qian F, Southard TE. Buccal corridor and Smile esthetics. *Am J Orthod Dentofacial Orthop* 2005;127:208-13.
- [12]. Chiche GJ, Pinault A. Smile Rejuvenation A methodic approach. *Pract Periodontics Aesthet Dent* 1993;5:37-44.

NURSING PRACTICES FOR SLEEP QUALITY OF PATIENTS IN INTENSIVE CARE AFTER CARDIOVASCULAR SURGERY: A SYSTEMATIC REVIEW

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ABSTRACT

Postoperative pain is a condition experienced intensely by patients undergoing cardiovascular surgery. This felt pain interferes with sleep quality, deep breathing and daily activities. 75% of patients who had open heart surgery have sleep problems after surgery. Sleep is among the primary needs of human beings in protecting body energy and supporting the regeneration process. Sleep quality is an important indicator of physical and mental health. It is one of the most basic needs of the individual, which is affected by biological, psychological, economic and environmental factors. Teamwork is required to minimize the sleep problems that occur in patients in the post-surgical period. A treatment plan that will increase the patient's sleep quality should be prepared, only mandatory care interventions should be applied at bedtime, a quiet environment should be created in the intensive care unit at bedtime, and a sleep-wake pattern should be maintained. The aim of the study is to systematically examine nursing practices for sleep quality of patients in intensive care after cardiovascular surgery. The keywords "cardiovascular surgery", "sleep", "nursing", "intensive care" were searched in Pubmed, Science Direct and Google Scholar databases between 2000-2023. Of the 988 studies reached, 3 studies that met the inclusion criteria were included in the study. It has been found that nursing interventions in intensive care units after cardiovascular surgery reduce the anxiety and depression levels of patients and have positive effects on self-efficacy, sleep quality and quality of life. It has been determined that nursing interventions for sleep quality in the intensive care unit in patients undergoing cardiovascular surgery have positive results for the patients.

Key words: Cardiovascular surgery, sleep, nursing, intensive care

**KARDİYOVASKÜLER CERRAHİ SONRASINDA YOĞUN BAKIMDA
HASTALARIN UYKU KALİTESİNE YÖNELİK HEMŞİRELİK UYGULAMALARI:
SİSTEMATİK DERLEME**

ÖZET

Ameliyat sonrası ağrı kardiyovasküler cerrahi geçiren hastaların yoğun yaşadığı bir durumdur. Hissedilen bu ağrı uyku kalitesini, derin nefes almayı ve günlük aktiviteleri engellemektedir. Açık kalp ameliyatı olan hastaların ameliyat sonrası %75'i uyku problemi yaşamaktadırlar. Uyku vücut enerjisini korunmasında, yenilenme sürecinin desteklenmesinde insanın birincil ihtiyaçları arasında yer almaktadır. Uyku kalitesi fiziksel ve mental sağlığın önemli bir göstergesidir. Biyolojik, psikolojik, ekonomik ve çevresel faktörlerden etkilenen bireyin en temel ihtiyaçlarından biridir. Cerrahi girişim sonrası dönemde hastalarda meydana gelen uyku sorunlarını en az seviyeye indirmek için ekip çalışması gerekmektedir. Hastanın uyku kalitesini arttıracak bir tedavi planı düzenlenmeli, uyku saatinde sadece zorunlu bakım girişimleri uygulanmalı, uyku vaktinde yoğun bakımda mümkün olduğunca sessiz bir ortam oluşturulmalı ve uyku uyandırma düzeni sağlanmalıdır. Çalışmanın amacı kardiyovasküler cerrahi sonrasında yoğun bakımda hastaların uyku kalitesine yönelik hemşirelik uygulamalarını sistematik olarak incelemektir. 2000-2023 yılları arasında Pubmed, Science Direct ve Google Scholar veri tabanlarında "cardiovascular surgery", "sleep", "nursing", "intensive care" anahtar kelimeleri taranmıştır. Ulaşılan 988 araştırmadan dahil edilme kriterleri uyan 3 araştırma çalışmaya dahil edilmiştir. Kardiyovasküler cerrahi sonrası yoğun bakımda hemşirelik girişimlerinin hastaların anksiyete ve depresyon düzeylerini azalttığı, öz-yeterlilik, uyku kalitesi ve yaşam kalitesi üzerinde olumlu etkileri olduğu bulunmuştur. Kardiyovasküler cerrahi geçiren hastalarda yoğun bakımda uyku kalitesine yönelik hemşirelik girişimlerinin hastalar için olumlu sonuçlar olduğu belirlenmiştir.

Anahtar Kelimeler: Kardiyovasküler cerrahi, uyku, hemşirelik, yoğun bakım

GİRİŞ

Uyku; vücut enerjisini korunmasında, yenilenme sürecinin desteklenmesinde insanın birincil ihtiyaçları arasında yer almaktadır. Uyku kalitesi fiziksel ve mental sağlığın önemli bir göstergesidir. Biyolojik, psikolojik, ekonomik ve çevresel faktörlerden etkilenen bireyin en temel ihtiyaçlarından biridir. (Şara ve diğ., 2022).

Ameliyat sonrası ağrı kardiyovasküler cerrahi geçiren hastaların yoğun yaşadığı bir durumdur. Hissedilen bu ağrı uyku kalitesini, derin nefes almayı ve günlük aktiviteleri engellemektedir. Açık kalp ameliyatı olan hastaların ameliyat sonrası %75'i uyku problemi yaşamaktadırlar (Tüfekçi ve diğ., 2022).

Sağlık problemleri ve hastane yatışları kişinin uyku düzenini değiştiren, uyku kalitesini olumsuz yönde etkileyen önemli faktörlerden olup insanın uyku ihtiyacını karşılama konusunda engel oluşturmaktadırlar (Şara ve diğ., 2022). Cerrahi müdahaleler bireyin yaşam aktivitelerinde ve vücut bütünlüğünde değişiklikler meydana getirir. Birey olumsuz ve acı veren durumlar içerisinde kalabilir. Bu açıdan yoğun bakımlarda tedavi gören hastalarda ağrı, bulantı, stres, ışık, hasta üzerinde fazla ekipmanın bulunması, hastaya tedavi ve bakım için fazla ve sık müdahale edilmesi, ventilasyon ve diğer yoğun bakım ünitesi cihazlarından kaynaklanan ajitasyon, yoğun bakım gürültüsü gibi durumların varlığı uyku kalitesini olumsuz olarak etkilemekte, uyku uyanıklık döngülerinin kısmen veya tamamen kaybına sebep olabilmektedir (Şara ve diğ., 2022) (Fontaine ve diğ., 2020).

Yoğun bakım ünitesinde tedavi gören hastalarda çoğunlukla uyku problemleri ve sirkadiyen ritimlerdeki bozulmalar, yoğun bakımda kalış süresini arttırabilir ve hastayı deliryuma sokabilir (Fontaine ve diğ., 2020). Hastaların kendi uyku düzenlerini devam ettirememeleri genel sağlık düzeyini olumsuz yönde değiştirmekte, hastaların daha fazla kaygı hissetmelerine sebep olmakta, yara iyileşmesini olumsuz yönde etkilemekte, ağrı şiddetini arttırmakta ve ağrı toleransını düşürmektedir (Şara ve diğ., 2022)

Cerrahi girişim sonrası dönemde hastalarda meydana gelen uyku sorunlarını en az seviyeye indirmek için ekip çalışması gerekmektedir. Hastanın uyku kalitesini arttıracak bir tedavi planı düzenlenmeli, uyku saatinde sadece zorunlu bakım girişimleri uygulanmalı, uyku vaktinde yoğun bakımda mümkün olduğunca sessiz bir ortam oluşturulmalı ve uyku uyanıklık düzeni sağlanmalıdır (Yanık ve Gürdil Yılmaz, 2019).

GEREÇ VE YÖNTEM

Çalışmanın amacı kardiyovasküler cerrahi sonrasında yoğun bakımda hastaların uyku kalitesine yönelik hemşirelik uygulamalarını sistematik olarak incelemektir. 2000-2023 yılları

arasında Pubmed, Science Direct ve Google Scholar veri tabanlarında “cardiovascular surgery”, “sleep”, “nursing”, “intensive care” anahtar kelimeleri taranmıştır. Ulaşılan 988 araştırmadan dahil edilme kriterleri uyan 3 araştırma çalışmaya dahil edilmiştir. Dahil edilen çalışmalar Tablo 1’de özetlenmiştir.

BULGULAR

Anderson ve Cutshall tarafından kardiyak cerrahi geçirmiş ve kardiyovasküler cerrahi yoğun bakımda yatan bir hastaya masaj tedavisi uygulanmıştır ve klinik vaka örneğini paylaşmışlardır. 48 yaşında erkek hasta 3 koroner arterin tıkanması sebebiyle koroner arter bypass greft ameliyatı olmuştur. Ameliyatın 2. gününde omuz, sırt ve sternumda sürekli ağrı şikayeti olmuştur. Hastaya fentanil infüzyonu ve hasta kontrollü bir ağrı kesici verilmiştir. Farmakolojik yöntemlere rağmen hastanın ağrısı devam etmiştir. Hasta uyuyamadığını, kendisini yorgun ve bitkin hissettiğini ifade etmiştir. Hastanın da izniyle hastaya masaj terapisi uygulanmıştır. Sırtın üst kısmı, boyun ve omuz bölgelerine masaj uygulanmıştır. Masaj sırasında dinlemesi için müzik hasta tarafından seçilmiştir. Hastaya 20 dakikalık masaj terapisi uygulanmıştır. Bir sonraki gün hasta boyun ve omuz ağrılarının geçtiğini ve rahat bir gece uykusu uyuyabildiğini ifade etmiştir. Daha önce sırt ve omuz ağrıları nedeniyle dolaşamayan hastanın masaj terapisi sonrası yoğun bakım etrafında birkaç kez dolaşabildiğini, spirometreyi rahatça kullanabildiğini belirtmiştir. Sol kol ve parmaklarında uyuşma şikayetinin geçtiğini söylemiştir. Ağrı ölçeğinde daha önce 7 olan ağrısının 2 puana düştüğünü ifade etmiştir. Hasta masaj terapisini tekrar almak istemiş ve kısmen masaj sayesinde beklenen günden bir gün önce yoğun bakımdan transferi sağlanmıştır (Anderson and Cutshall, 2007).

Zeng ve Guan tarafından yapılan bir çalışmada, kardiyovasküler cerrahi yoğun bakım ünitesinde yatan hastalara insanlaştırılmış bakım uygulayarak hastaların öz-yeterlilik, uyku kalitesi ve yaşam kalitesi üzerindeki etkisini araştırmayı amaçlanmaktadır. Kardiyovasküler cerrahi yoğun bakımda yatmakta olan toplam 134 hasta ile çalışmayı gerçekleştirmişlerdir. 134 hastayı rastgele kontrol ve gözlem grubuna ayrılmıştır. Kontrol grubundaki 64 hastaya rutin hemşirelik bakımı verilirken, gözlem grubundaki 70 hastaya ek olarak insanlaştırılmış bakım uygulanmıştır. Hemşirelik uygulamasından sonra, gözlem grubundaki hastalar, daha iyi uyku kalitesi göstermiştir. Sonuç olarak insanlaştırılmış bakım, kardiyopulmoner fonksiyonun iyileşmesine katkıda bulunduğu ve kardiyovasküler cerrahi yoğun bakımda yatan hastaların anksiyete ve depresyon düzeylerini azalttığı, öz-yeterlilik, uyku kalitesi ve yaşam kalitesi üzerinde olumlu etkileri olduğu bulunmuştur (Zeng and Guan, 2021).

Soltanpura ve arkadaşları tarafından yapılan bir çalışmada koroner arter baypas ameliyatı geçiren 80 hasta yer almıştır. Çalışma grubundaki hastalara bitkisel ilaç olarak 500 mg Melissa officinalis L. kurutulmuş yaprak tozu kullanılmıştır. Kontrol grubundaki hastalara ise plasebo olarak buğday nişastası içeren kapsüller verilmiştir. Her iki gruba da günde üç kez uygulanmıştır. Anksiyete ve uyku kalitesinin ölçülmesi amaçlanmıştır. Çalışmanın sonucu olarak koroner arter baypas ameliyatı sonrası hastalarda 7 günlük 1,5 g/gün kurutulmuş Melissa officinalis yaprağı tozu tedavisinin hastalarda anksiyete düzeyini azalttığı, uyku kalitesini arttırdığı belirlenmiştir (Soltanpour ve diğ., 2019).

SONUÇ

Araştırmaya dahil edilen çalışmalardan elde edilen sonuçlara göre kardiyovasküler cerrahi geçiren hastalarda yoğun bakımda uyku kalitesine yönelik hemşirelik girişimlerin hastalar için olumlu sonuçlar olduğu belirlenmiştir.

KAYNAKLAR

- Anderson, P. G., & Cutshall, S. M. (2007). Massage therapy: a comfort intervention for cardiac surgery patients. *Clinical nurse specialist CNS*, 21(3), 161–167. <https://doi.org/10.1097/01.NUR.0000270014.97457.d5>
- Fontaine, G. V., Der Nigoghossian, C., & Hamilton, L. A. (2020). Melatonin, Ramelteon, Suvorexant, and Dexmedetomidine to Promote Sleep and Prevent Delirium in Critically Ill Patients: A Narrative Review With Practical Applications. *Critical care nursing quarterly*, 43(2), 232–250. <https://doi.org/10.1097/CNQ.0000000000000304>
- Şara, Y., Örsal, Ö., Duru, P., & Köşgeroğlu, N. (2022). Evaluation of Preoperative Sleep Quality and Factors Affecting Pain Intensity of Patients Hospitalized in Surgical Services. *Journal of perianesthesia nursing : official journal of the American Society of PeriAnesthesia Nurses*, 37(4), 474–478. <https://doi.org/10.1016/j.jopan.2021.10.004>
- Soltanpour, A., Alijaniha, F., Naseri, M., Kazemnejad, A., & Heidari, M. R. (2019). Effects of *Melissa officinalis* on anxiety and sleep quality in patients undergoing coronary artery bypass surgery: A double-blind randomized placebo controlled trial. *European Journal of Integrative Medicine*, 28, 27-32. <https://doi.org/10.1016/j.eujim.2019.01.010>
- Tüfekçi, H., Akansel, N., & Sivrikaya, S. K. (2022). Pain Interference with Daily Living Activities and Dependency Level of Patients Undergoing CABG Surgery. *Pain management nursing : official journal of the American Society of Pain Management Nurses*, 23(2), 180–187. <https://doi.org/10.1016/j.pmn.2021.03.002>
- Yanık, T. Ç., & Gürdil Yılmaz, S. (2019). Kardiyovasküler cerrahi sonrası yoğun bakımda yaşanan sorunlar ve hemşirelik bakımı. *Sağlık Bilimleri Üniversitesi Hemşirelik Dergisi*, 1(2), 122-127.
- Zeng, Z., & Guan, Y. (2021). Influence of humanized care on self-efficacy, sleep and quality of life of patients in cardiovascular surgery intensive care unit. *American journal of translational research*, 13(5), 4884–4891.

Tablo 1. Çalışmaya Dahil Edilen Araştırmaların Genel Özellikleri

Araştırmayı Yapan Kişiler	Araştırma Tipi ve Örneklem	Girişim	Sonuç
Anderson ve Cutshall, 2007	Klinik Vaka Örneği N=1	Sırtın üst kısmı, boyun ve omuz bölgelerine 20 dakikalık masaj terapisi uygulanmıştır. Masaj sırasında dinlenmesi için müzik hasta tarafından seçilmiştir.	Sırt ve omuz ağrıları nedeniyle dolaşamayan hastanın masaj terapisi sonrası yoğun bakım etrafında birkaç kez dolaşabildiğini, spirometreyi rahatça kullanabildiğini belirtmiştir. Sol kol ve parmaklarında uyuşma şikayetinin geçtiğini söylemiştir. Ağrı ölçeğinde daha önce 7 olan ağrısının 2 puana düştüğünü ifade etmiştir ve hasta beklenenden 1 gün önce yoğun bakımdan transfer edilmiştir.
Zeng ve Guan 2021	Randomize Kontrollü Çalışma N=134	Kontrol grubundaki 64'e rutin hemşirelik bakımı verilirken, gözlem grubundaki 70 hastaya ek olarak insanlaştırılmış bakım uygulanmış.	İnsanlaştırılmış bakım, kardiyopulmoner fonksiyonun iyileşmesine katkıda bulunduğu ve kardiyovasküler cerrahi yoğun bakımda yatan hastaların anksiyete ve depresyon düzeylerini azalttığı ve öz-yeterlilik, uyku kalitesi ve yaşam kalitesi üzerinde olumlu etkileri olduğu bulunmuştur.
Soltanpura ve diğ. 2019	Çift kör, randomize, kontrollü bir klinik çalışma N=80	Çalışma grubundaki hastalar bitkisel ilaç olarak 500 mg Melissa officinalis L. kurutulmuş yaprak tozu kullanılmıştır. Kontrol grubundaki hastalara ise plasebo olarak buğday nişastası içeren kapsüller verilmiştir. Her iki gruba da günde üç kez uygulanmıştır.	Koroner arter baypas ameliyatı sonrası hastalarda 7 günlük 1,5 g/gün kurutulmuş Melissa officinalis yaprağı tozu tedavisinin hastalarda anksiyete düzeyini azalttığı, uyku kalitesini artırdığı bulunmuştur.

**DIGITAL NURSING CARE IN ORTHOPEDIC SURGERY: A SYSTEMATIC
REVIEW**

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ABSTRACT

The aim of the study is to systematically examine the digital nursing care applied in orthopedic surgery. Between 2000-2023, 'digital', 'orthopedic nurse', 'tele-nursing', 'nursing care', 'technology' keywords in Pubmed, Scopus, Google Scholar and Science Direct databases between 2000-2023 scanned. Of the 2,059 studies reached, 3 studies that met the inclusion criteria were included in the study. It has been determined that digital nursing care applied in orthopedic surgery increases the comfort of patients and nurses, saves time in the care applied, nurses can be original in the care of patients, and the feeling of trust in the patient-nurse relationship increases. It has been determined that digital nursing care is preferred because patients have easy access to care due to the limitation of movement experienced by patients in orthopedic surgery. According to the results obtained from the included studies, it was determined that the digital nursing care applied in orthopedic surgery had positive results for the patients.

Keywords: Digital, orthopedic nurse, tele-nursing, nursing care, technology

**ORTOPEDİK CERRAHİDE DİJİTAL HEMŞİRELİK BAKIMI: BİR SİSTEMATİK
DERLEME**

ÖZET

Çalışmanın amacı ortopedik cerrahide uygulanan dijital hemşirelik bakımlarını sistematik olarak incelemektir. 2000-2023 yılları arasında 2000-2023 yılları arasında Pubmed, Scopus, Google Scholar ve Science Direct veri tabanlarında 'digital', 'orthopedic nurse', 'tele-nursing', 'nursing care', 'techonology' anahtar kelimeleri taranmıştır. Ulaşılan 2,059 araştırmadan dahil edilme kriterleri uyan 3 araştırma çalışmaya dahil edilmiştir. Ortopedik cerrahide uygulanan dijital hemşirelik bakımlarının, hastaların ve hemşirelerin konforunu arttırdığı, uygulanan bakımda zamandan tasarruf edildiği, hemşirelerin hastaların bakımı konusunda özgün olabildikleri ve hasta-hemşire ilişkisinde güven duygusunun arttığı belirlenmiştir. Ortopedik cerrahide hastaların yaşadığı hareket kısıtlılığı nedeniyle hastaların bakıma kolay erişebilir olması nedeniyle de dijital hemşirelik bakımının tercih edilir olduğu belirlenmiştir. Dahil edilen araştırmalardan elde edilen sonuçlara göre, ortopedik cerrahide uygulanan dijital hemşirelik bakımının hastalar için olumlu sonuçlarının olduğu belirlenmiştir.

Anahtar Kelimeler: Dijital, ortopedi hemşiresi, tele-hemşirelik, hemşirelik bakımı, teknoloji

GİRİŞ

Son birkaç yılda teknoloji etkileşim kurma, iletişim kurma, eğlenme ve çalışma şeklimizi değiştirdi. Dünyadaki sağlık iş gücünün %50'sini oluşturan hemşirelik mesleği, yeni sağlık teknolojilerinin sektörde uygulanmasından doğrudan etkilenmektedir (Booth et al., 2021).

Dünya Sağlık Örgütü, sağlık teknolojilerini “Bir sağlık sorununu çözmek ve yaşam kalitesini iyileştirmek için geliştirilen cihazlar, ilaçlar, aşular, prosedürler ve sistemler şeklinde organize bilgi ve becerilerin uygulanması” olarak tanımlamaktadır. Bu tür teknolojiler arasında uzaktan izleme ve iletişim cihazları, sensörler ve giyilebilir cihazlar, mobil uygulamalar, Yapay Zeka (AI) ve Sanal Gerçeklik (VR) yer alır. Bu teknolojiler, sağlık hizmetlerinin sunulma biçimini yeniden şekillendirmekte, yeni ortamlarda ve gelişmiş yaklaşımlarda hizmet sunulmasını mümkün kılmaktadır. Bu teknolojiler sayesinde hemşireler izole ve uzak bölgelerdeki popülasyonlara ulaşabilmektedirler (Booth et al., 2021).

Sağlık hizmetlerinin sağlanmasına yönelik bu haber yolları ve alanları, hemşirelerin şu anda sağlık hizmetine ihtiyaç duyan bireylerle nasıl etkileşim kurduğunu etkilemektedir ve bu etkilerin gelecekte artması beklenmektedir. Bu etki, hemşirelerin, geleneksel olmayan ortamlarda daha fazla sağlık ve önleyici bakım sunma dürtüsünün yanı sıra, küçülen bir işgücünün zorluğuna hitap eden yeni roller keşfetmesine ve geliştirmesine yol açacaktır (Barbosa ve ark., 2021).

Ortopedi hastalarında bakımı bir uzmanlık alanı olarak ele almak önemlidir. Ortopedi hastaları çok çeşitli kas-iskelet yaralanmaları ve hastalıklarından muzdariptir, bu nedenle yüksek nitelikli hemşireler tarafından büyük ölçüde karşılanabilecek özel sağlık bakımına ihtiyaçları vardır. Ortopedi hemşireleri hastalarla fazlaca zaman geçirmekte ve bakım koordinatörü olarak hareket etmektedir (Gupta ve ark., 2018; Jansson ve ark., 2020).

GEREÇ VE YÖNTEM

Bu çalışmanın amacı ortopedi cerrahisinde kullanılan dijital hemşirelik uygulamalarını sistematik olarak incelemektir. 2000-2023 yılları arasında Pubmed, Scopus, Google Scholar ve Science Direct veri tabanlarında ‘digital’, ‘orthopedic nurse’, ‘tele-nursing’, ‘nursing care’, ‘techonology’ anahtar kelimeleri taranmıştır. Ulaşılan 2,059 araştırmadan dahil edilme kriterleri uyan 3 araştırma çalışmaya dahil edilmiştir. Çalışmaya dahil edilen araştırmalar Tablo 1’de verilmiştir.

BULGULAR

Jepsen ve arkadaşları tarafından bir ortopedi servisinde hemşirelere gerçek zamanlı dökümantasyon uygulaması çalışması yapılmıştır. Bu nitel olarak tasarlanan ve örneklemini

18 hemşirenin oluşturduğu bir çalışmadır. Gerçek zamanlı dökümantasyon uygulamasında mobil bilgisayarlar kullanılarak elektronik sağlık kaydına ulaşım sağlanmıştır ve vardiyalar arasında devir teslim yerine hastaların durumları, tanıları ve hemşirelik planlarının kısa bir özetini elde etmek için planlama ekranları kullanılmıştır. Uygulama hemşireler arasında desteği gerektirmekte, hastalar ile geçirilen zamanın artırılması daha iyi ilişkilere yol açmaktaydı. Gerçek zamanlı dökümantasyon ortopedi hemşireliğine daha entegre hale gelmiştir (Jepsen et al., 2022).

McGinley ve arkadaşları, diz enjeksiyonu olan otuz hastanın taburculuğu sonrası telefon ile görüşme sağlayarak hastalara tele-hemşirelik sunmuştur. Hastalar taburculuk sonrası hareket kabiliyetlerinin azalması nedeni ile kısa süre içinde klinik ziyareti tercih etmek yerine telefon ile görüşmeyi daha güvenli bulmuştur. Tele-hemşireliğin zaman kaybını azaltmanın etkili bir yol olduğu ve tercih edildiği bildirilmiştir (McGinley et al., 2006).

Flanagan ve arkadaşları, diz atroskopisi ameliyatı olan hastaların taburculuk sonrası telefon ile takip edilmesinin sonuçlarını incelemek amacıyla örneklemini 77 hastanın oluşturduğu nitel bir çalışma yapmıştır. Araştırma sonucunda hasta ve hemşire arasındaki sürekli iletişimin iyileşme dönemine yardımcı olduğu belirtilmiştir (Flanagan et al., 2009).

SONUÇ

Dahil edilen araştırmalardan elde edilen sonuçlara göre, ortopedik cerrahide uygulanan dijital hemşirelik bakımının hastalar için olumlu sonuçlarının olduğu belirlenmiştir.

KAYNAKÇA

- Booth, R. G., Strudwick, G., McBride, S., O'Connor, S., & López, A. L. S. (2021). How the nursing profession should adapt for a digital future. *BMJ*, 373. <https://doi.org/10.1136/bmj.n1190>
- Flanagan, J. (2009). Postoperative telephone calls: timing is everything. *AORN Journal*, 90(1), 41-51. <https://doi.org/10.1016/j.aorn.2009.04.001>
- Gupta, S., Jones, G., & Shah, S. (2018). Optimising orthopaedic follow-up care through a virtual clinic. *International Journal of Orthopaedic and Trauma Nursing*, 28, 37-39. <https://doi.org/10.1016/j.ijotn.2017.06.002>
- Jansson, M., Vuorinen, A. L., Harjumaa, M., Similä, H., Koivisto, J., Puhto, A. P., ... & Pikkarainen, M. (2020). The digital patient journey solution for patients undergoing elective hip and knee arthroplasty: Protocol for a pragmatic randomized controlled trial. *Journal of Advanced Nursing*, 76(6), 1436-1448. <https://doi.org/10.1111/jan.14343>
- Jepsen, J. H., Hellerup, M., & Specht, K. (2022). Orthopaedic nurses' experiences with real-time documentation in a high-tech ward: A qualitative study. *International Journal of Orthopaedic and Trauma Nursing*, 44, 100901. <https://doi.org/10.1016/j.ijotn.2021.100901>
- McGinley, A., & Lucas, B. (2006). Telenursing: A pilot of telephone review after intra-articular knee injection. *Journal of Orthopaedic Nursing*, 10(3), 144-150. <https://doi.org/10.1016/j.joon.2006.06.003>
- Barbosa, S. F. F., Abbott, P., & Dal Sasso, G. T. M. (2021). Nursing in the Digital Health Era. *Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing*, 53(1), 5–6. <https://doi.org/10.1111/jnu.12620>

Tablo 1. Çalışmaya Dahil Edilen Araştırmaların Genel Özellikleri

Araştırmayı Yapan Kişiler	Örneklem Sayısı	Araştırma Tipi	Girişim	Sonuç
Jepsen ve ark.,2022	N=18	Nitel	Gerçek zamanlı dökümantasyon uygulaması ile hemşirelik bakımının sağlanması	Araştırma sonucunda gerçek zamanlı dökümantasyon uygulamasına öncelik verildiği, hasta katılımı ve güvenliği üzerinde olumlu bir etkisi olduğu belirlenmiştir.
McGinley ve ark.,2006	N=30	Nitel	Diz enjeksiyonu olan 30 hastanın taburculuğu sonrası telefon ile görüşme sağlanarak tele hemşirelik uygulaması	Araştırma sonucunda diz enjeksiyonu yapılan ve taburcu olan hastalara sağlanan tele hemşirelik uygulamasının güvenli ve konforlu olduğu ayrıca zaman kaybını azalttığı bildirilmiştir.
Flanagan ve ark.,2009	N=77	Nitel	Diz atroskopisi ameliyatı olan hastaların taburculuk sonrası telefon ile takip edilmesi ve hasta deneyimlerinin açık uçlu sorularla incelenmesi	Araştırma sonucunda; iyileşme döneminde hemşireler tarafından sürekli iletişimin, hastaların cerrahi deneyimini tartışmasına yardımcı olduğu belirlenmiştir.

**TEAM BEHAVIOR AND AWARENESS IN SAFE SURGICAL CHECKLIST USE:
A SYSTEMATIC REVIEW**

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ABSTRACT

Operating rooms are stressful spaces where complex applications compete with time. All surgical team working in this complex area should work in coordination. Safe Surgical Checklists are an important tool for ensuring this coordination and preventing situations that threaten possible patient safety. Successful implementation of the Safe Surgery Checklist must embrace the importance of the checklist to ensure patient safety. At this point, first of all, it is necessary to draw attention to the attitude and awareness of the surgical team towards the Safe Surgery Checklist. The aim of this study is to systematically examine the attitude and awareness of the team in the use of the Safe Surgery Checklist. Between 2010-2023, 318 studies were reached using the keywords "Safe Surgery Checklist", "surgical team", "attitude" and "awareness" in Turkish and English in Pubmed, Science Direct and Google Scholar databases. Of these studies, 6 studies that met the inclusion criteria were reviewed. It has been determined that the use of the Safe Surgery Checklist by the surgical team improves teamwork. The surgical team was largely familiar with the Safe Surgery Checklist and was thought to be effective in improving cooperation and communication in the operating room team. Indifference of health professionals, lack of manpower in the surgical team, and long completion of the checklist were identified as barriers to the use of the Safe Surgery Checklist. **Keywords:** Safe Surgery Checklist, Communication, Surgical Team, Collaboration, Operating Room

GÜVENLİ CERRAHİ KONTROL LİSTESİ KULLANIMINDA EKİBİN TUTUM VE
FARKINDALIĞI: SİSTEMATİK DERLEME

ÖZET

Ameliyathaneler, zamanla yarışan ve karmaşık uygulamaların gerçekleştiği stresli alanlardır. Bu karmaşık alanda görev alan tüm cerrahi ekibin koordinasyon halinde çalışması gerekir. Güvenli Cerrahi Kontrol Listeleri, bu koordinasyonu sağlamada ve olası hasta güvenliğini tehdit eden durumları önlemeye yönelik önemli bir araçtır. Güvenli Cerrahi Kontrol Listesi'nin başarılı bir şekilde uygulanmasında hasta güvenliğini sağlamak için kontrol listesinin önemini benimsemesi gerekir. Bu noktada da öncelikle cerrahi ekibin Güvenli Cerrahi Kontrol Listesi'ne yönelik tutum ve farkındalığına dikkat çekmek gerekir. Bu çalışmanın amacı Güvenli Cerrahi Kontrol Listesi kullanımında ekibin tutumu ve farkındalığını sistematik olarak incelemektir. 2010-2023 yılları arasında Pubmed, Science Direct ve Google Scholar veri tabanlarındaki Türkçe ve İngilizce olarak "Safe Surgery Checklist", "surgical team", "attitude" ve "awareness" anahtar kelimeleri kullanılarak 318 çalışmaya ulaşılmıştır. Bu çalışmalardan dahil edilme kriterlerine uyan 6 çalışma incelenmiştir. Cerrahi ekibin Güvenli Cerrahi Kontrol Listesi kullanımının ekip çalışmasını geliştirdiği belirlenmiştir. Cerrahi ekip büyük oranda Güvenli Cerrahi Kontrol Listesi'ni bilmekte ve ameliyathane ekibindeki iş birliğini ve iletişimi geliştirmede etkili olduğu düşünülmektedir. Güvenli Cerrahi Kontrol Listesi'nin kullanımında engeller olarak sağlık profesyonellerinin ilgisizliği, cerrahi ekipte insan gücünün eksikliği, kontrol listesinin tamamlanmasının uzun sürmesi kontrol listesinin kullanımının önündeki engeller olarak belirlenmiştir.

Anahtar kelimeler: Güvenli Cerrahi Kontrol Listesi, İletişim, Cerrahi Ekip, İş birliği, Ameliyathane

GİRİŞ

Dünya Sağlık Örgütü (WHO) tarafından 2008 yılında “Güvenli Cerrahi Hayat Kurtarıcı” projesi oluşturulmuştur. Proje kapsamında dünya çapında cerrahiye bağlı ölüm sayısının azaltılması hedeflenmiştir. Hedefe bağlı olarak yetersiz anestezi güvenliği uygulamaları, yanlış hasta ve taraf cerrahileri, önlenebilir cerrahi enfeksiyonlar ve ekip üyeleri arasındaki zayıf iletişim dahil önemli güvenlik konuları belirlenerek politikaların oluşturulması amaçlanmıştır. Bu amaçlar doğrultusunda dünya çapında ameliyathanelerde kullanılması için 2009 yılında Dünya Sağlık Örgütü tarafından Güvenli Cerrahi Kontrol Listesi yayınlanmıştır (WHO, 2009).

Ameliyathaneler, zamanla yarışan ve karmaşık uygulamaların gerçekleştiği stresli alanlardır. Bu karmaşık alanda görev alan tüm cerrahi ekibin koordinasyon halinde çalışması gerekir. Güvenli Cerrahi Kontrol Listeleri, bu koordinasyonu sağlamada ve olası hasta güvenliğini tehdit eden durumları önlemeye yönelik önemli bir araçtır. Bu aracın kullanımı ve etkinliğine yönelik cerrahi ekip arasında genellikle görüş birliği yoktur. Güvenli Cerrahi Kontrol Listesi'nin başarılı bir şekilde uygulanmasında hasta güvenliğini sağlamak için kontrol listesinin önemini benimsemesi gerekir. Bu noktada da öncelikle cerrahi ekibin Güvenli Cerrahi Kontrol Listesi'ne yönelik tutum ve farkındalığına dikkat çekmek gerekir (Gökay ve ark., 2016; Soyer ve Yavuz Van Giersbergen, 2017).

GEREÇ VE YÖNTEM

Çalışmanın amacı Güvenli Cerrahi Kontrol Listesi kullanımında ekibin tutumu ve farkındalığını sistematik olarak incelemektir. Güvenli Cerrahi Kontrol Listesinin kullanımının cerrahi ekip üzerine etkisini inceleyen, 2010-2023 yılları arasında Pubmed, Science Direct ve Google Scholar veri tabanlarındaki Türkçe ve İngilizce olarak “Safe Surgery Checklist”, “surgical team”, “attitude” ve “awareness” anahtar kelimeleriyle 318 çalışmaya ulaşılmıştır. Bu çalışmada kullanılmaya uygun 6 araştırma çalışmaya dahil edilmiştir. Dahil edilen çalışmalar Tablo 1’de özetlenmiştir.

BULGULAR

Gürlek Kısacık ve Cigerci tarafından 102 ameliyathane hemşiresinin Güvenli Cerrahi Kontrol Listesi kullanımına yönelik görüşlerini inceleyen bir çalışma yapılmıştır. Çalışmada hemşirelerin tamamının Güvenli Cerrahi Kontrol Listesini bildiklerini ve ameliyathanelerinde kullandıklarını belirtirken, %80,4’ü Güvenli Cerrahi Kontrol Listesini hastane hizmet içi eğitimlerinde öğrendiğini belirtmiştir. Çalışmaya katılan hemşirelerin %68,6’sı Güvenli Cerrahi Kontrol Listesi kullanımının ameliyathane ekibindeki iş birliğini ve iletişimi geliştirmede etkili olduğunu belirtmiştir. Elde edilen bir diğer sonuç ise hemşirelerin %64,7’si kontrol listesini uygularken sorun yaşamakta ve bu sorunun %40’ını cerrahların kontrol aşamalarını bekleme konusunda isteksiz olmaları oluşturmaktadır. Kontrol listesinin kullanımını etkileyen faktörler hakkında görüşleri incelendiğinde büyük oranda ameliyathanede yoğun çalışma şartları ve cerrahi ekibin kontrol listesi kullanımı ve önemi konusunda anlaşmazlık olduğu görülmüştür (Gürlek Kısacık ve Cigerci, 2017).

Sharma ve arkadaşları, Güvenli Cerrahi Kontrol Listesi'nin kullanımına yönelik bilgi, tutum ve uygulamayı inceleyen bir çalışma yapmıştır. 104 katılımcı ile yaptıkları çalışmaya göre, cerrahi ekibin %92,3’ü Güvenli Cerrahi Kontrol Listesinden haberdardı ve yarısından fazlası (%54,17) da iyi düzeyde bilgiye sahipti. Cerrahi ekip, Güvenli Cerrahi Kontrol Listesinin amaçlarını, bileşenlerini ve uygulama protokollerini çok iyi biliyorlardı. Cerrahi ekibin kontrol listesine yönelik genel tutumu olumluydu. Ekibin çoğu, kontrol listesinin tüm cerrahi prosedürler için kullanılmasını istedi ve kullanımının ameliyathanedeki ekip arasındaki iletişimi ve iş birliğini geliştireceği fikrindeydi. Ekibin sadece beşte biri, kontrol listesi olmadan verimli bir şekilde çalışabileceklerini belirtmiştir. Ekip üyelerinin dörtte üçü,

ameliyat ekibinin tüm üyelerini ad ve soyad bazında tanıdığını bildirdi ve yaklaşık aynı oranda yanıt veren kişi, ameliyathanede ekip koordinasyonunun iyi olduğunu belirtmiştir. Ayrıca, katılımcıların üçte ikisi, ekip üyelerinin önerilerine ve fikirlerine açık olduğunu bildirmiştir (Sharma ve ark., 2020). Böhmer ve arkadaşları çalışmada Güvenli Cerrahi Kontrol Listesi'nin uyarlanmış hali olan 19 maddelik bir anket geliştirerek toplam 71 cerrahi ekip üyesi ile hasta güvenliği ve ekip çalışmasının kalitesini inceleyen bir çalışma yapmıştır. Çalışmada anketin uygulanmasının ardından kurumdaki ameliyathane ekibinin; ekipteki kişilerin adlarının ve görevlerinin bilinmesi, hastanın ameliyatı için yazılı onamın doğrulanması, cerrahi insizyondan önce antibiyotik endikasyonunun kontrolü ve meslekler arası iş birliğinin kalitesinin arttığı ve olumlu tutum geliştiği sonucuna ulaşılmıştır (Böhmer ve ark., 2012). Danyangs ve arkadaşları ameliyathane ekibinin Güvenli Cerrahi Kontrol Listesi kullanımına yönelik bilgi, tutum ve farkındalıklarını inceleyen bir çalışma yapmıştır. Çalışmaya katılan 68 cerrahi ekip üyesinin %47'si genellikle güvenlik hazırlığı için yeterli zamanlarının olmadığını ve %72,1'i güvenliği sağlamak için yeterli kaynağının bulunmadığını belirtmiştir. Ekibin %92,7'si kontrol listesinin kullanılmasını istediğini, ekibin iletişimini ve iş birliğini artıracaklarını düşündüğünü bildirmiştir. Ancak yarısından fazlası (%54,4), kontrol listesinin, uygulanmadan önce zaten uygulanmakta olan mevcut güvenlik prosedürlerine herhangi bir ek değer getirmeyebileceğini belirtmiştir. Kontrol listesinin kullanımının önündeki engeller olarak; yönetimin yaptırımının olmaması, sağlık profesyonellerinin ilgisizliği, cerrahi ekipte insan gücünün eksikliği ve ekip anlayışının olmaması olarak bildirilmiştir (Danyangs, 2016). Fourcade ve arkadaşları Güvenli Cerrahi Kontrol Listesi'nin benimsenmesine yönelik engelleri inceleyen çok merkezli bir çalışma yapmıştır. Çalışma yapılan merkezlerin %90,2'sinde Güvenli Cerrahi Kontrol Listesi'nin kullanıldığı ve kontrol listesinin %61 oranında tamamlandığı sonucuna ulaşılmıştır. Engellere yönelik bulunan sonuçlar arasında cerrahi ekibin iş yükünün fazla olması nedeniyle kontrol listesinin doldurulmasının zaman aldığı; ekibin kontrol listesine uyum konusunda ilgili olmadığı; kontrol listesinin faydalarını ve kontrol listesindeki bazı adımların zaman kısıtlaması nedeniyle herhangi bir değerlendirme yapılmadan ve sadece hastane direktiflerine uyulması amacıyla doldurulduğu; bazı maddelerin kontrollerinin anlaşılmadığı ve cerrahi ekip arasındaki zayıf iletişim olduğu görülmüştür. (8)

Gürkan ve arkadaşları cerrahi ekibin Güvenli Cerrahi Kontrol Listesi'ne yönelik tutum ve görüşlerini inceleyen bir çalışma yapmıştır. Bu çalışmaya 561 cerrahi merkezden cerrahi ekip üyeleri katılmıştır. Çalışma sonucunda cerrahi ekibin; %98'i kontrol listesinin kullanımının zorunlu olduğunu ve %57,8'i yalnızca günlük pratikte rutin bir uygulama olduğunu belirtmiştir. Ekibin %95,2'si komplikasyonları önlemede etkili olduğu için her hastada kullanılması gerektiğine inandığını ve %78,4'ü hasta güvenliğini artırdığını bildirmiştir. Ek olarak %69'u kontrol listesi ile ilgili eğitim aldığını bildirirken; %50,8'i bu eğitimlerin faydalı olmadığını düşünmektedir. (9)

SONUÇ

Güvenli Cerrahi Kontrol Listesinin kullanımı cerrahi ekip tarafından genellikle kabul görmektedir. Çalışmalarda, sağlık profesyonellerinin ilgisizliği, cerrahi ekipte insan gücünün eksikliği, kontrol listesinin tamamlanmasının uzun sürmesi kontrol listesinin kullanımının önündeki engeller olarak belirlenmiştir. Bununla birlikte yapılan çalışmalarda Güvenli Cerrahi Kontrol Listesinin ekip iletişimi ve iş birliğini geliştiren bir etken olduğu görülmüştür.

KAYNAKÇA

Böhmer, A. B., Wappler, F., Tinschmann, T., Kindermann, P., Rixen, D., Bellendir, M., Schwanke, U., Bouillon, B., & Gerbershagen, M. U. (2012). The implementation of a perioperative checklist increases patients' perioperative safety and staff satisfaction.

- Acta anaesthesiologica Scandinavica, 56(3), 332–338. <https://doi.org/10.1111/j.1399-6576.2011.02590.x>,
- Dangyangs, S.Y. (2016). Awareness, Knowledge and Perception of Safe Surgery Checklist and its Implementation in Jos University Teaching Hospital, Plateau State, Nigeria. *Journal of Clinical Research*, 3, 56-68.
- Fourcade, A., Blache, J. L., Grenier, C., Bourgain, J. L., & Minvielle, E. (2012). Barriers to staff adoption of a surgical safety checklist. *BMJ quality & safety*, 21(3), 191–197. <https://doi.org/10.1136/bmjqs-2011-000094>
- Gökay, P., Taştan, S., Ayhan, H., İyigün, E. & Can, M. (2016). Dünya sağlık örgütü güvenli cerrahi kontrol listesinin kullanımı: sistematik inceleme. *Gülhane Tıp Dergisi*, 58(2), 136-142.
- Gürkan, A. , Kırtıl, İ. & Dikmen, Y. (2022). Surgical Teams' Attitudes and Views Concerning the Surgical Safety ChecklistTR . *Clinical and Experimental Health Sciences* , 12 (2) , 410-419 . <https://doi.org/10.33808/clinexphealthsci.937745>
- Gürlek Kisacik, O., Cigerci, Y. (2019). Use of the surgical safety checklist in the operating room: Operating room nurses' perspectives. *Pakistan journal of medical sciences*, 35(3), 614–619.
- Sharma, P., Tripathi, V., Gupta, U. (2020). Knowledge, attitude and practices regarding World Health Organization surgical safety checklist and the challenges in its implementation at a teaching hospital in North India. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, 9(9), 3759-3763.
- Soyer, Ö., Yavuz Van Giersbergen, M. (2017). Güvenli Cerrahi Kontrol Listesinin Etkinliği: Sistematik İnceleme. *Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi*, 20(4): 286-298.
- WHO. Implementation Manual WHO Surgical Safety Checklist 2009. Retrieved from <https://www.who.int/publications/i/item/9789241598590> (Erişim Tarihi:08.04.2023)

Tablo 1. Çalışmaya Dahil Edilen Araştırmaların Genel Özellikleri

Araştırmayı Yapan Kişiler	Araştırma Tipi	Sonuç
Gürlek Kısacık ve Cığerci, 2019	Kesitsel	Araştırmaya katılan hemşireler Güvenli Cerrahi Kontrol Listesi kullanımının ameliyathane ekibindeki iş birliğini ve iletişimi geliştirmede etkili olduğunu ancak bir kısmının kontrol listesini uygularken sorun yaşadıkları ve bu sorunun %40'ını cerrahların kontrol aşamalarını beklemek konusunda isteksiz olduklarını belirtmiştir.
Sharma ve arkadaşları, 2020	Kesitsel	Çalışmaya katılan katılımcılardan büyük bir bölümü, kontrol listesinin tüm cerrahi prosedürler için kullanılması gerektiği düşüncesine sahiptir, listenin kullanımının ameliyathanedeki ekip arasındaki iletişimi ve iş birliğini geliştireceği sonucuna varılmıştır. Ekibin sadece beşte biri, kontrol listesi olmadan verimli bir şekilde çalışabileceklerini belirtmiştir. Ayrıca, katılımcıların üçte ikisi, ekip üyelerinin önerilerine ve fikirlerine açık olduğu belirlenmiştir.
Böhmer ve arkadaşları, 2012	Kesitsel	Araştırmaya katılan kişilerin güvenli cerrahi kontrol listesinin kullanımının meslekler arası iş birliğinin kalitesini arttırdığı ve olumlu tutum geliştirdiği sonucuna ulaşılmıştır.
Dangyangs ve arkadaşları, 2016	Kesitsel	Ekibin %92,7'si kontrol listesinin kullanılmasını istediğini, ekibin iletişimini ve iş birliğini artıracakını düşündüğünü bildirmiştir. Ancak yarısından fazlası (%54,4), kontrol listesinin, uygulanmadan önce zaten uygulanmakta olan mevcut güvenlik prosedürlerine herhangi bir ek değer getirmeyebileceğini belirtmiştir. Kontrol listesinin kullanımının önündeki engeller olarak; yönetimin yaptırımının olmaması, sağlık profesyonellerinin ilgisizliği, cerrahi ekipte insan gücünün eksikliği ve ekip anlayışının olmaması olarak bildirilmiştir.
Fourcade ve arkadaşları, 2012	Kesitsel	Yapılan çalışmada, cerrahi ekibin iş yükünün fazla olması nedeniyle kontrol listesinin doldurulmasının zaman aldığı; ekibin kontrol listesine uyum konusunda ilgili olmadığı; kontrol listesinin faydalarını ve kontrol listesindeki bazı adımların zaman kısıtlaması nedeniyle herhangi bir değerlendirme yapılmadan ve sadece hastane direktiflerine uyulması amacıyla doldurulduğu; bazı maddelerin kontrollerinin anlaşılmadığı ve cerrahi ekip arasındaki zayıf iletişim olduğu görülmüştür.
Gürkan ve arkadaşları, 2022	Kesitsel	Araştırmaya katılan katılımcılardan %95,2'lik kısmından liste kullanımının komplikasyonları önlemede etkili olduğu için her hastada kullanılması gerektiği, %78,4'lük kısmından hasta güvenliğini artırdığı belirlenmiştir. ancak katılımcıların %69'unun kontrol listesi ile ilgili eğitim aldığı bildirilirken ; %50,8'inden bu eğitimlerin faydalı olmadığı sonucuna ulaşılmıştır.

**GERİLİM DEĞİŞİM OLAYLARININ DÜZENLENMESİ İÇİN DİNAMİK
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ÖZET

Güç sistemlerinde gerilim değişimleri, istenmeyen olay ve arızalar sonrası yaşanabilmekte olan en önemli güç kalitesi sorunları arasındadır. Bu çalışmada, güç kalitesi problemlerinden biri olan gerilim düşümü/yükselmesi olayına çözüm sağlayan özel güç cihazı Dinamik Gerilim/Voltaj Regülatörü (DVR) ele alınmaktadır. DVR yapısı gereği hem gerilim düşümü hem de gerilim yükselmesi olayında başarı sağlayarak yük tarafındaki gerilimi nominal seviyede tutmak için düzeltme işlemi yapar. Bu çalışmada, şebekede yaşanmış gerçek gerilim değişim olay kayıtlarına göre oluşturulmuş 5 farklı senaryo eşliğinde benzetim çalışmaları gerçekleştirilmiştir. Bu amaçla tasarlanan DVR sistemdeki dengeli ve dengesiz gerilim değişimlerini istenilen seviyede tutma kabiliyetine sahiptir. Elde edilen benzetim sonuçlarında DVR'in gerilim telafisi yaparak yükü koruduğu ve yük gerilimini nominal seviyede tuttuğu görülmüştür.

Anahtar Kelimeler: Güç kalitesi, Dinamik gerilim regülatörü, Gerilim yükselmesi, Gerilim düşmesi

**DESIGN AND SIMULATION OF DYNAMIC VOLTAGE REGULATOR FOR
REGULATION OF VOLTAGE DISTURBANCES EVENTS**

ABSTRACT

In power systems, voltage disturbances can occur after undesired events and faults that is among the most important power quality problem. In this study, a special power device Dynamic Voltage/Voltage Regulator (DVR), which provides a solution to the voltage drop/swell phenomenon, is discussed. Due to its structure, it corrects the voltage on the load side, which is successful in both voltage drop and voltage rise, and keeps it at the nominal level. Simulation studies were carried out with 5 different scenarios created according to the voltage change event recorded in the power system network. The DVR designed for this purpose has the ability to keep the balanced and unbalanced voltage disturbances in the system at the desired level. In the simulation results obtained, it has been seen that the DVR protects the load by voltage compensation and keeps the load voltage at the nominal level.

Keywords: Power quality, Dynamic voltage regulator, Voltage swell, Voltage sag

1. Giriş

Elektrik enerji sistemlerinde güç kalitesi önemli bir çalışma alanı içerisinde değerlendirilmektedir. Güç kalitesi elektrik şebekesine bağlı cihaz, ekipman, elektriksel yüklerin önemli bir performans ve ömür kaybı yaşamadan çalışmasını sağlayan düzenlemelerin bütünüdür. Elektrik şebekesinde meydana gelebilecek gerilim, akım ve frekans değişimlerinden kaynaklı sorunlar güç kalitesi problemi olarak tanımlanmaktadır. Gerilim düşmeleri, yükselmeleri, titreme, gerilim çentiği, harmonik bozulmalar, geçici akımlar ve anlık kesintiler endüstriyel müşterileri etkileyen en yaygın güç kalitesi sorunlarıdır (Brumsickle ve diğ., 2001 ve Abhijee ve Kumar, 2014). Üretim süreçlerinde bulunan hassas elektronik ekipmanlar, kritik ve doğrusal olmayan yükler, güç kalitesi problemlerinden olumsuz etkilenmektedir. Parasal kayıplara, ekipmanların hasar görmesine ve ürün kalitesinin düşmesine vb. sorunlara neden olmaktadır (Remya ve diğ., 2018). Temel olarak kaliteli elektrik enerjinde gerilimin dalga şeklinin sinüzoidal formda, frekans değerinin sabitli ve yük geriliminin istenilen seviyede olması bu şartların başında gelmektedir. Aynı zamanda tüketicinin talep ettiği elektrik enerjisi istenilen düzeyde ve kesintisiz olarak karşılanabilmelidir.

Güç sistemlerinin üretimi, iletimi ve dağıtım gibi her aşamalarda meydana gelebilecek bir takım istenmeyen olaylar enerji kalitesi açısından sorunlar oluşturabilmektedir. Bu iç ve/veya dış kaynaklı olaylara; kısa devre hataların oluşması, yıldırım düşmesi, yüksek başlangıç akımlarına ihtiyaç duyan büyük yüklerin enerjilendirilmesi, aşırı yüklenmeler ve büyük yüklerin devreden çıkması vb. durumlar örnek olarak gösterilebilir (Özdemir, 2020 ve Damaraju ve Lalitha,2015). Sistem koşullarına ve arıza yerine bağlı olarak gerilimde düşme, yükselme veya kesintiler oluşabilmektedir. Bu olumsuz etkilerden dolayı güç sisteminde gerilim düşümü ve gerilim yükselmesi olayları elektrik enerjinin kullanıldığı tüm noktalarda önem arz etmekte ve en önemli güç kalitesi problemi olarak değerlendirilmektedir. Elektrik şebekesine bağlı çok sayıda bilgisayar ve diğer hassas elektrik yükleri, şebeke bozulmalarından doğrudan etkilenir. Bu bozulmaların büyük çoğunluğu, gerilim düşüşleri gibi gerilim geçişleri ile ilgilidir. Mevcut senaryoda, hassas yükler, özellikle gerilim düşüşü nedeniyle güç kalitesi sorunlarının yaklaşık %80'inden muzdariptir (Brito ve diğ., 2014 ve Kassarwani ve diğ., 2018).

Gerilim çökmesi, güç dağıtım sistemlerinde en fazla yaşanan güç kalitesi sorunudur. Bu problem ekipman arızalarına yol açabildiği gibi endüstriyel tüketicinin yanı sıra kamu hizmeti

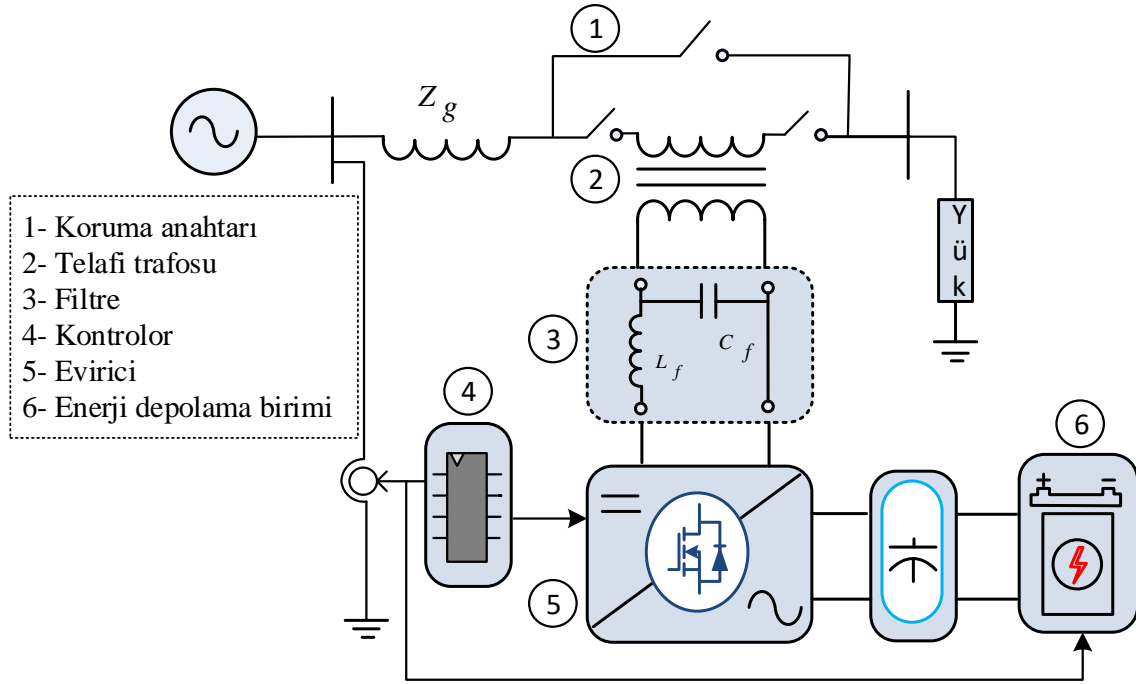
şirketi içinde mali kayıplara neden olur. Geçmişte bu sorunların çözümünde şönt kompanzasyon cihazları kullanılmaktaydı. Ancak yüksek hizmet maliyeti, zor bakım, gerekli geniş alan ve küçük gerilim düşüş değerini telafi etme şönt kompanzasyon cihazlarının eksiklikleri arasında yer almaktadır. DVR'nin maliyetinin düşük, küçük boyutlu ve teknik olarak geliştirebilir bir cihaz olması hem gerilim düşümü ve hem de gerilim yükselmesini telafi etmesi nedeniyle günümüzde tercih edilen bir güç cihazıdır (Vasudevan ve Prasad, 2017 ve Soomro ve diğ., 2021). En iyi ve en uygun maliyetli çözüm sunan DVR gerilim olaylarını telafi etmek için güç elektroniği tabanlı bir çözümdür. Yapılan bir çalışmada, DVR topolojilerinin kapsamlı bir tartışmasını ve incelemesi yapılmıştır. Özellikle güç dönüştürücülerine dayalı DVR kontrol topolojileri, kontrol birimleri ve bunların her bir çalışma modu ayrıntılı olarak açıklanmaktadır (Moghassemi ve Padmanaban, 2020). Diğer bir çalışmada DVR için Geliştirilmiş Senkron Referans Çerçevesine dayalı yeni bir referans oluşturma yöntemi sunulmuştur. Önerilen yöntem, dengesiz gerilim düşüş/yükselişini ve dengesiz gerilim harmoniklerini aynı anda kompanze etmek için hem tek fazlı hem de üç fazlı sistemler için kullanılabilir (İnci ve diğ., 2016).

DVR'nin amacı gerilim düşmesi ve yükselmesi olayında yük gerilimini istenilen seviyede tutmaktır. Herhangi bir gerilim düşümü ve yükselmesi durumunda devreye girerek, ihtiyaç olan gerilimi telafi transformatörü ile yük gerilimine aktarmaktadır. Bu çalışmada gerilim düşümü ve yükselmesi olaylarına karşı yükü korumak ve gerilimi regüle etmek için kullanılan özel güç cihazı olan bir DVR tasarlanmıştır. Gerilim olaylarının benzetimi güç sisteminde yaşanan gerçek gerilim değişimlerini temsil eden farklı arıza kayıt örnekleri kullanılmıştır. Bu arıza senaryoları MATLAB/Simulink ortamında tasarlanan DVR ile simüle edilmiştir. Gerilimdeki değişimlerin miktarı, faz açısının ve genliğin vektörel kontrolü yapılarak tespit edilmiştir. Simülasyonda PI kontrolör ve PWM genlik modülasyonu kullanılmıştır. Benzetim sonuçları istenen seviyede yük gerilimi elde edildiği ve gerilim regülasyon işlemi yapıldığını göstermiştir. Tasarlanan sistem dengeli/dengesiz gerilim değişimlerinin telafi edilmesinde başarılı bir performans göstermektedir.

2. DVR'nin Genel Yapı ve Prensip Şeması

DVR güç sisteminde meydana gelen anlık gerilim düşmeleri ve yükselmelerine karşı hassas yükleri korumak için tasarlanmış, sisteme seri bağlı özel güç cihazlardan biridir. DVR'nin çalışma prensibi gerilim düşümü veya yükselme olayında yük gerilimini nominal seviyede tutmak için sisteme telafi gerilimi aktarmasına dayanmaktadır (Ağalar ve Kaplan, 2017).

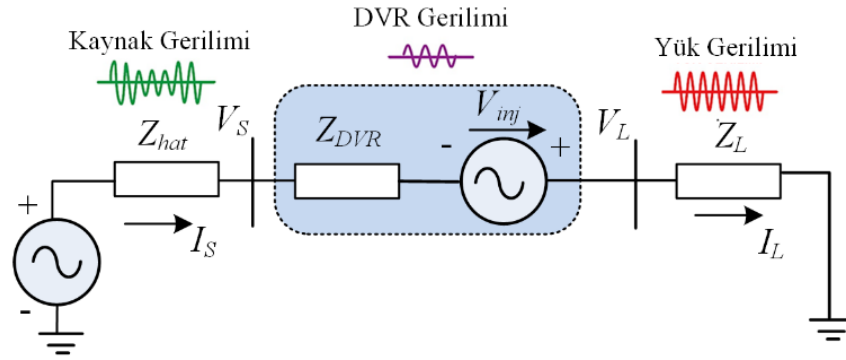
Telafi gerilimi kaynak geriliminin genliđi, açısı referans alınarak oluşturulur. Sistemde oluşan gerilim deđişimleri DVR tarafından sürekli olarak izlenmektedir. Kaynak gerilim seviyesinin deđişmesi DVR aktif edecek ve yük gerilimini istenen seviyeye getirecektir. DVR'nin temel prensip şeması Şekil 1'de gösterilmektedir. Gerilim olaylarının düzenlenmesi için kullanılan DVR aygıtı beş ana bileşenden meydana gelmektedir. Bunlar enerji depolama birimi, evirici birimi, filtre birimi, bağlantı (telafi) transformatörü ve koruma anahtarından oluşmaktadır (Özdemir, 2020).



Şekil 1. DVR'nin temel prensip şeması.

Gerilim düşümü sırasında yük geriliminin dengelenmesi için gerekli olan enerji yardımcı bir kaynaktan veya şebekenin kendisinden kullanılabilir. Güç sistemdeki gerilim düşümü fazla olduğunda performansı artırmak ve yüke aktif güç sağlamak için yardımcı besleme yöntemi uygulanır. Enerji depolama ünitesi, gerilim düşmesi sırasında yük geriliminin dengelenmesi için gerekli olan potansiyel gücü sağlamaktadır (Ağalar ve Kaplan, 2017). Gerilim kaynaklı evirici (VSI), enerji depolama cihazı tarafından sağlanan DC gerilimi AC gerilime dönüştürmek için kullanılır. Bu şekilde istenmeyen gerilim deđişimleri için gerekli olan frekans, genlik ve faz açısındaki sinüzoidal gerilim bu cihaz tarafından üretilir. Gerilim, bağlantı transformatörü ile istenilen seviyeye yükseltilir. Filtre, evirici biriminin DC'den AC dönüşüm esnasında üretilen telafi geriliminde yüksek dereceli harmonik bileşenlerin filtre edilmesi amacıyla kullanılır. Pasif filtreler evirici biriminin çıkış tarafına yerleştirilebilir.

Bağlantı transformatörünün görevi ise evirici biriminden elde edilen gerilimi istenilen seviyesine yükseltmektir. Ayrıca transformatör DVR'nin sistemden izole olmasını da sağlamaktadır. DVR sisteme seri bağlı bir güç cihaz olduğundan, sistemden gelen bir arıza nedeniyle oluşacak hata akımı, yapısı gereği evirici birimine ulaşacaktır. Bu durumda birimdeki ekipmanlar zarar görebilir. Bu nedenle, evirici birimini koruma altına almak için DVR sistem yapısına bir koruma anahtarı (by-pass) dâhil edilmektedir. Koruma devresinin temel işlevi, şebekedeki geçen akımı algılamaktır. Eğer eviricinin zarar göreceği akım seviyesinde ise; anahtar kapalı pozisyona geçerek DVR devre dışı bırakır. Böylelikle DVR yüksek akımlara karşı koruma altına alınmış olunur. Yüksek bir akım geçmediği sürece koruma anahtarının pozisyonu açık devre olacaktır (Ghosh ve diğ., 2004, Taiwo ve diğ., 2018 Abhijee ve Kumar, 2014, Chandrasekaran ve Ramachandaramurthy, 2016, Sadigh ve diğ., 2016).



Şekil 2. DVR'in eş değer devre şeması (Moghassemi ve Padmanaban, 2020, 19. Boonchiam ve Mitholananthan, 2006).

Bilindiği gibi kaynak tarafında meydana gelen gerilim bozulmasını telafi etmek için gerekli gerilim DVR tarafından üretilir. DVR'ye ait eşdeğer devre şeması Şekil 2'de verilmiştir. Gerilim düşmesi/yükselmesi meydana geldiğinde, DVR bu gerilim düşümünü algılayarak telafi transformatörü aracılığıyla şebekeye seri gerilim (V_{inj}) enjekte eder. Böylelikle yük tarafının bu gerilim değişimlerinden etkilenmesi önlenir (Pal ve Gupta, 2020). Bu durumda yük gerilimi;

$$V_L = V_S + V_{inj} \quad (1)$$

şeklinde oluşur. Burada V_L yük gerilimi, V_S sarkık besleme gerilimi ve V_{inj} ise sisteme enjekte edilen gerilimi göstermektedir.

Telafi gerilimi V_{DVR} Denklem 2'de gösterildiği gibi tanımlanır.

$$V_{DVR} = V_L + Z_{th}I_L - V_{th} \quad (2)$$

Burada Z_{th} sistem empedansı, I_L yük akımını, V_{th} hata durumunda meydana gelen sistem gerilimini göstermektedir. Sistemdeki yük akımı Denklem 3'deki gibi yazılır.

$$I_L = \frac{P_L + jQ_L}{V_L} \quad (3)$$

Burada, P_L yükün aktif gücünü, Q_L yükün reaktif gücünü temsil eder. Yük gerilimi V_L referans büyüklük olarak alındığında DVR gerilim Denklem 4'teki gibi tanımlanır.

$$V_{DVR}\angle\alpha = V_L\angle 0 + Z_{th}I_L\angle(\beta - \theta) + V_{th}\angle\delta \quad (4)$$

Burada, α DVR'nin açısını, β hat empedansın açısını, δ kaynak gerilimin açısı ve θ güç açısını ifade eder. Güç açısı Denklem 5 ile tanımlıdır.

$$\theta = \tan^{-1} \frac{Q_L}{P_L} \quad (5)$$

DVR'nin kompleks güç ifadesi Denklem 6 ile tanımlanır.

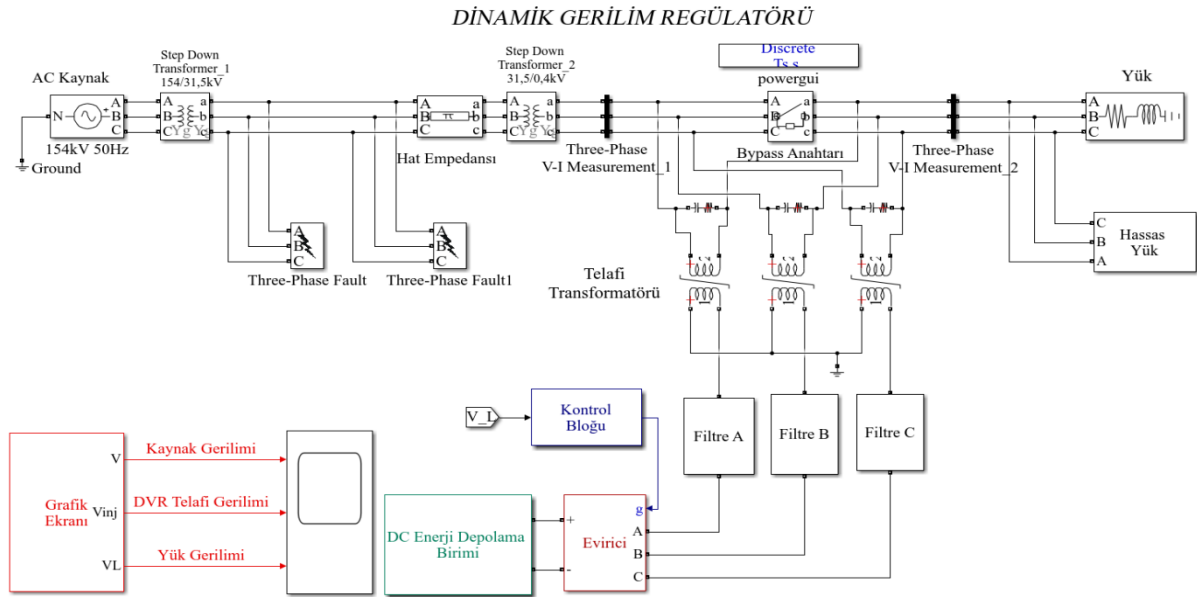
$$S_{DVR} = V_{DVR}I_L^* \quad (6)$$

Burada I_L^* yük akımının eşleniğini ifade etmektedir.

3. DVR'nin Benzetim Modeli

Bu çalışmada alçak gerilim şebekesinde oluşan gerilim değişimlerinin (gerilim düşümü ve yükselmesi) giderilmesi için bir DVR modeli tasarlanmıştır. Tasarlanan DVR modeli hem dengeli ve hem de dengesiz gerilim değişimlerinde etkili olacak şekilde çalışmaktadır. Bu amaçla sisteme ilişkin modelleme çalışmaları MATLAB/Simulink ortamında gerçekleştirilmiştir.

Oluşturulan DVR ve güç sistemi modeli bütünleşik olarak değerlendirilmiştir. Yani sistem parametreleri tanımlanırken güç sistemine ilişkin elektrik dağıtım şebekesi ve unsurlarına da yer verilmiştir. Oluşturulan tümleşik DVR benzetim modelinin MATLAB/Simulink gösterimi blok şeması Şekil 3'te, sistem parametreleri ise Çizelge 1'de verilmiştir. Dinamik bir analiz için, DVR'nin ana bileşenleri modellenmiştir. Görüldüğü üzere her sistem donanımı; gerilim kaynaklı evirici, telafi transformatörü, filtre devresi, kontrol sistem bloğu vb. ayrı ayrı modellenerek DVR'nin tümleşik devre yapısı elde edilmiştir.



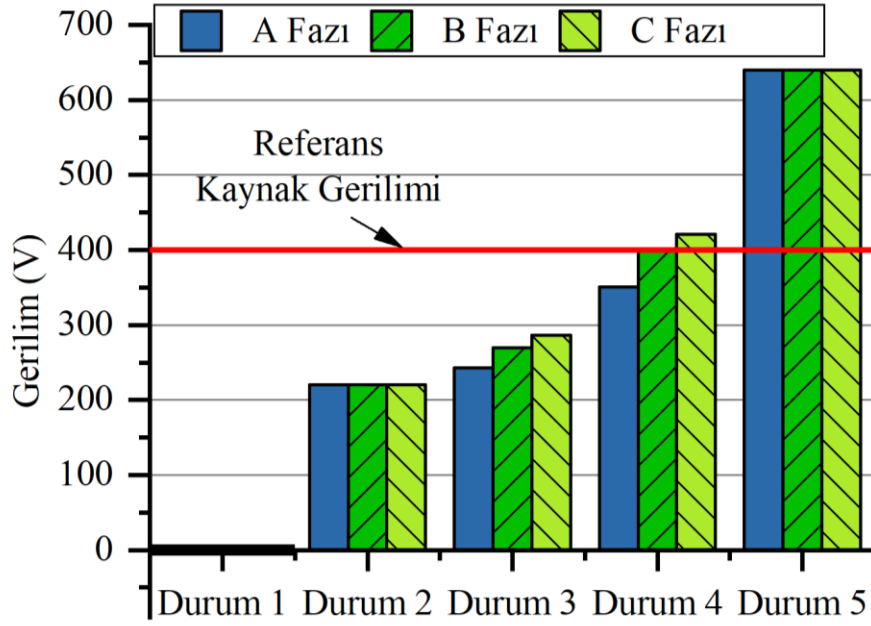
Şekil 3. Tümüleşik DVR benzetim modelinin MATLAB /Simulink gösterimi blok şeması

Çizelge 1. DVR benzetim modeli için sistem parametreleri

Sistem Birimleri		Birim Değeri					
AC Gerilim Kaynağı							
Gerilim / Frekans		154 kV (Faz-Faz, RMS, Faz Açısı=0°) / 50 Hz					
Dağıtım Hattı							
Hat Empedansı		0.01273+ j0.3864					
İndirici Transformatörler(Step Down)							
No	Güç (MVA)	Primer Gerilimi (kV)	Sekonder Gerilimi (kV)	Primer Direnci ve Endüktansı	Sekonder Direnci ve Endüktansı	Mıknatıslanma Direnci ve Reaktans	Bağlantı Grubu
1	120	154	31,5	0.042-0.094pu	0.037-0.068pu	625-625Ω	Δ-Δ
2	120	31,5	0,4	0.012-0.029pu	0.002-0.008pu	500-500Ω	Δ-Y
DVR Parametreleri							
Telafi Transformatörü							
Güç (MVA)	Primer Gerilimi (kV)	Sekonder Gerilimi (kV)	Primer Direnci ve Endüktansı	Sekonder Direnci ve Endüktansı	Mıknatıslanma Direnci ve Reaktans	Bağlantı Grubu	
10	0,4	0,4	0.002-0.008pu	0.002-0.008pu	500-500Ω	Δ-Δ	
Evirici							
Anahtarlama Elemanı ve Frekansı		IGBT – 2 kHz					
DC Gerilim		1000 V					
Telafi Gerilimi ve Kapasitesi		0.4kV - %65					
Filtre							
Kondansatör / Bobin		0,835μF / 0,01mH					
Rezonans		17 kHz					
Yük							
No	Tanımı	Güç ve Karakteristik					
1	Dengesiz yük	10 kW					
2	Hassas yük	60 +j0.015					

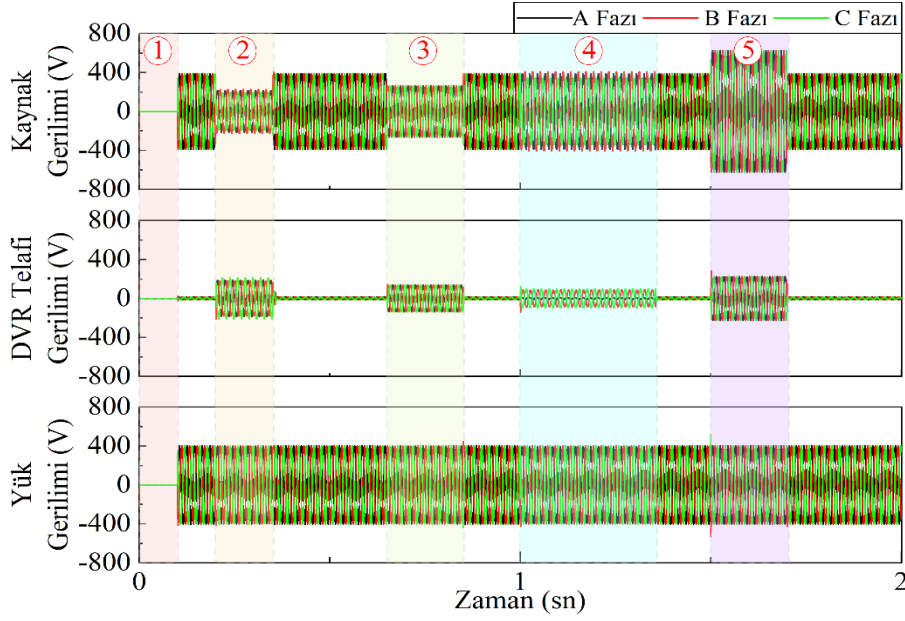
4. Benzetim Sonuçları ve Tartışma

Güç sisteminin alçak gerilim tarafında da birçok gerilim düşümü ve yükselme olayları oluşmaktadır. Bu gerilim değişim hataları; genellikle şebekeden meydana gelen hata olaylarından, kapasitesi yüksek bir yükün veya büyük güçlü kapasitelerin devreye girip çıkması gibi durumlardan kaynaklanmaktadır. Güç sisteminin alçak gerilim şebekesinde yaşanmış ve şebekeye bağlı bir tüketici tarafından kayda geçmiş gerilim düşümü ve yükselmesine ait gerçek gerilim olayları Şekil 4'te gösterilmiştir. Benzetim çalışmalarında DVR'nin performans değerlendirilmesini yapmak amacıyla gerçek bir güç sisteminde yaşanmış arıza olayları ele alınmıştır.



Şekil 4. Alçak gerilim şebekesinde yaşanmış gerilim düşümü ve yükselme olay verileri.

Çalışmada gerçek bir güç sisteminde gözlenen gerilim değişimi olaylarına ait beş farklı durum ele alınmıştır. Birinci durumda şebekede kesinti, ikinci durum dengeli gerilim düşümü, üçüncü durum dengesiz gerilim düşümü, dördüncü durum A fazında gerilim düşümü C fazında gerilim yükselmesi ve beşinci durum ise dengeli gerilim yükselmesidir. Gerçek bir sistemden gözlemlenen bu gerilim değişimi olaylarına bakıldığında gerilim değişimlerinin hem dengeli hem de dengesiz şekilde oluştuğu görülmektedir. Dengeli gerilim düşümleri genellikle üç fazlı simetrik hatalarda oluşmaktadır. Dengesiz gerilim düşümleri ise faz-toprak hatası veya iki faz kısa devre durumlarından kaynaklanmaktadır. Bu çalışmada alçak gerilim şebekesi tarafında yaşanan toplam 5 farklı gerilim olayı simüle edilmiş ve benzetim sonuçları toplu olarak Şekil 5’de verilmiştir. Şekil 5’de 1 enerji kesintisini, 2 dengeli gerilim düşümünü, 3 dengesiz gerilim düşümü, 4 yine farklı genlik değerlerine sahip dengesiz gerilim düşümü, 5’te ise dengeli bir gerilim yükselmesi olayına karşı kaynak gerilimi, DVR gerilimi ve yük üzerinde düzenlenmiş gerilimlerinin sonuçları gösterilmiştir. Sonuçlara bakıldığında sistem üzerinde tüm hata durumlarına karşı önerilen DVR ile gerilim değişimleri başarılı bir şekilde telafi edilmiştir. Alçak gerilim şebekesinde yaşanan 5 farklı durum bazlı çalışmanın benzetim sonuçları tartışılmıştır.



Şekil 5. Alçak gerilim şebekesinde yaşanan gerilim olaylarının benzetimi a) kaynak gerilimi b) DVR telafi gerilim c) yük gerilimi.

Durum 1: Bu olay şebekede yaşanan 100ms süreli bir kesintiye karşılık gelmektedir. Kesinti durumunda kaynak gerilimi 0 V'tur. DVR kaynak gerilimi 0.1-0.9 pu değeri arasında telafi gerilimi oluşturacak şekilde tasarlanmıştır. Dolayısıyla bu durumda DVR aktif olmayıp yük tarafına herhangi bir telafi gerilimi aktarmamıştır. Kesinti 100 ms sonra sonlanmış ve şebeke yeniden nominal değerine ulaşmıştır.

Durum 2: Şebekede 150 ms süreli, 0.55 pu'lık orana sahip üç faz dengeli bir gerilim düşümü olayı yaşanmıştır. Bu durumda sistem gerilimi 220 V'a düşmüştür. Gerilimin nominal değere ulaştırılması için gerekli telafi gerilim değeri 180V'tur. DVR gerilim düşümünü algılayarak aktif hale gelmiş ve gerekli telafi gerilimini yüke sağlamıştır. Şebekede yaşanan gerilim düşümü sona erdiğinde DVR bekleme moduna geçmiştir.

Durum 3: Şebekede 300 ms süreyle dengesiz bir gerilim düşümü yaşanmış ve gerilim düşümü oranları A fazı için 0,61pu, B fazı için 0,67pu ve C fazı için 0.71pu'tir. Gerilimin nominal değere ulaştırılması için gerekli olan gerilim değeri A fazı için 157 V, B fazı için 130 V ve C fazı için 114V'tur. DVR tarafından her fazın gerilim düşümü ayrı ayrı olarak algılanarak ihtiyaç olan telafi gerilimi üretilmiştir. Böylelikle bu süre zarfında yük gerilimi nominal değere ulaştırılmıştır.

Durum 4: Şebekede 350 ms süreli durum 3'e benzer şekilde yine dengesiz bir gerilim düşümü yaşanmıştır. Bu gerilim düşümü olayı iki faz ve toprak hatası olayı sonrası gerçekleşmiş olup karakteristik değerleri farklıdır. Hata olayı, A fazında gerilim düşümüne, C fazında gerilim

yükselmesine neden olmuş B fazında ise her hangi bir gerilimin değişimi oluşmamıştır. Fazlar arası gerilim düşümü oranları A fazı için 0.88 pu, B fazı için 1 pu ve C fazı için 1.05 pu'tir. Gerilimin nominal değere ulaştırılması için gerekli olan gerilim değeri A fazı için 49 V, B fazı için 0 V ve C fazı için -21V'tur. DVR dengesiz bu gerilim düşümünü algılayarak A fazına telafi gerilim aktarırken, C fazında bir yük gibi çalışarak fazla olan gerilimi telafi etmiştir.

Durum 5: Bu olayda, şebekede 200 ms süreli 1,66 pu'luk üç fazlı dengeli bir gerilim yükselmesi yaşanmıştır. Gerilimin nominal değere ulaştırılması için gerekli olan telafi gerilim değeri 240V'tur. Yük tarafında gerekli olan nominal telafi gerilimi DVR tarafından oluşturulmuş ve yük tarafına aktarılmıştır. Şebekede yaşanan gerilim düşümü sona erdiğinde DVR bekleme durumuna geçmiştir.

Alçak gerilim şebekesinde yaşanan beş farklı gerilim olaylarına ait kaynak gerilimi, gerilim olaylarının karakteristik değerleri ve telafi gerilimi sonuçları Çizelge 2'de özetlenmiştir.

Çizelge 2. Alçak gerilim şebekesinde yaşanan gerilim olaylarına ait karakteristik değerler ve benzetim sonuçları.

Olay Durumu	Tanım Faz Türü	Kaynak Gerilimi (V)	Gerilim Düşümü			Telafi Gerilimi (V)
			Sistem Gerilim Değeri (V)	Oranı	Süresi (ms)	
1	A	0	0	1pu	100	0
	B	0	0	1pu	100	0
	C	0	0	1pu	100	0
2	A	400	220	0.55pu	150	180
	B	400	220	0.55pu	150	180
	C	400	220	0.55pu	150	180
3	A	400	243	0.61pu	300	157
	B	400	270	0.67pu	300	130
	C	400	286	0.71pu	300	114
4	A	400	351	0.88pu	350	49
	B	400	400	1pu	350	0
	C	400	421	1.05pu	350	-21
5	A	400	640	1.6pu	200	-240
	B	400	640	1.6pu	200	-240
	C	400	640	1.6pu	200	-240

5. Sonuçlar

Bu makale çalışmasında, şebekede yaşanan gerilim değişim olaylarının düzenlenmesi için DVR tasarımı ve benzetimi gerçekleştirilmiştir. DVR'nin benzetimde, güç sisteminde arıza kayıtlarına geçen gerçek gerilim düşümü ve yükselme olaylarına yer verilmiştir. Dağıtım şebekesi alçak gerilim kısmında meydana gelen hatalar sonucu oluşan gerilim değişimlerine ilişkin şebekede yaşanan beş farklı durum olayını benzetimi yapılmıştır. Dağıtım şebekesi alçak gerilim kısmında meydana gelen; dengeli/dengesiz gerilim düşümü ve yükselmesi

durumların benzetim alıřmaları yapılarak incelenmiřtir. DVR'nin gerilim dūřümü ve yükselmesi durumunda etkin, verimli ve dinamik bir gü cihazı olduėu simülasyon sonuçlarından görölmektedir. Sonuç olarak tasarlanan DVR sistemdeki dengeli ve dengesiz gerilim deėiřim olaylarını düzenleme kabiliyetine sahiptir. Elde edilen benzetim sonuçları göstermektedir ki DVR'in gerilim telafisi yaparak yükü korumakta ve yük gerilimini nominal seviyede tutmaktadır.

Kaynaklar

- Abhijee, S. and Kumar, P. 2014. Enhancement of Power Quality Problem by Using Dynamic Voltage Restorer. *International Journal of Innovative Research in Advanced Engineering*. 1: 400-407.
- Ağalar, S. and Kaplan, Y. A. (2017). Power quality improvement using STS and DVR in wind energy system. *Renewable Energy and International Journal*. 118: 1031-1040.
- Boonchiam, P. Mitholanathan, N. (2006). Understanding of dynamic voltage restorers through MATLAB simulation. *Thammasat Int. J. Sci. Technol.* 11: 1–6.
- Brito, M.E.C., Limongi, L.R., Cavalcanti, M.C., Neves, F.A.S., Azevedo, G.M.S. (2014). A step-dynamic voltage regulator based on cascaded reduced-power series transformers. *Electric Power Systems Research*, 108: 245-253. Doi: 10.1016/j.epsr.2013.11.024.
- Brumsickle, W. E., Schneider, R. S., Luckjiff, G. A., Divan, D. M., and McGranaghan, M. F. (2001). Dynamic sag correctors: cost-effective industrial power line conditioning. *IEEE Transactions on Industry Applications*, 37(1): 212-217.
- Chandrasekaran, K., and Ramachandramurthy V. (2016). An Improved Dynamic Voltage Restorer for Power Quality Improvement. *Electrical Power and Energy Systems*, 82: 354-362.
- Damaraju, R., and Lalitha, S. V. N. L. 2015. A Fuzzy Controller for Compensation of Voltage Sag/Swell Problems using Reduced Rating Dynamic Voltage Restorer. *Indian Journal of Science and Technology*, 8 (23): 1-6. Doi: 10.17485/ijst/2015/v8i23/71858
- Ghosh, A., Jindal, A. K., and Joshi, A. 2004. Design of a capacitor-supported dynamic voltage restorer (DVR) for unbalanced and distorted loads. *IEEE Trans. Power Del.*, 19: 405-413.
- İnci, M., Bayındır, K. Ç., Tümay, M. 2016. Improved Synchronous Reference Frame based controller method for multifunctional compensation. *Electric Power Systems Research*, 141: 500-509. Doi: 10.1016/j.epsr.2016.08.033.
- Kassarwani, N., Ohri J., and Singh, A. 2018. Design and performance of dynamic voltage restorer using genetic algorithm. *International Journal of Electronics*, 105 (1): 88-103. Doi: 10.1080/00207217.2017.1347828
- Moghassemi, A.; Padmanaban, S. 2020. Dynamic Voltage Restorer (DVR): A Comprehensive Review of Topologies, Power Converters, Control Methods, and Modified Configurations”, *Energies*, 13: 4152. Doi:10.3390/en13164152.
- Özdemir, Ö. 2020. Güç Sistemlerinde Dinamik Voltaj Regülatörlerin Kullanılması. Yüksek Lisans Tezi, Pamukkale Üniversitesi Fen Bilimleri Enstitüsü, Elektrik-Elektronik Mühendisliği Anabilim Dalı, Denizli.
- Pal, R., Gupta, S. 2020. Topologies and Control Strategies Implicated in Dynamic Voltage Restorer (DVR) for Power Quality Improvement. *Iran J Sci Technol Trans Electr Eng*, 44: 581–603. Doi:10.1007/s40998-019-00287-3.
- Remya, V. K., Parthiban, P., Ansal, V., and Chitti Babu, B. 2018. Dynamic Voltage Restorer (DVR) – A Review”. *Journal of Green Engineering*, 8(4): 519-572. Doi: 10.13052/jge1904-4720.844
- Sadigh, A. K., Dargahi, V., and Corzine, K. 2016. New configuration of dynamic voltage restorer for medium voltage application. *IEEE. Conf. Applied Power Electronics Conference and Exposition, California, USA*, 2187–2193.

- Soomro A. H., Larik, A. S., Mahar, M. A., Sahito, A. A., Soomro, A. M., Kaloi, G. S. 2021. Dynamic Voltage Restorer—A comprehensive review. *Energy Reports*, 7:6786-6805. Doi: 10.1016/j.egy.2021.09.004.
- Taiwo, O. P., Tiako R., and Davidson, I. E. 2018). Voltage Unbalance Mitigation and Voltage Profile Enhancement in Secondary Distribution System Using Dynamic Voltage Restorer. *International Journal of Engineering Research in Africa*, 34: 81-101.
- Vasudevan, L.P., and Prasad, V. 2017. Performance enhancement of a dynamic voltage restorer”, *Turkish Journal of Electrical Engineering & Computer Sciences*, 25: 2293-2307.

**ÖRGÜTSEL ADALETİN İŞ TATMİNİ VE PERFORMANS ÜZERİNDEKİ ETKİSİ:
5 YILDIZLI OTEL ÇALIŞANLARI ÜZERİNE BİR UYGULAMA**

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ÖZET

Konaklama işletmeleri içerisinde önemli bir yere sahip olan oteller, nitelikli insan gücüne ihtiyaç duyan işletmelerdir. Bu kapsamda işletmeler, nitelikli çalışanların işe alınmasının yanı sıra mevcut çalışanların işletme ile olan ilişkisinin sürekliliğine de eğilim göstermek durumundadırlar. Otel işletmelerinde iş tatmini ve performans üzerinde etkili olan unsurların incelenmesi insan kaynakları stratejileri geliştirilmesinde işletmelere önemli ipuçları sunacaktır. Örgütsel adaletin, örgütsel değişkenler üzerindeki etkisine yönelik literatürde araştırmalar yer almaktadır. Özellikle rekabetin yoğun olduğu sektörlerde örgütsel adalet araştırmalarının sayıca artırılması yararlı olacaktır. Araştırma, örgütsel adaletin iş tatmini ve öz değerlendirme performansı üzerindeki etkisine odaklanmaktadır. Araştırmada performans ölçümü, çalışanların öz değerlendirmelerine bağlı olarak ölçülerek bağımsız bir ölçüm geliştirilmek istenmiştir. Araştırmanın evrenini Antalya'daki beş yıldızlı otel işletmelerinin çalışanları oluşturmaktadır. İşletmelerin seçiminde kolayda örneklem yöntemi kullanılmıştır. Araştırmada önerilen model doğrultusunda belirlenen hipotezler test edilmiştir. Araştırmanın örneklem sayısı 389 anket formunda yer alan verilerden yola çıkarak değerlendirilmiştir. Önerilen yapısal modeli test etmek için Smart PLS kullanılmıştır. Yol analizi sonuçları incelendiğinde, örgütsel adaletin iş tatmini ve öz değerlendirme performansı üzerinde anlamlı pozitif etkisi olduğu sonucuna ulaşılmıştır (H₁ ve H₂). Araştırmada ayrıca örgütsel adaletin dağıtım, etkileşim ve prosedür adaleti boyutlarının hem iş tatmini (H1a, H1b, H1c) hem de öz değerlendirme performansı (H2a, H2b, H2c) üzerinde anlamlı pozitif etkisi olduğu sonuçlarına ulaşılmıştır. Araştırma sonuçları ile otel işletmelerine birtakım öneriler sunulmaya çalışılmıştır.

Anahtar Kelimeler: Örgütsel adalet, iş tatmini, performans.

THE EFFECT OF ORGANIZATIONAL JUSTICE ON JOB SATISFACTION AND PERFORMANCE: AN APPLICATION ON 5-STAR HOTEL EMPLOYEES

ABSTRACT

Hotels, which have an important place in accommodation businesses, are businesses that need qualified manpower. In this context, businesses have to tend to the continuity of the relationship of existing employees with the business, as well as hiring qualified employees. Examining the factors that affect job satisfaction and performance on hotel businesses will provide important clues to businesses in developing human resources strategies. There are researches in the literature on the effect of organizational justice on organizational variables. It would be beneficial to increase the number of organizational justice researches, especially in sectors where competition is intense. The research focuses on the effect of organizational justice on job satisfaction and self-assessed performance. In the research, it was desired to develop an independent measurement by measuring the performance measurement depending on the self-evaluation of the employees. The population of the research consists of the employees of the five-star hotel businesses in Antalya. Convenience sampling method was used in the selection of the enterprises. The hypotheses, determined in line with the model proposed in the research, were tested. The sample number of the study was evaluated based on the data in the questionnaire form of 389. Smart PLS was used to test the proposed structural model. When the path analysis results were examined, it was concluded that organizational justice had a significant positive effect on job satisfaction and self-assessed performance (H1 and H2). In the research, it was also concluded that the distributive, interactional and procedural justice dimensions of organizational justice had significant positive effect on both job satisfaction (H1a, H1b, H1c) and self-assessed performance (H2a, H2b, H2c). With the results of the research, some suggestions were tried to be presented to the hotel businesses.

Keywords: Organizational justice, job satisfaction, performance.

1. GİRİŞ

Bir çalışan ile görev yaptığı işletme arasındaki ilişkinin temelinde karşılıklı fayda sağlamak amacı vardır. Buna göre bir çalışan işletmesinden kendileri için değer yaratacak faaliyet ve düzenlemeler arzularken işletmeler, çalışanlarından işletmeyi amaçlarına ulaştıracak güçlü bir performans beklentisi içerisindedirler. Günümüzde birçok işletme, amaçlarına ulaşmak adına, çalışan performansının, tatminin ve adanmışlığın önemini kabul etmektedirler (Shmailan, 2015). Ayrıca literatürdeki araştırmalar, iş tatmini ile performans arasındaki ilişkiyi ortaya koymaktadır (Ziegler vd., 2012; Bakotić, 2016). İş tatmini, bir çalışanın beklentilerine uygun çalışma koşullarının yanı sıra değer ve eşitlik değerlendirmelerini de kapsamaktadır (Liu vd., 2016). Diğer ifadeyle iş tatmini, çalışma ortamındaki doğru ve adil uygulamalara yönelik değerlendirmeleri de içeren geniş bir konseptte dayanmaktadır. Literatürde örgütsel adalet-iş tatmini (Clay-Warner vd., 2005; Al-Zu'bi, 2010; Ghnan vd., 2019) ve örgütsel adalet-performans (Wang vd., 2010; Conlon vd., 2013; Yu vd., 2020) arasındaki ilişkilere yönelik araştırmalar yer almaktadır. Bu araştırmaların artırılması önemlidir. Zira örgütsel araştırmaların (örgütlerin kültür, çalışma prensipleri, yönetim anlayışı, kamu-özel statüleri, sektör özellikleri gibi birçok açıdan birbirlerinden farklı olmaları nedeniyle) farklı sektör ve kültürlerde araştırılması ve sonuçların öncül çalışmalarla karşılaştırılması hem uygulayıcılara hem de araştırmacılara önemli bilgiler sağlayacaktır. Ayrıca çalışanların iş tatmini ve performanslarının rekabetin yoğun olduğu sektörlerde daha fazla incelenmesi ve sonuçlarının ortaya konulması önem taşımaktadır.

Bu doğrultuda araştırma, örgütsel adaletin iş tatmini ve performans üzerindeki etkisine odaklanmaktadır. Araştırmada, örgütsel adalet, literatürle uyumlu olarak, dağıtım, prosedür ve etkileşim boyutlarıyla ele alınmıştır. Performansın ölçümünde ise çalışanların kendilerini değerlendirmesine dayanan öz değerlendirme yöntemi kullanılmıştır. Araştırma sonuçlarının başta otel işletmeleri olmak üzere hizmet sektöründe yer alan işletmelere önemli katkılar sağlayacağı düşünülmektedir.

2. KAVRAMSAL ÇERÇEVE

2.1. Örgütsel Adalet

Örgütsel adalet, bireyin içerisinde yer aldığı örgütüne ilişkin adalet algılarını yansıtmaktadır (Greenberg, 1996; Hoy ve Tarter, 2004: 250; Colquitt vd., 2013: 4). Örgütsel adalet, bir çalışanın, yönetim kararlarının ve uygulamalarının ne derece adil olduğuna ilişkin algılarına atıfta bulunur. Bu algılar, çalışanların yönetime karşı tutumları üzerinde etkili olabilmektedir (Yean ve Yusof, 2016: 798-799). Örgütsel adalet ayrıca güven, bağlılık, iş performansı ve

müşteri tatmininin artması, daha yardımsever vatandaşlık davranışları sergilenmesi ve örgütsel çatışmanın azaltılması gibi örgütler ve çalışanlar açısından potansiyel faydalar oluşturabilir (Cropanzano vd., 2007). Literatürde örgütsel adaletin yaygın olarak dağıtım, prosedür ve etkileşim adaleti olmak üzere üç boyutta incelendiği görülmektedir (Colquitt ve Greenberg, 2003; Jafari ve Bidarian, 2012). Buna göre dağıtım adaleti, bir çalışanın örgütünden elde ettiği sonuçların algılanan adaletini yansıtmaktadır (Al-Zu'bi, 2010: 103). Diğer ifadeyle bir çalışan, işyerinden “elde ettikleri” ile “verdiklerinin” adillğini kıyaslamaya başvurur ve bu kıyaslama sonuca ilişkin beklenti değerlendirmesine dayanır. Buna göre dağıtım adaleti esasen mübadele prensibine dayanmaktadır (Lambert, 2003: 156-157). Prosedür adaleti ise sonuçları belirlemek için kullanılan prosedürlerin adillğinin sorgulanmasına dayanmaktadır. Bir çalışan, prosedürlerin işleyişine ilişkin sahip olduğu inançlar doğrultusunda adalet değerlendirmesi yapmaktadır (Karriker ve Williams, 2009: 114). Prosedür adaletinde çalışan, kararların ve sonucu belirlemek için kullanılan süreç ve araçların doğruluğuna ve adillğine odaklanır (Fernandes ve Awamleh, 2006: 703). Dağıtım adaleti, sonucun kendisinin algılanan adaletini yansıtırken, prosedür adaleti, sonucu belirlemek için kullanılan araç ve prosedürlerin algılanan adaletine dayanmaktadır (Viswesvaran ve Ones, 2002: 193). Son olarak etkileşim adaleti, kişilerarası ilişki süreçlerinin kalitesine, kuruluşun bireylere yönelik davranışlarına ve sonucun arkasındaki nedenlerin ne ölçüde açıklandığına yönelik algıları yansıtmaktadır (Bies and Moag, 1986, Ghosh vd., 2014).

2.2. İş Tatmini

Bir çalışanın işinden tatmin ya da tatminsizlik yaşaması muhtemeldir. İş tatmini, çalışanın beklentileri ile elde ettiği sonuçların karşılaştırmasına dayanmaktadır. Bu karşılaştırma neticesinde çalışanın olumlu duygulara sahip olması iş tatminini yansıtmaktadır (Jalagat, 2016: 37). İş tatmini, bir çalışanın işine yönelik duygusal değerlendirmelerini içermektedir (Zhu, 2013: 294). İş tatmini ayrıca bir çalışanın iş deneyimlerindeki değer ve eşitliğe ilişkin değerlendirmelerini ve bunun sonucunda beklentilerini karşılayan çalışma koşullarına ilişkin olumlu duygusal tepkilerini yansıtmaktadır (Liu vd., 2016: 87). Abou Elnaga ve Imran (2014), işyerinde iş tatmini ve yüksek düzeyde verimlilik açısından çalışanların güçlendirilmesi yoluyla özgüvenlerinin ve güven seviyelerinin artırılması gerektiğini ifade etmişlerdir. Koustelios (2001), çalışanların iş tatminini daha iyi açıklayabilmek için bireysel faktörlerin yanı sıra örgütsel değişkenlerin etkilerinin dikkate alınması gerektiğine işaret etmiştir. Weiss (2002: 173) iş tatmininin, işin değerlendirilmesi, işe yönelik inançlar ve işe yönelik duygusal deneyimler olmak üzere birbirleriyle ilişkili ancak birbirlerinden farklı üç temel yapıyla

açıklanabileceğini savunmaktadır. İş tatmini, bireyin gelecekte elde edilmesi veya kaçınılması gereken olumlu ve olumsuz sonuçların etkileyciliğiyle ilişkili anlayışa atıfta bulunabilir. Ayrıca bir çalışanın iş tatmini veya tam tersi tatminsizlik yaşamaları işletme içerisinde bazı etkiler ortaya çıkarabilir. Örneğin devamsızlık, şikayet, sağlık sorunları ve işten ayrılma niyeti genellikle tatminsizlikle ilişkilendirilmektedir (Schmidt, 2007: 483).

2.3. Öz değerlendirme Performansı

Performans, örgütlerin amaçlarına ulaşmak adına minimum kaynak kullanımı ile hedefe ulaşmalarını ifade etmektedir (Ghalem vd., 2016). Hedeflere ne ölçüde ulaşıldığı ise performansın ölçümüne bağlıdır. Literatürde performans ölçümüne yönelik araştırmaların bir kısmında öz değerlendirme performans ölçüm yönteminin incelendiği görülmektedir (Truxillo vd., 2008; Engelberg vd., 2011; Kifor vd., 2022). Öz değerlendirme, kişinin kendisine yönelik algılarını yansıtmaktadır. Örneğin, kişi yetenekli olduğuna ilişkin bir algıya sahipse bunu kendi iç dünyasında raporlayacaktır (Lorini vd., 2020). Öz değerlendirmede kişiler beklentileri ile performanslarını karşılaştırarak görevdeki ilerlemeleri konusunda içsel değerlendirmeler yapmaktadırlar (Andrade ve Valtcheva, 2009: 14). Panadero vd. (2019: 152), performans üzerine düşünme eyleminin sonraki performans üzerinde olumlu etkiler oluşturmasının muhtemel olduğunu bu durumun kişinin kendisini değerlendirmesinin kendi performansı üzerine düşünmesinden ve kendisine verdiği skorları zihninde bir puanlama tablosuna yerleştirmesinden kaynaklandığını belirtmişlerdir. Öz-değerlendirme, davranışın içsel gözlemlenmesi, değerlendirilmesi ve tepki verilmesi sürecidir. Bu yöntem, performansın sadece ölçülmesiyle sınırlı olmayıp, bununla birlikte performansın yorumlanmasını da içermektedir (Bose vd., 2001).

3. KURAMSAL ÇERÇEVE

Al-Zu'bi (2010), çok sayıdaki elektrik sanayi şirketinin 229 çalışanı ile gerçekleştirdikleri araştırmada, örgütsel adalet ile iş tatmini arasında pozitif bir ilişki olduğu sonucuna ulaşmış ve ayrıca örgütsel adaletin iş tatmininin önemli bir belirleyicisi olduğu değerlendirmesini yapmıştır. Fernandes ve Awamleh (2006), örgütsel adalet boyutlarının iş tatmini ve öz değerlendirme performansı üzerindeki etkilerini incelemişlerdir. Araştırmaya Birleşik Arap Emirlikleri vatandaşları ile yabancı çalışanlar katılmış, değişkenler arasındaki etkiler her iki katılımcı grubu için ayrı ayrı raporlaştırılmıştır. Araştırmada, Birleşik Arap Emirlikleri vatandaşları için, dağıtım ve etkileşim adaletinin iş tatminini anlamlı olarak etkilediği, prosedür adaleti ile iş tatmini arasında ise anlamlı ilişkiye rastlanılmadığı sonucu elde edilmiştir. Araştırmada ayrıca yabancı çalışanlar için örgütsel adaletin her üç boyutunun iş

tatmini üzerinde anlamlı etkilere sahip olduğu sonuçları paylaşılmıştır. Sia ve Tan (2016), Metropolitan Cebu/Filipinler’de dokuz otelin 13 farklı departmanından toplanan verilere dayanarak, örgütsel adaletin dağıtım ve etkileşim adaleti boyutlarının çalışanların iş tatminini pozitif yönde etkilediğini, prosedür adaletinin ise iş tatmini üzerinde anlamlı bir etkiye sahip olmadığını ifade etmişlerdir.

Buna göre aşağıdaki hipotezler geliştirilmiştir.

H1: Örgütsel adaletin iş tatmini üzerinde anlamlı pozitif etkisi bulunmaktadır.

H1a: Örgütsel adaletin dağıtım adaleti boyutunun iş tatmini üzerinde anlamlı pozitif etkisi bulunmaktadır.

H1b: Örgütsel adaletin etkileşim adaleti boyutunun iş tatmini üzerinde anlamlı pozitif etkisi bulunmaktadır.

H1c: Örgütsel adaletin prosedür adaleti boyutunun iş tatmini üzerinde anlamlı pozitif etkisi bulunmaktadır.

Elamin ve Alomaim (2011), Suudi Arabistan vatandaşları ile yabancı işçilerin örgütsel adalet algılarının iş tatmini ve performans (kişisel algılanan performans) üzerindeki etkilerini farklı kuruluşlarda Suudi vatandaşı olan ve olmayan 793 çalışandan topladıkları verilere göre incelemişlerdir. Araştırmada performansa ilişkin sonuçlar incelendiğinde, Suudi çalışanlar için örgütsel adaletin hiçbir boyutunun kişisel algılanan performansla bir ilişki göstermediği, buna karşılık yabancı çalışanlar için tüm örgütsel adalet boyutlarının kişisel algılanan performansını anlamlı şekilde etkilediği sonuçları paylaşılmıştır. Fernandes ve Awamleh (2006), Birleşik Arap Emirlikleri vatandaşları için, dağıtım ve etkileşim adaletinin öz değerlendirme iş performansı üzerinde anlamlı etkiye sahip olduğu buna karşılık prosedür adaletinin öz değerlendirme iş performansı ile anlamlı bir ilişki göstermediği sonuçlarını paylaşmışlardır. Araştırmada yabancılar için örgütsel adaletin hiçbir boyutunun öz değerlendirme performansı üzerinde anlamlı bir etki ortaya çıkarmadığı sonuçları elde edilmiştir.

Buna göre aşağıdaki hipotezler geliştirilmiştir.

H2: Örgütsel adaletin öz değerlendirme performansı üzerinde anlamlı pozitif etkisi bulunmaktadır.

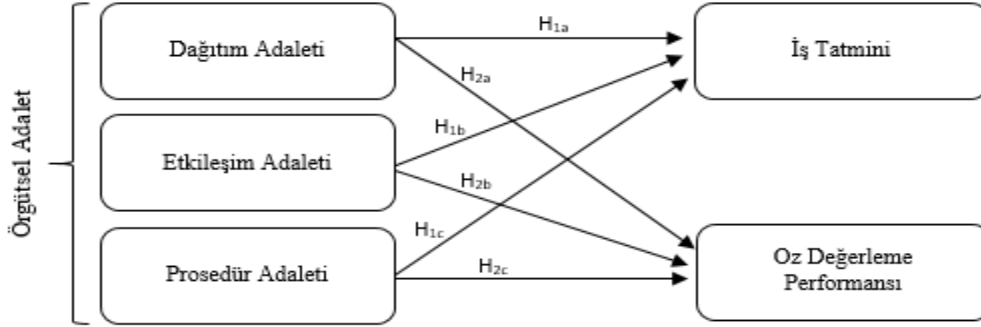
H2a: Örgütsel adaletin dağıtım adaleti boyutunun öz değerlendirme performansı üzerinde anlamlı pozitif etkisi bulunmaktadır.

H2b: Örgütsel adaletin etkileşim adaleti boyutunun öz değerlendirme performansı üzerinde anlamlı pozitif etkisi bulunmaktadır.

H2c: Örgütsel adaletin prosedür adaleti boyutunun öz değerlendirme performansı üzerinde anlamlı pozitif etkisi bulunmaktadır.

4. YÖNTEM

Çalışma örgütsel adalet ve boyutlarının (dağıtım, etkileşim, prosedür) iş tatmini ve öz değerlendirme performansı üzerindeki etkilerini ölçmek amacıyla gerçekleştirilmiştir. Araştırmanın evrenini Antalya'daki beş yıldızlı otel işletmelerinin çalışanları oluşturmaktadır.



Şekil 1: Araştırma Model Önerisi

Araştırmada, verilerin toplanması anket tekniği kullanılarak gerçekleştirilmiştir. Araştırmada veri toplamak için Antalya'da yer alan beş yıldızlı otel işletmelerinin çalışanları seçilmiştir. Bu işletmelerin seçilmesinde kolayda örneklem yöntemi kullanılmış ve çalışmaya katılmak için gerekli izinler alınmıştır. Verilerin toplanması için araştırmanın detayları çalışanlara anlatılmış ve tüm soruların yanıtlanması sağlanmıştır. Anketler yüz yüze gerçekleştirilmiştir. Hair vd. (2018) gözlemlenen her ifade için en az 5 katılımcıya sahip olunması gerektiğini belirtmişlerdir. Bu nedenle 31 ifadeden oluşan 5 yapı için gereksinimi karşılayan bir örneklem büyüklüğünü hedeflenmiş ve örneklem sayısı 400 anket formunda yer alan verilerden yola çıkarak değerlendirilmiştir. Eksik ve hatalı veriler neticesinde 11 anket değerlendirmeden çıkartılmış ve çalışmada 389 anket analize tabi tutulmuştur. Çalışma kapsamında veriler, modelde belirlenen örgütsel adalet ve boyutları (dağıtım, etkileşim, prosedür) iş tatmini, öz değerlendirme performansı ve demografik soruları kapsayan bir anketle oluşturulmuştur.

	Kategoriler	n	%
Cinsiyet	Kadın	182	46.8
	Erkek	207	53.2
Yaş	18-24	131	33.7
	25-34	173	44.5
	35-44	68	17.5
	45-54	17	4.4
Eğitim	İlköğretim	17	4.4
	Lise	79	20.3
	Ön lisans	159	40.9
	Lisans	125	32.1
	Lisansüstü	9	2.3
Gelir Algısı	Çok Düşük	143	36.8
	Düşük	127	32.6
	Orta	107	27.5
	Yüksek	8	2.1
	Çok Yüksek	4	1.0

Katılımcıların %46,8'i kadın (n: 182), %53,2'si erkektir (n: 207). Katılımcıların yaş aralığının %44,5'i (n: 173) 25-34 aralığındadır. Çalışanların %40,9'u (n: 159) ön lisans mezunudur. Katılımcıların gelir algılarına bakıldığında, %36,8'i (n: 143) kendisinin çok düşük düzeyde gelire sahip olduğunu belirtmiştir.

4.1. Ölçekler

Anket ifadeleri daha önceki araştırmalarda doğrulanmış ve güvenilir olduğu gösterilen çok maddeli ölçümlerden oluşturulmuştur. Dağıtım, etkileşim ve prosedür adaleti, Niehoff ve Moorman (1993) tarafından geliştirilen ölçekler kullanılarak ölçülmüştür. Dağıtım adaleti boyutu 5 ifadeden oluşmaktadır. Prosedür adaleti boyutu benzer şekilde 5 ifadeden oluşmaktadır. Örgütsel adaletin son boyutu olan etkileşim adaleti ise 9 ifadeden oluşmaktadır. Bağımlı değişkenleri ölçmek için iki değişken benimsemiştir. Bu değişkenler Fernandes ve Awamleh (2006) tarafından geliştirilmiş ve doğrulanmıştır. İş tatmini, örgütsel davranış araştırmalarında kullanılan alanları kapsayan 7 ifadelik bir ölçekle değerlendirilmiştir. Öz değerlendirme performans ölçeği ise 5 ifadeden oluşmaktadır. Bu ölçeklerin tamamı bir ankete dahil edilmiştir. İfadelerin tamamında beşli likert tipi ölçek kullanılmıştır.

4.2. Veri Analizi

Araştırmanın veri analizi için SmartPLS4 istatistik analizi kullanılmıştır. PLS ölçüm modeli değerlendirilirken iç tutarlılık güvenilirliği, yakınsak geçerlilik ve ayırt edici geçerlilik analizleri kullanılmıştır (Çavuşoğlu, 2021a). İç tutarlılık güvenilirlik analizi için Cronbach Alpha (α), bileşik güvenilirlik (rho_c ve rho_a) kullanılmıştır. Yakınsaklık geçerliliği için faktör yükleri (λ), Ortalama açıklanan varyans (AVE), diskriminant (ayrım) geçerliliği için Fornell-Larcker Kriteri kullanılmıştır. Yapısal model değerlendirilirken InnerVIF ve yol analizi yapılmıştır (Çavuşoğlu, 2021b).

4.3. Ölçüm Modeli Sonuçları

Modelde yer alan ölçümlerin α , rho_c ve rho_a değerlerinin 0,70'in üzerinde olduğu (Hair vd., 2019) ve modelin iç tutarlılık ve güvenilirliğe sahip olduğu görülmüştür.

Tablo 1: Güvenirlik ve Geçerlik

<i>Ölçekler</i>	λ	<i>t-</i> <i>statistics</i>	rho_c	rho_a	AVE
Dağıtım Adaleti($\alpha=0.87$)					
1 DA1	0.817	25.469	0.88	0.88	0.64
2 DA2	0.784	23.587			
3 DA3	0.832	22.144			
4 DA4	0.816	24.112			
5 DA5	0.808	30.084			
Prosedür Adaleti($\alpha=0.88$)					
1 PA1	0.818	28.578	0.89	0.89	0.67
2 PA2	0.801	25.168			
3 PA3	0.838	32.368			
4 PA4	0.846	30.147			
5 PA5	0.840	32.367			
Etkileşim Adaleti ($\alpha=0.87$)					
1 EA1	0.798	23.912	0.86	0.86	0.61
2 EA2	0.771	19.697			
3 EA3	0.803	20.168			
4 EA4	0.816	22.183			
5 EA5	0.806	21.641			
6 EA6	0.809	25.239			
7 EA7	0.811	24.274			
8 EA8	0.798	23.498			
9 EA9	0.821	23.867			
İş Tatmini ($\alpha=0.83$)					
1 İST1	0.783	24.204	0.81	0.82	0.58
2 İST2	0.748	19.963			
3 İST3	0.810	22.470			
4 İST4	0.847	30.870			
5 İST5	0.832	31.521			
6 İST6	0.796	30.498			
7 İST7	0.791	29.988			
Öz Değerleme Performansı ($\alpha=0.90$)					
1 ÖDP1	0.861	32.217	0.90	0.90	0.65
2 ÖDP2	0.873	32.037			
3 ÖDP3	0.789	24.721			
4 ÖDP4	0.827	31.146			
5 ÖDP5	0.802	29.966			

NFI=0,88; SRMR=0,036; $\chi^2=1336.108$

Yakınsak geçerliliği belirlemek için AVE değerleri hesaplanmıştır. AVE değerleri (Hair vd. 2019) 0,50'nin üzerindedir. Böylece araştırma modeli yakınsak geçerliliğe sahiptir. Ayrıca maddelerin faktör yükleri 0.50'nin üzerindedir (Kaiser, 1974). Böylece, araştırma modeli yapı geçerliliğine sahiptir (bkz. Tablo 1).

Ayrt edici geçerliliği değerlendirmek için temel bir kural olarak, Fornell ve Larcker (1981), 0,50 veya daha fazla puanla AVE'nin kullanılmasını önermiştir. Yeterli ayrt edici geçerliliği elde etmek için, AVE'nin karekökü, gizli yapılar arasındaki korelasyonlardan daha büyük olmalıdır (Fornell ve Larcker, 1981). Tablo 2'de, yapılar arasındaki korelasyonlar, çıkarılan ortalama varyansların karekökü ile karşılaştırılmıştır (değerler kalın harflerle yazılmıştır). SmartPLS'den elde edilen sonuç, çıkarılan ortalama varyansların karekökünün, gizli yapılar

arasındaki korelasyonlardan daha büyük olduğunu ve bu da yeterli ayırt edici geçerliliği olduğunu göstermektedir (Garson, 2016).

Tablo 2: Ayrışma Geçerliliği (Fornell-Larcker)

Değişkenler	1	2	3	4	5
Dağıtım Adaleti	0,800				
Prosedür Adaleti	0,612	0,818			
Etkileşim Adaleti	0,587	0,623	0,781		
İş Tatmini	0,593	0,608	0,547	0,761	
Öz Değerleme Performansı	0,542	0,621	0,598	0,608	0,806

4.4. Yapısal Model Sonuçları

Araştırma modelinde yer alan iki veya daha fazla gizil değişkenin çoklu bağlantı probleminde olmadığını ve varyansı artırmadığını belirlemek için InnerVIF değerleri incelenmiştir. InnerVIF 5'ten düşük çıkmıştır ve çoklu bağlantı sorunu bulunmadığı tespit edilmiştir (Smith vd., 2020) (bkz. Tablo 3). Hipotezler yapısal eşitlik modellemesi ile analiz edilmiştir.

Tablo 3: Yapısal Eşitlik Modeli Sonuçları

Hipotezler Model	β	S.S.	t-değeri	VIF	p-değeri
H ₁ Örgütsel Adalet>>>İş Tatmini	0,783	0,050	9,875	2.362	0,000***
H _{1a} Dağıtım Adaleti>>>İş Tatmini	0,439	0,035	5,810	3.123	0,000***
H _{1b} Etkileşim Adaleti>>> İş Tatmini	0,524	0,040	7,154	1.054	0,000***
H _{1c} Prosedür Adaleti>>> İş Tatmini	0,647	0,045	8,124	2.449	0,000***
H ₂ Örgütsel Adalet>>> Öz Değerleme Performansı	0,771	0,034	9,456	3.014	0,000***
H _{2a} Dağıtım Adaleti>>> Öz Değerleme Performansı	0,643	0,031	8,115	2.168	0,000***
H _{2b} Etkileşim Adaleti>>> Öz Değerleme Performansı	0,489	0,030	5,984	3.478	0,000***
H _{2c} Prosedür Adaleti>>> Öz Değerleme Performansı	0,578	0,042	7,269	2.235	0,000***

$p < 0.001$ ***, $p < 0.01$ ** , $p < 0.05$ *

Yol analizi sonuçları incelendiğinde, örgütsel adaletin iş tatmini ve öz değerlendirme performansı üzerinde anlamlı pozitif etkisi olduğu sonucuna ulaşılmıştır (H₁ ve H₂). Araştırmada ayrıca örgütsel adaletin dağıtım, etkileşim ve prosedür adaleti boyutlarının hem iş tatmini (H_{1a}, H_{1b}, H_{1c}) hem de öz değerlendirme performansı (H_{2a}, H_{2b}, H_{2c}) üzerinde anlamlı pozitif etkisi olduğu sonuçlarına ulaşılmıştır.

5. SONUÇ, TARTIŞMA ve ÖNERİLER

Araştırmada, örgütsel adaletin ve örgütsel adaletin dağıtım, prosedür ve etkileşim adaleti boyutlarının iş tatmini ve öz değerlendirme performansı üzerindeki etkileri incelenmiştir. Model önerisi doğrultusunda oluşturulan hipotezler yapısal eşitlik modellemesi ile analiz edilmiştir. Araştırmada örgütsel adaletin ve örgütsel adaletin dağıtım, prosedür ve etkileşim adaleti boyutlarının iş tatmini üzerinde anlamlı pozitif etkiye sahip olduğu sonuçlarına ulaşılmıştır. Elde edilen sonuçlar literatürle kısmen tutarlılık içermektedir (Fernandes ve Awamleh, 2006; Al-Zu'bi, 2010; Sia ve Tan, 2016). Sonuçlar ayrıca örgütsel adaletin iş tatmininin önemli bir belirleyicisi olduğunu ortaya koymaktadır. Buna göre bir çalışan, çalışma programının, iş

yükünün ve işle ilgili alınan kararların tüm çalışanlara adil ve tutarlı şekilde uygulandığına inandığında, alınan kararlara karşı itiraz hakkına sahip olduğunda ve işletmede alınan her türlü kararda çalışanın kişisel ihtiyaçlarına eğilim gösterildiğinde bu durum iş taminini olumlu yönde etkileyecektir.

Araştırmada, örgütsel adaletin ve üç boyutunun (dağıtım, prosedür ve etkileşim adaleti) öz değerlendirme performansı üzerinde anlamlı pozitif etkiye sahip olduğu sonuçları elde edilmiştir. Sonuçlar, literatürle kısmen tutarlılık içermektedir (Fernandes ve Awamleh, 2006; Elamin ve Alomaim, 2011). Buna göre bir çalışanın işyerinde örgütsel adalete ilişkin olumlu algılara sahip olması, kendi performans değerlemesi üzerinde olumlu bir etki ortaya çıkarmaktadır. Diğer ifadeyle örgütte çalışanlara saygılı davranıldığında, tüm kararlar çalışanlara açık ve net olarak aktarıldığında ve çalışan tarafından talep edilmesi durumunda onlara kararlar hakkında ilave bilgi paylaşıldığında, iş yükü, maaş ve çalışma programı konularında herkese adil davranıldığında bu durum çalışanın öz değerlendirme performansını olumlu yönde etkileyecektir. Araştırmada elde edilen sonuçlara bağlı olarak, otel işletme yöneticilerinin örgütsel adaletin sağlanması açısından duyarlı davranmaları yararlı olacaktır. Zira araştırmada örgütsel adalet ve örgütsel adaletin tüm boyutları hem iş tatmini hem de performansı üzerinde anlamlı bir etki ortaya çıkarmıştır. Bu kapsamda otel işletme yöneticilerine maaş, işyükü, fazla çalışma saatleri ve çalışma programlarının düzenlenmesinde herkese adil davranmaları, işe ilişkin kararlarda çalışanların fikirlerine önem vermeleri ve çalışanların alınacak kararlara dahil edilerek görüşlerinin alınması önerilmektedir. Bununla birlikte yöneticilere alınan ve uygulanan her türlü kararda tarafsız davranmaları, görev dağılımında şeffaf ve adil olmaları önerilmektedir. İşyerinde yetki ve sorumluluk denkliliğinin sağlanması, çalışan kaygılarının dikkate alınması ve onlara karşı nazik ve anlayışlı davranılması, işyerinde kararların tartışılabilmesi demokratik platformlar oluşturulması, her türlü kararın çalışan hakları gözetilerek uygulanması yararlı olacaktır. Yöneticilere son olarak çalışanların tatmin ve performanslarına odaklanmaları önerilmektedir. Bu kapsamda tatmin ve performansı olumsuz etkileyen bireysel ve örgütsel tüm faktörlerin araştırılması, tatminsizliğe neden olan ya da performansı olumsuz etkileyen unsurların tespit edilerek düzeltici önlemlere başvurulması yararlı olacaktır. Bu kapsamda yöneticilere etkili insan kaynakları stratejileri geliştirmeleri ve çalışan sorunlarına daha fazla eğilim göstermeleri önerilmektedir.

6. ARAŞTIRMANIN SINIRLILIKLARI VE GELECEK ARAŞTIRMALAR İÇİN ÖNERİLER

Arařtırma birtakım sınırlılıklar içermektedir. Arařtırmanın ilk sınırı arařtırmanın deęiřkenlerine iliřkindir. Arařtırmada iř tatmini ve performansın belirleyicisi olarak örgütsel adalete odaklanılmaktadır. Daha sonra yapılacak arařtırmalarda farklı deęiřkenlerin etkisinin incelenmesinin yararlı olacağına inanılmaktadır. Arařtırmada ayrıca performansın ölçümü, çalışanların öz deęerlendirmelerine baęlı olarak elde edilmiřtir. Daha sonra gerçekleştirilecek arařtırmalarda performans ölçümünün farklı bir ölçüm teknięi ile ölçülmesi yararlı olacaktır. Son olarak arařtırmanın farklı kültür, coęrafya ve sektörlerde gerçekleştirilmesinin arařtırma sonuçlarının karşılaştırılması açısından yararlı olacağına inanılmaktadır.

KAYNAKÇA

- Abou Elnaga, A. ve Imran, A. (2014). The impact of employee empowerment on job satisfaction theoretical study. *American Journal of Research Communication*, 2(1), 13-26.
- Al-Zu'bi, H. A. (2010). A study of relationship between organizational justice and job satisfaction. *International Journal of Business and Management*, 5(12), 102-109.
- Andrade, H. ve Valtcheva, A. (2009). Promoting learning and achievement through self-assessment. *Theory into practice*, 48(1), 12-19.
- Bakotić, D. (2016). Relationship between job satisfaction and organisational performance. *Economic research-Ekonomska istraživanja*, 29(1), 118-130.
- Bies, R.J. ve Moag, J.F. (1986). "Interactional justice: communication criteria of fairness", in Lewicki, R.J., Sheppard, B.H. and Bazerman, M.H. (Eds), *Research on Negotiation in Organizations*, JAI Press, Greenwich, CT, Vol. 1, pp. 43-55.
- Bose, S., Oliveras, E. ve Edson, W. N. (2001). How can self-assessment improve the quality of healthcare. *Operations research issue paper*, 2(4), 1-27.
- Clay-Warner, J., Reynolds, J. ve Roman, P. (2005). Organizational justice and job satisfaction: A test of Three Competing Models. *Social Justice Research*, 18(4), 391-409.
- Colquitt, J. A. ve Greenberg, J. (2003). Organizational justice: A fair assessment of the state of the literature. In J. Greenberg (Ed.), *Organizational behavior: The state of the science* (pp. 165–210). Lawrence Erlbaum Associates Publishers.
- Colquitt, J. A., Greenberg, J. ve Zapata-Phelan, C. P. (2013). What is organizational justice? A historical overview in *Handbook of Organizational Justice*.
- Conlon, D. E., Meyer, C. J. ve Nowakowski, J. M. (2013). How does organizational justice affect performance, withdrawal and counterproductive behavior?. In *Handbook of organizational justice* (pp. 301-327). Psychology Press.
- Cropanzano, R., Bowen, D. E. ve Gilliland, S. W. (2007). The management of organizational justice. *Academy of Management Perspectives*, 21(4), 34-48.
- Çavuşoğlu, S. (2021a). Yeşile boyama ve yeşil satın alma davranışı arasındaki ilişkide yeşil marka imajı ve yeşil marka sadakatinin aracılık rolü. *İşletme Araştırmaları Dergisi*, 13(3), 2146-2161.
- Çavuşoğlu, S. (2021b). Yeşil reklam ve yeşil marka farkındalığının yeşil müşteri tatmini üzerindeki etkisi: yeşil satın alma davranışının aracılık rolü. *Gaziantep University Journal of Social Sciences*, 20(3), 1355-1374.
- Elamin, A. M. ve Alomaim, N. (2011). Does organizational justice influence job satisfaction and self-perceived performance in Saudi Arabia work environment. *International Management Review*, 7(1), 38-49.
- Engelberg, T., Skinner, J. ve Zakus, D. H. (2011). Exploring the relationship between commitment, experience, and self-assessed performance in youth sport organizations. *Sport Management Review*, 14(2), 117-125.
- Fernandes, C. ve Awamleh, R. (2006). Impact of organisational justice in an expatriate work environment. *Management Research News*, 29(11), 701-712.
- Fornell, C. ve Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Garson, G. D. (2016). *Partial Least Squares: Regression & Structural Equation Models*. Politeness and Audience Response in Chinese-English Subtitling, Statistical Publishing Associate.

- Ghalem, Â., Chafik, Okar, C., Chroqui, R. ve El Alami, S. (2016). Performance: A concept to define! La performance: Un concept à définir!.
- Ghosh, P., Rai, A. ve Sinha, A. (2014). Organizational justice and employee engagement: Exploring the linkage in public sector banks in India. *Personnel Review*, 43(4), 628-652.
- Ghran, L. A. Z., Jameel, A. S. ve Ahmad, A. R. (2019). The effect of organizational justice on job satisfaction among secondary school teachers. *International Review*, 3(3-4), 82-90.
- Greenberg, J. (1996), *The Quest for Justice on the Job*, Sage, Thousand Oaks, CA.
- Hair, J.F., Black, W.C., Anderson, R.E. ve Babin, B.J. (2018). *Multivariate data analysis*, 8th ed., Cengage Learning EMEA, London.
- Hair, J.F., Risher, J.J., Sarstedt, M. ve Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24.
- Hoy, W. K. ve Tarter, C. J. (2004). Organizational justice in schools: No justice without trust. *International Journal of Educational Management*, 18(4), 250-259.
- Jafari, P. ve Bidarian, S. (2012). The relationship between organizational justice and organizational citizenship behavior. *Procedia-Social and Behavioral Sciences*, 47, 1815-1820.
- Jalagat, R. (2016). Job performance, job satisfaction, and motivation: A critical review of their relationship. *International Journal of Advances in Management and Economics*, 5(6), 36-42.
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36.
- Karriker, J. H. ve Williams, M. L. (2009). Organizational justice and organizational citizenship behavior: A mediated multifoci model. *Journal of Management*, 35(1), 112-135.
- Kifor, C. V., Săvescu, R. F. ve Dănuț, R. (2022). Work from home during the COVID-19 Pandemic—The impact on employees' self-assessed job performance. *International Journal of Environmental Research and Public Health*, 19(17), 10935.
- Koustelios, A. D. (2001). Personal characteristics and job satisfaction of Greek teachers. *International Journal of Educational Management*, 15(7), 354-358.
- Lambert, E. (2003). The impact of organizational justice on correctional staff. *Journal of Criminal Justice*, 31(2), 155-168.
- Liu, Y., Aunguroch, Y. ve Yunibhand, J. (2016). Job satisfaction in nursing: a concept analysis study. *International Nursing Review*, 63(1), 84-91.
- Lorini, C., Lastrucci, V., Paolini, D. ve Bonaccorsi, G. (2020). Measuring health literacy combining performance-based and self-assessed measures: The roles of age, educational level and financial resources in predicting health literacy skills. A cross-sectional study conducted in Florence (Italy). *BMJ open*, 10(10), e035987.
- Niehoff, B. P. ve Moorman, R. H. (1993). Justice as a mediator of the relationship between methods of monitoring and organizational citizenship behavior. *Academy of Management Journal*, 36(3), 527-556.
- Panadero, E., Lipnevich, A., Broadbent, J. (2019). Turning Self-Assessment into Self-Feedback. In: Henderson, M., Ajjawi, R., Boud, D., Molloy, E. (eds) *The Impact of Feedback in Higher Education*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-25112-3_9.
- Sia, L. A. ve Tan, T. A. G. (2016). The influence of organizational justice on job satisfaction in a hotel setting. *DLSU Business & Economics Review*, 26(1), 17-29.
- Schmidt, S. W. (2007). The Relationship Between Satisfaction with Workplace Training and Overall Job Satisfaction. *Human Resource Development Quarterly*, 18(4).481-498.

- Shmailan, A. S. B. (2015). The relationship between job satisfaction, job performance and employee engagement: An explorative study. *Issues in Business Management and Economics*, 4(1), 1-8.
- Smith, R. A., White-McNeil, A. ve Ali, F. (2020). Students' perceptions and behavior toward on-campus food service operations. *International Hospitality Review*, 34(1), 13-28.
- Truxillo, D. M., Seitz, R. ve Bauer, T. N. (2008). The role of cognitive ability in self-efficacy and self-assessed test performance. *Journal of Applied Social Psychology*, 38(4), 903-918.
- Viswesvaran, C. ve Ones, D. S. (2002). Examining the construct of organizational justice: A meta-analytic evaluation of relations with work attitudes and behaviors. *Journal of Business Ethics*, 38, 193-203.
- Wang, X., Liao, J., Xia, D. ve Chang, T. (2010). The impact of organizational justice on work performance: Mediating effects of organizational commitment and leader-member exchange. *International Journal of manpower*, 31(6), 660-677.
- Weiss, H. M. (2002). Deconstructing job satisfaction: Separating evaluations, beliefs and affective experiences. *Human Resource Management Review*, 12(2), 173-194.
- Yean, T. F. ve Yusof, A. A. (2016). Organizational justice: A conceptual discussion. *Procedia-Social and Behavioral Sciences*, 219, 798-803.
- Yu, J., Lee, A., Han, H. ve Kim, H. R. (2020). Organizational justice and performance of hotel enterprises: Impact of job embeddedness. *Journal of Quality Assurance in Hospitality & Tourism*, 21(3), 337-360.
- Zhu, Y. (2013). A review of job satisfaction. *Asian Social Science*, 9(1), 293-298.
- Ziegler, R., Hagen, B. ve Diehl, M. (2012). Relationship between job satisfaction and job performance: Job ambivalence as a moderator. *Journal of Applied Social Psychology*, 42(8), 2019-2040.

YÜKSEK YAPILARA YÖNELİK TASARIM REHBERLERİ VE TÜRKİYE’DEKİ
DURUMUN DEĞERLENDİRMESİ

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ÖZET

Küreselleşme ve artan teknolojik imkanlar neticesinde ivme kazanan yüksek yapılar, kullanıcı sayısının fazla olması sebebiyle bulunduğu alanda yoğunluğu arttırmaktadır. Bu durum kentler üzerinde *büyük etkilere* sebep olmaktadır. Teknik anlamda bu yapıların zorunlu olarak sağlanması gereken performans sınırlarının denetim altına alınması ise ilgili yönetmeliklerle sağlanmaktadır. Ancak bu yapıların kent ölçeğindeki etkileri düşünüldüğünde; tek tipleşme, kent kimliklerini değiştirme, kamusal açık alanların yok olması gibi problemlerle karşılaşmaktadır. Bahsedilen yüksek yapı ve kent ilişkisindeki sorunlarla başa çıkmak adına ise özellikle gelişmiş ülkelerde yüksek yapıların kente ve kentliye etkilerini kontrol altına alabilmek adına *yüksek yapı tasarım rehberleri* hazırlanmakta ya da bu konu *kentsel tasarım rehberleri* içerisine dahil edilmektedir. Bu rehberlerin amacı kentlerin karakterine zarar vermeyen, çevresindeki yapılardan farklılaşarak kentin işleyişinde önem kazanan yüksek yapıların tasarlanmasına yönelik yol gösterici kriterler ortaya koymaktır. Bu araştırmada bahsedilen rehberlerin kent yaşamı için ihtiyaç duyulan kamusal açık alanlara etkisi, bu yapıların kentlilere aktardığı mesajlar, bu yapıların yaya düzleminde kente müdahaleleri kapsamında bir değerlendirme yapılması hedeflenmiştir. Nitel araştırma yöntemlerinden veri toplama ve iz sürme metotları kullanılarak yurtdışında hazırlanmış yüksek yapı tasarım rehberleri ve yüksek yapılar hakkında veri içeren kentsel tasarım rehberleri incelenmiştir. Sonrasında ise Türkiye’de yüksek yapı üretimi konusunda uygulamada olan yönetmelik ve kanunların içerikleri derlenmiştir. Bulgular kısmında ise farklı ülkelerden derlenen 40 rehber kapsamında elde edilen tasarım başlıklarının Türkiye’den 7 adet yönlendirici doküman kapsamında mevcut olma durumları tartışılmıştır. İnceleme sonucunda farklı disiplinlere hitap eden ulusal dokümanlarda kentsel yaşamın gerekliliklerini barındıran kamusal açık alanlar, insan ölçeği, canlı sokaklar, sokak dokusu, karakter, manzara gibi konuların olmadığı gözlemlenmiştir. Bu çalışmanın özellikle tasarımcı aktörler için yararlı olacağı düşünülmektedir.

Anahtar Kelimeler: Yüksek yapılar, tasarım rehberleri, yönetmelikler, kentsel tasarım

DESIGN GUIDELINES FOR HIGH-STRUCTURES AND ASSESSMENT OF THE
SITUATION IN TURKEY

ABSTRACT

Tall buildings, which gain momentum as a result of globalization and increasing technological opportunities, increase the density in the area where they are located due to the high number of users. This situation has *great effects* on cities. Technically, the control of the performance limits that these structures must necessarily provide is provided by the relevant regulations. However, considering the effects of these structures on the urban scale, they encounter problems such as uniformization, changing urban identities, and the disappearance of public open spaces. To cope with the problems in the relationship between the high-rise building and the city, especially in developed countries, high-rise design guidelines are prepared, or this subject is included in the urban design guidelines in order to control the effects of high-rise buildings on the city and the citizens. The aim of these guidelines is to reveal guiding criteria for the design of high-rise buildings that do not harm the character of cities and gain importance in the functioning of the city by being different from the surrounding structures. In this research, it is aimed to make an evaluation within the scope of the effects of the guidelines mentioned in the public open spaces needed for urban life, the messages these structures convey to the citizens, and the interventions of these structures to the city on the pedestrian level. Tall building design guidelines prepared abroad and urban design guidelines containing data about high-rise buildings were examined by using data collection and tracing methods from qualitative research methods. Afterwards, the contents of the regulations and laws in practice on the production of high-rise buildings in Turkey were compiled. In the findings part, the availability of the design titles obtained within the scope of 40 guides compiled from several countries within the scope of 7 guiding documents from Turkey is discussed. As a result of the examination, it has been observed that there are no subjects such as public open spaces, human scale, active streets, street texture, character, landscape, which contain the requirements of urban life, in national documents addressing different disciplines. It is thought that this study will be especially useful for the actors who design.

Keywords: Tall buildings, design guidelines, regulations, urban design

GİRİŞ

Kent planlaması, sosyal, doğal ve fiziksel çevre arasındaki ilişkilerde meydana gelen sorunlara sistemli bir çözüm bularak, kentin ekonomik, fiziksel, toplumsal ve çevresel olarak gelecekte erişilmesi beklenen düzeye ulaşması için teorik ve uygulama çalışmalarının yapılması olarak ifade edilebilir (Aydemir vd., 2004: 357). İnsanların içinde yaşadıkları çevreye müdahale ederek şekillendirmeleri ilkel yerleşimlerden itibaren görülen bir durumdur ve kent planlamasının temellerini oluşturan bu davranışlar zaman içerisinde evrilerek günümüzdeki sanat ve bilimsel verilerle desteklenen bir disiplin haline almıştır. İkel dönemlerde yalnızca yakın çevresine müdahale eden insan, nüfus artışı ve artan yapıli çevreye kentsel tasarım ile tepki vermiştir. İnsanlar için mekan üretme sanatı olan kentsel tasarım, insanlar ile mekanlar, ulaşım ile kent formu, doğa ile yapıli çevre arasındaki bağlantıları ve başarılı kent ve alt yerleşimlerinin meydana gelme süreçleri ile ilintilidir (CABE, 2000). Kentsel tasarım yer, insan, nesne ve birçok diğeri ögenin etkileşim halinde olması neticesinde oluşan bir tasarım tavrıdır ve farklı dinamikleri barındırması sebebiyle kentlerin kendiliğinden oluşumuna fırsat verecek mekanizmalara olanak sağlamaktadır (Ulusoy ve Tokol, 2001).

Sanayi devriminin ardından ortaya çıkan üretim biçimleri ve küreselleşme, kent kimlikleri üzerinde farklı yapı tipleri ile kalıcı etkiler yaratmış, şehir merkezlerinde binaların kat adetleri artarak farklı fonksiyonların bir arada kullanıldığı karma kullanımlı yapılar üretilmiştir. Özellikle kentlerde yapılaşma alanları azaldıkça küçük arazi kullanımına sahip yüksek yapılar inşa edilmeye başlanmıştır. Yapılarda yükseklere ulaşmak; güç, itibar göstergesi olarak karşımıza çıktığı için her geçen gün sayıları daha çok artan bu tip yapılar geleneksel dokuya zarar vermekte ve kentlerde yoğunluğun artmasına sebep olmaktadır. Bu gelişmeler ardından “kentsel tasarım kavramının gelişerek önem kazanmasıyla beraber kentlerin birbirleri ile rekabet içine girmeleri ile sürdürülebilir, yaşanılabilir ve gelecek nesillere bırakılabilir kentlerin ortaya çıkmasını sağlamak için kentsel tasarımda kontrol ve uygulayıcı olarak kentsel tasarım rehberlerinin ortaya çıkması gerekliliği” gündeme gelmektedir (Arısu, 2018). Gelişmiş ülkelerde bu gereklilikler için ise kamusal alanlardaki değişimlerin yönetilmesi konusu üzerinde çalışmalar yapılmaya başlanmıştır (Özer ve Özer, 2021: 175).

Kentsel tasarımın yalnızca çekme mesafeleri, kat yükseklikleri, otopark sayıları gibi zorunlu olan yönetmeliklerde ve imar planlarında bulunan sayısal verilerle ifade edilemeyecek genişlikte bir kapsama sahip olması ve imar kanunları ile yönetmeliklerin kentlerin hızlı

gelişimi hakkında yeterli içeriğe sahip olmadığına anlaşılması üzerine kentsel tasarım kavramı altındaki bilgileri aktaracak destekleyici belgelerin oluşturulması gereksinimi doğmuştur. Böylelikle kanun ve yönetmelikler gibi yaptırımları olmayan ve tavsiye niteliğinde olan tasarım rehberleri ortaya çıkmıştır.

Yönlendirici standartlar veya tasarım rehberleri olarak ifade edebilecek, yerel yönetimler tarafından hazırlanan, tasarımsal hayal gücünü kısıtlamayan fakat kentteki yapıları belirli bir standardın üzerinde tutmayı amaçlayan yönlendiriciler, özgün ve kimlikli kentler yaratmak için kavramsal düzenleyicileri kullanan bir yöntemdir. İşlevsel, erişilebilir ve sürdürülebilir kentler yaratarak, yaşam kalitesinin arttığı, fiziksel ve psikolojik tüm gereksinimlere cevap verebilen yapılı çevre ve açık alanların kentsel tasarım rehberlerinin yardımıyla üretilmesi hedeflenmektedir (CABE, 2007). Tasarım rehberlerinin temel amaçları yaşanabilir, topluluk hissine sahip, kaliteli kamusal alanlar içeren, insan ölçeğine uygun, verimli, dayanıklı, uyarlanabilir, kimlikli, karakter sahibi, estetik, farklı etkinlikler içeren, karma kullanımlı, güvenli, erişilebilir, ulaşılabilir ve sürdürülebilir bir kent yaratmaktır. Bahsedilen bu amaçlar daha sonra farklı kentlerin bağlam ve yorumlamaları doğrultusunda ilkeler ve tasarım kriterlerine evrilmiştir (Asaad, Khalifa & Abd Elrahman, 2019)

Bir bütün yaratmak için cephe, malzeme, ulaşım, kamusal açık alan ve kent mobilyası gibi kenti oluşturan elementlerin birbirleriyle olan ilişkileri üzerinde durarak mekan tasarımında ortak bir dil kullanılmasını sağlamaya çalışan tasarım rehberleri, yerel olarak hazırlanmaları ve bölgenin ihtiyaçları doğrultusunda içeriklere sahip olmaları hasebiyle içerik olarak birbirinden ayrılmaktadır. Kentsel tasarım gibi geniş bir alana ait bilgiler içeren rehberlerin yanında açık kamusal alan tasarımı, yeşil alan tasarımı, kıyı bölgesi tasarımı, konut tasarımı ve yüksek yapı tasarımı gibi direkt olarak detaylara yönelik çözüm üreten rehberler mevcuttur. Bu rehberlerden kısaca bahsetmek gerekirse;

- En genel kapsamlı olan kentsel tasarım rehberleri (Urban Design Guidelines); kentin kimliği, özgünlüğü, kalitesi gibi yere ait özellikleri korurken, çevresel sürekliliği sağlayıp, yapılı çevre ve açık alanların birbirini destekleyerek bir bütünü oluşturması amacıyla hazırlanmaktadır (Arisu, 2018). Canlı kamusal alanlar ve kullanılan sokaklar sayesinde daha güvenli bir çevre oluşturmak ve bunlara katkı sağlayacak yapıların üretilmesi kentsel tasarım rehberlerinin diğer amaçlarındandır.
- Açık kamusal alan tasarım rehberleri (Public Open Spaces Design Guidelines); kentli ve gelen turistlerin sosyalleşme ihtiyaçlarının karşılanması ve özgün, nitelikli kamusal alanlar oluşmasına yöneliktir.

- Yeşil alan tasarım rehberleri (Green Spaces Design Guidelines); doğal yeşil alanların korunması ve kent içinde yeşil alanların oluşturulması amacıyla hazırlanmaktadır.
- Kıyı bölgesi tasarım rehberleri (Coastal Area Design Guidelines); kıyı şeridi ve o bölgeye hizmet eden bölümlerin planlanması ve gelişimi hakkında bilgiler barındırmaktadır.
- Konut tasarım rehberleri (Housing Design Guidelines); konut kullanıcılarının yaşam kalitesini arttırmak için yapı elemanlarına odaklanmaktadır.
- Yüksek yapı tasarım rehberleri (Tall Building Design Guidelines); yüksek yapıların çevreleriyle ilişkileri, komşu yapılara veya açık alanlara etkileri gibi konuları ele almaktadır.

Bu çalışmada yüksek yapı tasarımında yönlendirici özelliğe sahip tasarım rehberleri ve yönetmelikler araştırma odağına alınarak, nitel araştırma yöntemlerinden veri toplama ve iz sürme metotları kullanılarak dünyadan 40 ve Türkiye'den 7 adet yönlendirici belge incelenmiştir. İnceleme sonucunda Türkiye'de yüksek yapılar ve tasarım rehberleri hakkında veri içeren yönlendirici belgelerin içerikleri karşılaştırılmıştır.

DÜNYANIN FARKLI YERLERİNDE YAYIMLANMIŞ YÜKSEK YAPI TASARIMINA YÖNELİK REHBERLER

Yüksek yapılar, kent ile ilişki kurmaması, kendi başına var olarak çevresinden soyutlanması, ulaşım ve altyapılarda yoğunluk oluşturması, yüksekliği nedeniyle insan ölçeğinde ezici etki oluşturması gibi pek çok eleştiriye maruz kalan bir yapı tipidir. Bu nedenle içinde buldukları bağlama uygun tasarlanarak kentsel peyzaja, kalıplara, ölçeğe, sokak dokusuna, karaktere ve silüete uyumlu olarak ele alınmalıdırlar. Oluşabilecek sorunlara çözüm arayan yapılar, başarılı örnekler olup buldukları kente katkı sağlama potansiyeline sahiptir (Al-Kodmany, 2012). Dünyada pek çok metropol kent için yüksek yapıların çevresiyle uyumlu bir şekilde tasarlanmasını sağlayacak nitelikte kılavuzlar yayınlanmaktadır. Bu kılavuzlardaki içeriklerin yönlendirmeleri ile yüksek yapı tasarım sürecinde yapının kentle uyum sağlayarak bütünleşeceği mimari çözümler yapılabilmektedir. Bu kılavuzların amacı kentlerin karakterine zarar vermeyen, çevresindeki yapılardan farklılaşarak kentin işleyişinde önem kazanan yüksek yapılara yönelik yol gösterici bilgiler ortaya koymaktır.

Dünyada Amerika, Avustralya, Çin, Galler, Güney Afrika, İngiltere, Kanada ve Yeni Zelanda gibi pek çok ülkede örnekleri görülen kentsel tasarım ve yüksek yapı rehberleri, zorunlu olarak uyulması gereken yasalardan ziyade yol gösterici birer rehber niteliği

taşımaktadır. Bu sebeple hayal gücünü kısıtlamayıp daha iyiye ve güzele ulaşmayı amaçlarken yapıyı çevre ve açık alan tasarımının belirli bir standardın altına düşmesini engellemektedir. Yüksek yapıların tasarımı, 19. yüzyılın sonlarından bu yana kapsamlı bir şekilde gelişirken, günümüzde görülen en yaygın uygulamanın bir kule ve bir bazadan oluşan biçimlenme olduğu gözlemlenmektedir. Her ne kadar en yaygın kullanım alanı bulan biçimlenme bazalı yüksek yapılar olsa da yalnız kuleden oluşan yüksek yapılar da mevcuttur. Bazalı veya bazasız yüksek yapıların yapı zemini/baza, kule ve bitiş noktası olarak üç bölümden oluştuğunu kabul ederek incelemek daha net veriler elde edilmesini sağlamaktadır. Bütün yüksek yapılarda bu üç bölüm ayrı ayrı görülememekte, yapının tasarım özelliklerine bağlı olarak bu ayrımlar belirginleşip kaybolmaktadır. Yüksek bir yapının zemin katı ile bitiş noktasından beklenen tutum ve kaynaklanan sorunlar aynı değildir, bu nedenle de ayrı ayrı ele alınması çevre ilişkilerini kavramak açısından en faydacıl yöntemdir.

Çalışma kapsamında Dünyanın farklı yerlerinde yerel yönetimlerce yayınlanmış olan yüksek yapı tasarım rehberleri ve yüksek yapı tasarımlarını kentsel tasarım rehberleri içinde ele alan yönlendiriciler araştırılarak 40 adet rehberle ulaşılmıştır. Çin, Galler, Yeni Zelanda, Güney Afrika, Avusturalya, Amerika, İngiltere ve Kanada'da yapılmış olan bu yönlendirici standartların 21 tanesi kentsel tasarım rehberi olup içinde yüksek yapı tasarımına yönelik maddeler içermekteyken 19 tanesi yalnızca yüksek yapı tasarımına yönelik olarak hazırlanmıştır (Tablo 1).

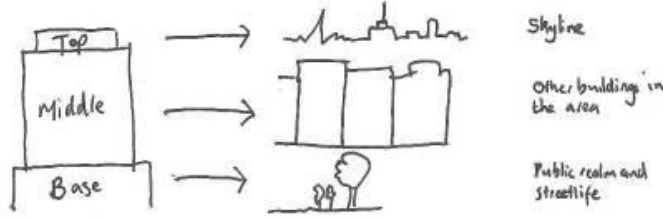
Tablo 1. Ulaşılan Tasarım Rehberlerinin Ülke Bazındaki Sayısına Göre Sıralaması

Şehir/Bölge	Ülke	Tür	Yüksek Yapı Değerlendirmesi	Tarihi	Rehberlerdeki Konular
Hong Kong	Çin	Kentsel	bütüncül	2013	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Cardiff	Galler	Yüksek Yapı	bütüncül	2013	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Auckland	Yeni Zelanda	Kentsel	bütüncül	2012	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Cape Town	Güney Afrika	Yüksek Yapı	baza-kule-bitiş	2017	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Nelson Mandela Bay	Güney Afrika	Yüksek Yapı	baza-kule-bitiş	2009	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Elizabeth Quay	Avusturalya	Kentsel	baza-kule-bitiş	2017	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Melbourne	Avusturalya	Kentsel	bütüncül	2018	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Sydney	Avusturalya	Yüksek Yapı	bütüncül	2011	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Los Angeles	Amerika	Kentsel	bütüncül	2016	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Oklahoma	Amerika	Kentsel	bütüncül	2018	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
San Francisco	Amerika	Kentsel	bütüncül	2012	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Seattle	Amerika	Kentsel	bütüncül	2012	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
West Loop	Amerika	Kentsel	bütüncül	2012	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Bristol	İngiltere	Kentsel	baza-kule-bitiş	2018	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Cambridge	İngiltere	Yüksek Yapı	bütüncül	2016	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Hackney	İngiltere	Yüksek Yapı	bütüncül	2007	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Islington	İngiltere	Yüksek Yapı	bütüncül	2020	Form, Yaya, Çevre ile İlişkiler, Kamusal
Kensington & Chelsea	İngiltere	Kentsel	baza-kule-bitiş	2013	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Leeds	İngiltere	Yüksek Yapı	bütüncül	2006	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Merton	İngiltere	Kentsel	bütüncül	2010	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Newcastle	İngiltere	Yüksek Yapı	bütüncül	2016	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Northampton	İngiltere	Yüksek Yapı	bütüncül	2017	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Tower Hamlets	İngiltere	Yüksek Yapı	bütüncül	2010	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Watford	İngiltere	Yüksek Yapı	baza-kule-bitiş	2017	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Worthing	İngiltere	Yüksek Yapı	bütüncül	2010	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Burlington	Kanada	Yüksek Yapı	baza-kule-bitiş	2018	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Edmonton	Kanada	Yüksek Yapı	baza-kule-bitiş	2005	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Hamilton	Kanada	Yüksek Yapı	baza-kule-bitiş	2013	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Kitchener	Kanada	Yüksek Yapı	baza-kule-bitiş	2018	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Markham	Kanada	Kentsel	bütüncül	2015	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Milton	Kanada	Yüksek Yapı	bütüncül	2017	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Mississauga	Kanada	Kentsel	baza-kule-bitiş	2012	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Naperville	Kanada	Kentsel	bütüncül	2017	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
New Westminster	Kanada	Kentsel	bütüncül	2018	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Ottawa	Kanada	Yüksek Yapı	baza-kule-bitiş	2010	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Pickering	Kanada	Kentsel	bütüncül	2013	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Richmond Hill	Kanada	Kentsel	baza-kule-bitiş	2012	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
St. Catharines	Kanada	Kentsel	bütüncül	2015	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Toronto	Kanada	Yüksek Yapı	baza-kule-bitiş	2020	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal
Waterloo	Kanada	Kentsel	bütüncül	2018	Cephe, Form, Yaya, Çevre ile İlişkiler, Kamusal

Araştırma esnasında tasarım rehberlerinin bir kısmında yüksek yapıyı incelemek amacıyla yapı zemini/baza, kule ve bitiş noktasına ayırarak inceleme yönteminin kullanıldığı gözlemlenmiştir. Ulaşılan 40 tasarım rehberinden 14 tanesi yüksek yapıyı yapı zemini/baza, kule ve bitiş noktası olarak ele almış ve parçacıl bir yaklaşım ile daha doğru bir değerlendirme yapılabileceğini belirtmiştir. Geriye kalan 26 rehberin ise bütüncül bir yaklaşım ile yüksek

yapıyı inceleme yolunu tercih ettiği tespit edilmiştir. Ek olarak, detay başlıklar gruplandırıldığında kentsel ölçekte referans verilen konu kapsamı Cepheyi, Yapı Formunu, Yayıları, Çevre ile İlişkileri ve Kamusal Kullanımı Etkileyen Faktörler olarak karşımıza çıkmaktadır. Rehberlerin teknik niteliğinin yanında insan ölçeğine uygun tasarıma yönelik tavsiyeler içermesi yüksek yapı tasarımının etki ettiği konu başlıklarını da ortaya çıkarmaktadır.

Kent ile kuracağı ilişki ve çevre yapılar ile etkileşimi bakımından farklı ölçeklerde farklı etkilere sahip olan yüksek yapılar, kendilerinden beklenen tavır ve çevre ilişkileri bakımından bir bütün olarak her seviyede aynı tepkiyi vermemekte, üç ana bölüm olarak değerlendirilerek her kısımda bağımsız tutumlar sergilemektedir (Şekil 1). Örneğin yüksek yapıların silüete etki eden bitiş noktaları şehrin uzak mesafelerinden algılanırken, kent ile ilişki kuran zemin katlar yalnızca yapının yakın çevresinden görülebilmektedir. Bu nedenle hem farklı mesafelerden algılanışları hem de kente katılım biçimleri bakımından çeşitli etkilere sahip olan yüksek yapıların, yapı zemini, kule ve bitiş noktası olmak üzere üç parçadan oluştuğu kabul edilmektedir (Al-Kodmany, 2012). Kentteki etkileri ve neden olduğu sorunlar bakımından farklı çözümlere ihtiyaç duyan ve bir bütünü oluşturan parçaların ayrı ayrı ele alınması sayesinde detaylı bir inceleme yapılabilen, böylelikle daha iyi alternatiflerin üretilmesi sağlanmaktadır.



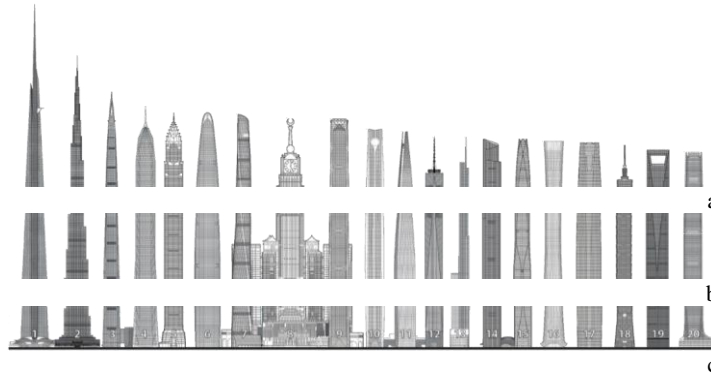
Şekil 1. Bitiş noktası, kule ve yapı zemini gösterimi ve etki alanları (Watford Borough Council, 2016).

Yurt dışında hazırlanan rehberlerde görülen ve yüksek yapılar incelenirken kullanılan üç bölüme ayırarak inceleme yöntemi sayesinde yapının farklı bölümlerinden beklentiler, ortaya çıkan sorunlar ve çözümleri kılavuzlarda daha net bir şekilde ifade edilmektedir. Binanın üç ayrı ölçeğe hitap eden bu üç bölümü kısaca, yapı zemini/bazası yaya alanına, bina kulesi çevredeki yapılara ve bitiş noktası da silüete etki etmektedir (Planning Staff of City of Hamilton, 2018) (Şekil 1). Biraz daha detaylandırmak gerekirse;

- **Bitiş Noktası;** Yüksek yapıların bitiş noktası uzak mesafeden görülen ve kent silüetine etki eden bölümdür (Şekil 2. a). Tepe noktası kule tasarımı ile bütünleşmeli ve tasarımı

güçlendirici özelliklere sahip olmalıdır. Yapının markasını, şehrin imajını ve silüetini doğrudan etkileme yetisine sahip olduğu için oldukça büyük önem taşımaktadır (Bristol City Council, 2018).

- **Kule;** Kulenin konumu, ölçeği, taban oturma alanı, yönü ve çekme mesafeleri çevresine karşı etkileri bağlamında gökyüzü görünümünü, mahremiyeti, rüzgarı ve kamusal alan ve çevre yapılarına ulaşan güneş ışığı miktarını ve gölge düşme sürelerini etkilemektedir (Toronto City Council, 2013). Bunlara ek olarak simgesel rol oynadığı için kule tasarımı yakın çevredeki kamusal alana ve uzak mesafede ufuk çizgisine etki etmektedir (Şekil 2. b) (Burlington City Council, 2017).
- **Yapı Zemini/Bazası;** Yapının sokak ve insan ile ilk temas kurduğu, ilk izlenimlerin oluştuğu bağlantı noktası olmakla beraber çevresiyle nasıl bütünleştiği ve nasıl etkileşime geçtiğini ifade ettiği bölümdür (Şekil 2. c) (Tower Hamlets City Council, 2018). Yapının zemindeki biçimlenişi, konum, yükseklik, hacim olarak insan ölçeği ve çevre yapılarla pozitif ilişki kurmalı, bina ile kamusal alan arasında etkileşim sağlamalıdır. Yüksek yapıların zeminle buluştukları noktada insan ölçeğinde nasıl algılandığı ve deneyimlendiği yapının başarılı ya da başarısız olarak sayılmasındaki en önemli etkidir, bu nedenle amaç insan ölçeğinde bir kamusal alan yaratmak olmalıdır (Bristol City Council, 2018).



Şekil 2. Yüksek yapıların (a) bitiş noktası; (b) kule; (c) Yapı zemini (URL-1)

TÜRKİYE'DE YÜKSEK YAPI TASARIMI İLE İLGİLİ YÖNETMELİKLER

Bugün Türkiye'de kullanılan yönetmeliklerde yüksek yapılar oldukça basit tanımlamalarla ifade edilmektedir. Yönetmelikler incelendiğinde bahçe çekme mesafeleri, binalar arası olması gereken mesafe, silüet etkisi, yapı strüktürü, çevresel etkisi, jeolojik ihtiyaçları, hava trafiği etkisi, genel ulaşım, yangın etkisi, deprem etkisi, altyapı etkisi, güneş ve rüzgara göre

çekme mesafeleri hakkında ifadeler yer aldığı görülmektedir. Yurt dışı örneklerinde kentsel tasarım rehberlerinin yüksek yapılar hakkında veri içermesi Türkiye'de yapılmış kentsel tasarım rehberlerinin araştırılması gerekliliğini doğurmuştur. Ancak görülmüştür ki bu konu hakkında yerel yönetimler herhangi bir çalışma yapmamıştır. Bu sebeple kentsel tasarım rehberleri hakkındaki durumun incelenmesi de bu araştırmanın konusuna dahil edilmiştir. Türkiye'de henüz kentler için hazırlanmış kentsel tasarım rehberlerinin yapılmamış olması sebebiyle yönetmeliklerde geçen kentsel tasarım rehberleri hakkındaki ifadelere yer verilmiştir.

Planlı Alanlar İmar Yönetmeliği (2017)

“Plan, fen, sağlık ve sürdürülebilir çevre şartlarına uygun yapı ve yapılaşma ile projelendirmeye ve denetime ilişkin usul ve esasları” belirlemek için yapılan bu yönetmelik uygulama imar planı bulunan alanları kapsamaktadır. Bu yönetmelikte bulunan Madde 4’ün, aaaaa Bendinde; “Yüksek Bina: Bina yüksekliği 21,50 metreden veya yapı yüksekliği 30,50 metreden fazla olan binaları (Bina yüksekliği 51,50 metreden veya yapı yüksekliği 60,50 metreden daha yüksek olan binalar çok yüksek yapılardır) ifade eder” denilerek yüksek bina tanımı yapılmıştır.

Yönetmelik dahilinde yüksek yapı tasarımı hakkında tesisat katlarının katlar alanına dâhil edilmeyeceği, ön, arka ve yan bahçe çekme mesafeleri, bazalı olması durumunda parsel yaklaşma mesafesi, bazanın kat sayısı ve büyükşehir tarafından siluet onayı alınması gerektiği bilgileri yer almaktadır.

Deprem Yönetmeliği, Ek, Deprem Etkisi Altında Binaların Tasarımı İçin Esaslar (2018)

Bu Yönetmelik, “yeni yapılacak binaların deprem etkisi altında tasarımı ile mevcut binaların değerlendirilmesi ve güçlendirme tasarımı” amacıyla hazırlanmıştır. Yüksek yapı tanımı “Tipik bir yüksek bina, genellikle zemine gömülü bodrum katlarının üstünde yer alan az katlı bir baza (podyum) ve onun üstünde yükselen bir kule bölümünden oluşur. Yüksek binaların çok büyük bir bölümü bu tanıma uymaktadır, ancak bazı yüksek binalarda baza olmayabilir” şeklindedir.

Yönetmelik dahilinde yüksek yapı tasarımı hakkında deprem ve rüzgar yüklerini karşılamak üzere sahip olması gereken taşıyıcı sistemi hakkında bilgiler içermektedir.

İzmir Büyükşehir Belediyesi Yüksek Yapı Yönetmeliği (2013)

Bu Yönetmelik, “Yüksek Yapıların tasarım, yapım ve denetim aşamalarında İzmir Büyükşehir Belediye Başkanlığı'nın kent bütününde eşgüdümlü ve uyumlu uygulamayı sağlamak üzere, ilgili kurum, kuruluş ve kurullar ile bu konudaki görev, yetki ve yöntemleri” belirlemek üzere

hazırlanmıştır. Yüksek yapı tanımı hakkında “Yüksek yapılar: Yüksek yapı, genel olarak yakın ve uzak çevresini, fiziksel çevre, kent dokusu ve her türlü kentsel altyapı yönünden etkileyen bir yapı (bina) türüdür. Son kat tavan döşeme kotu 30,80 metreyi ve/veya bodrum kat dahil olmak üzere toplam kat adedi 13’ü aşan (13 kat hariç) yapılar Yüksek Yapı olarak kabul edilir” ifadesi yer almaktadır.

Yönetmelik dahilinde yüksek yapı tasarımı hakkında çevresel ve şehir silueti etkisi, jeolojik yapının incelenmesi, hava trafiğinin incelenmesi, genel ve yangın ulaşım planlarının incelenmesi, altyapı bağlantısı ve kapasite durumunun incelenmesi, güneşin açılarına ve rüzgara göre çekme mesafelerinin incelenmesi, parsel çekme mesafeleri hakkında hükümler içermektedir.

İstanbul Yüksek Binalar Deprem Yönetmeliği (2008)

Bu Yönetmelikte “İstanbul Büyükşehir Belediyesi sınırları içinde yapılacak yüksek binaların, depreme karşı tasarımı için uygulanacaktır. Yüksek binalar, tamamı yer altında olan ve binayı tümü ile kuşatan yüksek yatay rijitlikli çevre perdelerine sahip bodrum katları hariç olmak üzere, en düşük yer seviyesinden itibaren yüksekliği en az 60 metre olan binalardır” ifadeleri yer almaktadır.

Yönetmelik dahilinde yüksek yapı tasarımı hakkında deprem hareketleri altında oluşabilecek farklı hasar türleri ve hesaplanması hakkında bilgiler içermektedir.

Bahsedilen yönetmelik maddeleri incelendiğinde yüksek yapıların mimari tasarım ve kentsel tasarım kararlarına yönelik çok kısıtlı ifadeler yer aldığı görülmektedir. Buradan anlaşılmaktadır ki Türkiye’de kullanılan yönetmelikler imar durumu, kat yüksekliği, çekme mesafeleri gibi yalnızca yapı performansına yönelik maddeler içermektedir. Türkiye’de görülen yüksek yapılar ile ilgili bu bilgi ihmali durumu kentsel tasarım rehberleri ile benzer kaderi paylaşmaktadır. Kent planlamaları yapılırken kentsel tasarım rehberlerinin hazırlanması konusunda bir gelişim gerçekleşmemiştir. Kentsel tasarım rehberleri hakkında da yönetmeliklerde kısıtlı veri yer almaktadır.

Mekânsal Planlar Yapım Yönetmeliği (2014)

Bu yönetmelik “fiziki, doğal, tarihi ve kültürel değerleri korumak ve geliştirmek, koruma ve kullanma dengesini sağlamak, ülke, bölge ve şehir düzeyinde sürdürülebilir kalkınmayı desteklemek, yaşam kalitesi yüksek, sağlıklı ve güvenli çevreler oluşturmak üzere hazırlanan, arazi kullanım ve yapılaşma kararları getiren mekânsal planların yapımına ve uygulanmasına ilişkin usul ve esasları” belirleme amacıyla hazırlanmıştır. Yönetmelik dahilinde kentsel tasarım rehberleri hakkında “İdare gerekli gördüğü alanlarda mekânın imge, anlam ve kimlik

kazanmasını, estetik ve sanat değerinin yükseltilmesini, yapıların bir uyum içerisinde ve bütünlük oluşturacak şekilde düzenlenmesini amaçlayan ve mekânsal planlama sistematığı içerisinde uygulamaya yönelik kılavuz ve tavsiye niteliğinde kararları içerecek şekilde kentsel tasarım rehberi hazırlayabilir” ifadesi yer almaktadır.

İmar Kanunu (1985)

Bu Kanun, “yerleşme yerleri ile bu yerlerdeki yapılaşmaların; plan, fen, sağlık ve çevre şartlarına uygun teşekkülünü sağlamak” için hazırlanmıştır. Kentsel tasarım rehberleri hakkında “Yerleşme ve yapılaşma özellikleri, mimari doku ve karakteri, gelişme düzey ve potansiyeli açısından önem arz eden köylerde bu özellikleri korumak, geliştirmek ve yaşatmak amacıyla muhtarlık katılımı ile ilgili idarelerce köy tasarım rehberleri hazırlanabilir. Köy tasarım rehberleri ilgili idare meclisi kararı ile onaylanır ve uygulanır” ifadesine yer verilmiştir.

Çevre ve Şehircilik Bakanlığınca Onaylanacak Kentsel Tasarım Projelerinin Hazırlanmasına ve Değerlendirilmesine İlişkin Yönerge (2018)

Bu Yönergenin amacı; “644 sayılı Çevre ve Şehircilik Bakanlığının Teşkilat ve Görevleri Hakkında Kanun Hükmünde Kararnamenin 2nci maddesi birinci fıkrasının (ğ) bendi uyarınca Bakanlıkça belirlenen finans ve ticaret merkezleri, (1) bendinde belirlenen alanlar, 6306 Sayılı Afet Riski Altındaki Alanların Dönüştürülmesi Hakkındaki Kanun ve bu Kanunun Uygulama Yönetmeliğinde tanımlanan uygulama alanları ile Çevre ve Şehircilik Bakanlığınca onaylanan imar planlarında kentsel tasarım projesi onay yetkisinin Bakanlık uhdesine alındığı alanlarda, ilgililerince mevzuat hükümleri doğrultusunda hazırlanarak Bakanlığa sunulacak Kentsel Tasarım Projelerinin incelenmesi, değerlendirilmesi ve onaylanmasına ilişkin usul ve esasları belirlemektir.” Kentsel tasarım rehberleri hakkında “Kentsel Tasarım Rehberi: Mekânın; imge, anlam ve kimlik kazanmasını, estetik ve sanat değerinin yükseltilmesini, yapıların bir uyum içerisinde ve bütünlük oluşturacak şekilde düzenlenmesini amaçlayan, kılavuz ve tavsiye niteliğinde kararları içeren belgeyi ifade eder” şeklinde bir tanım yapılmıştır.

İmar kanunu ve belediyelerin düzenlediği parsellerdeki yapılaşma, yalnızca hukuki anlamda veri sunarak tek yapı özelinde kalmakta ve yapılar veya kamusal alanlar arasında kurulması beklenen ilişkiler hakkında veri sağlamamaktadır. Arazi kullanım planları çevre kalitesi yönetiminde etkili veriler sağlasa da kentsel tasarım planları olmadan kaliteli kamusal alanlar yaratılması için yeterli olmamaktadır (Aydemir vd., 2004: 370). Yüksek yapıların sahip olduğu olumsuz etkileri azaltmak ve şehrin karakterini ve ambiyansını koruyabilmesi böylelikle özgün nitelikleri korunarak gelişmesi için kentsel ve mimari tasarım rehberleri yol

göstermektedir (Al-Kodmany, 2012). Başarılı ve sürdürülebilir şehirlerin meydana gelmesi için kentsel tasarım ve kent planlamasının birbirini tamamlayan parçalar olduğunu kabullenen bir yaklaşım gereklidir (Aydemir vd., 2004: 371). Türkiye’de şehirler planlı veya plansız bir şekilde değişip dönüşürken birbirinin aynısı, özgün karaktere sahip olmayan mekanlar ortaya çıkmaktadır. Yaşanılan bu durumun sebebi kentlerin özgün özelliklerinin belirlenerek planlar dahilinde korunması eksikliğidir (Kiper, 2021: 139). Türkiye’de yalnızca imar planları tarafından yol genişlikleri, bina yükseklikleri ve bahçe çekme mesafeleri gibi yapılanma ile ilgili çok kısıtlı bilgiler dahilinde yapılan şehirler tek tipleşerek yerel kimliklerini kaybetmektedir (Özer ve Özer, 2021: 171).

2015 yılında T.C. Çevre ve Şehircilik Bakanlığı ve Mimar Sinan Güzel Sanatlar Üniversitesi, Kentsel Tasarım Uygulama ve Araştırma Merkezi arasında imzalanan protokol çerçevesinde hazırlanan Kentsel Tasarım Rehberleri 2016 yılında yayımlanmıştır. Bu çalışma kapsamında şehirlerin özgün mimari dokusuna uygun tasarım rehberlerinin hazırlanabilmesi amacıyla bir altlık oluşturması böylelikle yerel yönetimlere tasarım rehberi hazırlama yönteminin öğretilmesi hedeflenmiştir (Kentsel Tasarım Rehberleri, Cilt 1, 2016). Bu çalışmada Almanya, Fransa, İngiltere, Yeni Zelanda, Japonya, Barselona, Miami gibi farklı ülkelerden örneklerin konu özelinde incelenerek tasarım rehberlerinin oluşturulması ve uygulaması konusunda faydalanılmıştır. Bu rehberlerde yüksek yapılar hakkında kent imajı ve silueti bağlamında önem teşkil etmesi nedeniyle yüksek yapılar hakkında ek rehberler oluşturulması gerektiği belirtilmiştir (Kentsel Tasarım Rehberleri, Cilt 2, 2016). Üç ciltten oluşan bu rehberlerde yüksek yapılar hakkında başka bilgiye yer verilmemiş, ek olarak araştırılması ve hazırlanması gerekliliği vurgulanmıştır.

SONUÇ

Küreselleşmenin etkileri teknoloji, sanat, haberleşme gibi pek çok alanda olduğu gibi mimaride de görülmektedir. Gündelik hayatı kolaylaştıran etmenlerden olan teknoloji gerek tek yapı özelinde gerekse kentsel alanda büyük değişimler yaşanmasına sebep olmaktadır. Teknoloji yapı üretimine büyük bir ivme kazandırırken hızla inşa edilen yapılar kent yaşamı üzerinde büyük etkilere sebep olmaktadır. Küreselleşmenin etkileri ile üretimi hızlanarak artan, şehirler üzerinde insan, ulaşım, alt ve üst yapı bağlamında oldukça fazla yoğunluk yaratan yüksek yapılar, sebep olacağı etkiler farklı bağlamlarda incelenmeden ve yeterli planlama yapılmadan inşa edildiğinde az katlı bir yapıya kıyasla çok daha fazla olumsuz etkiye sebebiyet vermektedir. Parseller üzerinde yapıların çekme ve yükseklik değerlerine ilişkin veri sağlayan yönetmelikler ışığında gelişen kentler tek tipleşme, kimliklerini

kaybetme, yaşıyanların ihtiyalarına cevap verememe, kamusal aık alanların yok olması gibi problemlerle karşı karşıya kalmaktadır. Bahsedilen bu sorunlarla başa çıkmak adına dünyada İngiltere, Amerika, Çin gibi pek ok lke kent planlamasına katkı saėlaması adına kentsel tasarım rehberleri hazırlanmaktadır. Bu rehberler kent yaşıamı iin ihtiya duyulan kamusal aık alanlar ve ticari alanlar gibi konulara deėinirken farklı yapı tipolojilerinin tasarımı ve kente katılımı hakkında veriler iermektedir. Yerel ynetimlerce hazırlanan tasarım rehberleri blgenin ihtiyaları doėrultusunda deėişiklikler gstermektedir.

Kente katılımı konusunda byk sorunlar yaşıanan yksek yapılar hakkında kentsel tasarım rehberleri ierisinde veriler yer almakta ya da *yksek yapı tasarım rehberleri* hazırlanmaktadır. Bylelikle yaşıanabilecek sorunların tasarım aşıamasında nlenmesi hedeflenmektedir. Kentler iin byk etkiye sahip olan yksek yapılar hakkında yapılan bu alıřmalar kaliteli ve zgn bir Őehir yaşıamı yaratmak iin yapılmaktadır. Yalnızca kanun ve ynetmelikler doėrultusunda tasarlanan yksek yapılar kentsel yaşıamın gerekliliklerini barındıran kamusal aık alanlar, insan leėi, canlı sokak, sokak dokusu, karakter, manzara gibi birok kavramın gzden kaırılarak inřa edilmesine sebebiyet vermektedir.

Dnyada bu konuyu merkeze alan rehberler yaygın olarak kullanılmaktadır. alıřma kapsamında dnya zerindeki yksek yapı tasarımına iliřkin veri saėlayan 40 adet rehberin incelenmesi ile temel bařlıklar; Cepheyi Etkileyen, Yapı Formunu Etkileyen, Yayıları Etkileyen, Kamusal Kullanımı Etkileyen ve evre ile İliřkileri Etkileyen Faktrler kapsamında st bařlıklar ile sınıflandırılabilir.

Arařtırma kapsamında incelenen ve Trkiye’de yrrlkte olan ynetmelikler ierisinde yksek yapılar ve kentsel tasarım rehberleri hakkında tanım ve ynlendirici olan sylemler ieren ynetmeliklerin tasarım rehberlerinin temel konu bařlıklarına gre daėılımı Tablo 2’de gsterilmiřtir.

Tablo 2. Türkiye’deki yönetmeliklerde geçen başlıkların tasarım rehberlerinde geçen konulara göre dağılımı

	Cepheyi Etkileyen Faktörler	Yapı Formunu Etkileyen Faktörler	Yayaları Etkileyen Faktörler	Kamusal Kullanımı Etkileyen Faktörler	Çevre ile İlişkileri Etkileyen Faktörler
Planlı Alanlar İmar Yönetmeliği		3			1
Deprem Yönetmeliği		1			
İzmir Büyükşehir Belediyesi Yüksek Yapı Yönetmeliği		3	1		4
İstanbul Yüksek Binalar Deprem Yönetmeliği		2			
Mekânsal Planlar Yapım Yönetmeliği	2	2			2
İmar Kanunu					2
ÇŞB Yönerge	2	1			4

Bu yönetmelikler dahilindeki yüksek yapı ve tasarım rehberleri hakkında veri içeren ifadelerde yer alan başlıklar tasarım rehberlerinde yer alan konu başlıkları altında gruplandırılmış ve karşılaştırmalı olarak başlıkların konular altındaki dağılımı ifade edilmiştir (Tablo 3).

Tablo 3. Türkiye’deki yönetmeliklerde geçen başlıkların tasarım rehberlerinde geçen konular altında gruplanması

Cepheyi Etkileyen Faktörler	Yapı Formunu Etkileyen Faktörler	Yayaları Etkileyen Faktörler	Kamusal Kullanımı Etkileyen Faktörler	Çevre ile İlişkileri Etkileyen Faktörler
Estetik Sanat	Kat alanı Çekme mesafeleri Güneş ve rüzgara göre çekme mesafesi Baza parsel yaklaşımı Taşıyıcı sistem Mekânsal planlama Jeolojik yapı Hasar türleri İmge	Ulaşım		Baza kat sayısı Siluet etkisi Çevresel etki Hava trafiği Mimari doku Uyum Bütünlük Kimlik Altyapı Anlam

Temel hedef doğrultusunda Türkiye’de uygulamada olan yönetmelikler incelenerek daha verimli kullanımlarının sağlanması için eksiklikleri ifade edilmiştir. Türkiye’de yapılaşma oranları yüksek olsa da yeterli yönetmelik ve denetim olmaması nedeniyle yüksek yapılar, kent, siluet ve çevre etkisi tam olarak planlanıp, denetlenmeden üretildiği için yapıldığı yere ve zamana yönelik çözüm sunamayıp sorunlara neden olmakta; bu da aslında küçük alanda büyük çözümler sunma potansiyeline sahip yüksek yapıların yanlış bir şekilde değerlendirilmesine neden olmaktadır. Türkiye’de yüksek yapılar özelinde hazırlanmış herhangi bir yönlendirici rehber olmadığı gibi kentsel tasarım rehberleri de bulunmamaktadır. Yüksek yapıların kent ile bütünleşmesi kapsamında bilgi içeren kaynak eksikliğinin Türkiye’de görüldüğü bu çalışma kapsamında kanıtlanmıştır. Bu konu hakkında yapılması

gereken; yurt dıřında eřitli lkelerde kentsel veya yksek yapı trne zel olarak hazırlanan tasarım rehberleri gibi yapı ve kent tasarımlarını en iyi sonular vermeye ynlendirecek rehberlerin oluřturulmasıdır. Yksek yapı tasarımına ynelik hayal gcn kısıtlamayan fakat kentteki yapıları belirli bir standardın zerinde tutmayı amalayan tasarım rehberlerinin oluřturulması sayesinde evreye saygılı, ekonomiye katkı saėlayan yapılar tasarlanmış olacaktır. Kent dokusunun, imajının ve silüetinin olumsuz etkilenmemesi saėlanarak, tasarımcılar, yatırımcılar ve denetleyiciler iin bir dizi veri paketi elde edilmiş olacaktır.

KAYNAKÇA

- Al-Kodmany, K. (2012). Guidelines for tall buildings development. *Int. J. High-Rise Build*, 1(4), 255-269.
- Aydemir, Ş., Erkonak Aydemir, S., Beyazlı, D., Ökten, N., Öksüz, A.M., Sancar, C., ... Aydın Türk, Y. (2004). *Kentsel Alanların Planlanması ve Tasarımı*. Trabzon: Akademi Kitabevi.
- Asaad, M., Khalifa, M., & Abd Elrahman, A. S. (2019). Bridging the Gap Between Theory and Practice in the Urban Design Process: Towards a Multi-disciplinary Approach. *The Academic Research Community publication*, 3(1), 115-135.
- Arısu, S. (2018). Kentsel Tasarım Kavramında Kentsel Tasarım Rehberlerinin Yeri ve Önemi. *Kent Akademisi*, 11 (2), 243-255.
<https://dergipark.org.tr/tr/pub/kent/issue/38213/427575>
- Aydemir, Ç., Gül, A., & Akın, T. (2020). Yapılı Çevre Üretiminde Kentsel Tasarımın Yasal Boyutunun İrdelenmesi. *İdealkent*, 11(Kentleşme ve Ekonomi), 1313-1338.
- Bristol City Council, (2018). *Urban Living Supplementary Planning Document*.
<https://www.bristol.gov.uk/documents/20182/34520/Urban+Living+SPD+Making+successful+places+at+higher+densities.pdf/ec07c68e-f068-8ff7-083e-04250462715a>
- Burlington City Council (2017). *City of Burlington Tall Building Guidelines*.
https://www.burlington.ca/en/services-for-you/resources/Planning_and_Development/Urban-Design/May_2017_Tall_Building_Guidelines.pdf
- CABE (Commission for Architecture and Built Environment), (2000). *By Design: urban design and planning system: towards better practice*. DETR, Londra.
- CABE (Commission for Architecture and Built Environment), (2007). *Guidance on tall buildings*, Londra.
- Çevre ve Şehircilik Bakanlığınca Onaylanacak Kentsel Tasarım Projelerinin Hazırlanmasına ve Değerlendirilmesine İlişkin Yönerge, (2018).
- Deprem Yönetmeliği, Ek, Deprem Etkisi Altında Binaların Tasarımı İçin Esaslar, (2018).
- İmar Kanunu, (1985).
- İstanbul Yüksek Binalar Deprem Yönetmeliği, (2008).
- İzmir Büyükşehir Belediyesi Yüksek Yapı Yönetmeliği, (2013).
- Kentsel Tasarım Rehberleri, M. S. G. S. Ü., Uygulama, T., & Merkezi, A. (2016). *Kentsel Tasarım Rehberleri/Cilt I: Araştırma ve Tanımlama*. T.C. Çevre ve Şehircilik Bakanlığı yayını.
- Kentsel Tasarım Rehberleri, M. S. G. S. Ü., Uygulama, T., & Merkezi, A. (2016). *Kentsel Tasarım Rehberleri/Cilt II: İçerik*. T.C. Çevre ve Şehircilik Bakanlığı yayını.
- Kiper, P., (2021). *Farklı Koruma Alanları İçin Planlama/Tasarım İlkeleri*. Kentsel Tasarım (pp.139-166), Ankara: Nobel.
- Mekânsal Planlar Yapım Yönetmeliği, (2014).
- Özer, G., ve Özer, M. N., (2021). *Kent Kimliğinin Oluşumunda Kentsel Tasarım Rehberlerinin Önemi*. Kentsel Tasarım (pp.167-187), Ankara: Nobel.
- Planlı Alanlar İmar Yönetmeliği, (2017).
- Planning Staff of City of Hamilton, (2016). *Hamilton Tall Building Guidelines*.
<https://www.hamilton.ca/sites/default/files/media/browser/2018-03-16/downtownhamilton-dhtallbuildingsstudyguidelines-mar2018-1.pdf>
- Toronto City Council, (2013). *Tall Building Guidelines*, Toronto <https://www.toronto.ca/wp-content/uploads/2018/01/96ea-cityplanning-tall-buildings-may2013-final-AODA.pdf>

- Tower Hamlets City Council, (2018). London Borough Tower Hamlets Tall Buildings Study. https://www.towerhamlets.gov.uk/Documents/Planning-and-building-control/Strategic-Planning/Local-Plan/Submission_2018/Tall_Buildings_Study_2018.pdf
- Ulusoy, Z., & Tokol, A. (2001). Arada” bir tasarım alanı: kentsel tasarımda farklı duruşlar. Mimarlık Dergisi, 302, 42-44.
- Varol, A, İ, (2009). Yapı-kent İlişkisi Bağlamında Karma Kullanımlı Yapılar, Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi Fen Bilimleri Enstitüsü, İstanbul.
- Watford Borough Council, (2016). Skyline - Watford’s Approach to Taller Buildings Supplementary Planning Document. [https://www.watford.gov.uk/downloads/file/939/skyline -
_watfords_approach_to_taller_buildings_-_supplementary_planning_document](https://www.watford.gov.uk/downloads/file/939/skyline_-_watfords_approach_to_taller_buildings_-_supplementary_planning_document)
- URL-1; <https://www.nbmcw.com/images/nbm-media/Articles/Green-Construction/29179-tallest20in2020.jpg>

**DEFINITION OF BRAND ARCHITECT THROUGH PRITZKER
ARCHITECTURE PRIZE-WINNING ARCHITECTS**

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ABSTRACT

The concept of brand is defined as symbols, signs and features that introduce a product or service and distinguish it from other competitors. Today, the concept has evolved into a significant trend not only for companies but also for buildings in the built environment. Certain designs, buildings or structures are identified with their architects; thus, it is possible to presume the architect of a structure once one sees it, without receiving any additional information. This circumstance equals the recognition of a product thanks to its high brand value even if it has not been imprinted with a logo. The aim of the study is to investigate the notion of brand identity and its reflections in the field of architecture. The definition of “brand architect” has been established through examining the characteristics and identifiable design language of architects who can be regarded as brands considering their projects. To institute an effective platform, the research population of the study was formed by Pritzker Award winner architects having contributed immensely to community and architecture with their talents and intuitions and sense of responsibility. In the realm of the study, applying data collection and tracing methods within the framework of qualitative research methods, an evaluation table was formed involving their websites, philosophies, architectural project theme distribution, varying basic design parameters, approaches towards formatting buildings and materials utilized. Making inferences regarding “becoming a brand” given the table involving the selected samples by the awarded architects and the parameters, the attitude through which brand identity is projected via architecture was endeavored to be attained. Consequently, it has been noticed that these architects, who have reached highest levels in their careers with the awards they have won, sign their buildings metaphorically employing a unique and recognizable design language; thus, they are consistent within themselves complying with all the requirements of the “brand architect” concept.

Keywords: brand architect, design identity, Pritzker Architecture Prize

PRITZKER MİMARLIK ÖDÜLÜ KAZANAN MİMARLAR ARACILIĞIYLA MARKA MİMAR TANIMI

ÖZET

Marka kavramı bir ürün ya da hizmeti tanıtan, rakiplerden ayrılmasını sağlayan simge, işaret ve özellikler olarak tanımlanmaktadır. Günümüzde bu kavram artık sadece şirketler için değil yapıları çevredeki binalar için de önemli bir trend haline gelmiştir. Bazı binalar mimarlarıyla özdeşleştirilir. Yapıyı görünce hiçbir ek bilgiye gerek duymadan mimarını tahmin etmek mümkündür. Bu durum marka değeri yüksek bir ürünü logosu olmadan tanımak ile eşdeğerdir. Bu çalışmanın hedefi marka kimliğinin tasarımını ve mimarlık alanındaki yansımalarını araştırmaktır. Marka olarak adlandırılacak mimarların inşa ettikleri tasarımların özellikleri ve tasarım yaklaşımları, projeleri üzerinden incelenerek “marka mimar” tanımı ortaya konulmuştur. Etkin bir tartışma ortamı oluşturmak için çalışmanın evreni; yetenekleri, önsözleri ve sorumluluk bilinciyle, topluma ve mimarlığa anlamlı katkılar sağlayan Pritzker Mimarlık Ödülü’ne sahip mimarlar ile oluşturulmuştur. Çalışmada nitel araştırma yöntemlerinden veri toplama ve iz sürme metotları kullanılarak; web siteleri, felsefeleri, mimari proje konu dağılımları, farklılaşan temel tasarım parametreleri, binaları biçimlendirme yaklaşımları ve projelerde kullanılan malzemeler başlıkları altında bir değerlendirme tablosu oluşturulmuştur. Seçilen ödüllü mimarların örneklerinin bulunduğu tablo ile parametreler gözetilerek marka olma yönünde çıkarımlar yapıp, marka kimliğinin mimari yardımıyla yansıtılmasındaki tutum elde edilmeye çalışılmıştır. Sonuç olarak, kazandıkları ödüller ile kariyerlerinde gelinebilecek en üst seviyede bulunan bu mimarların yapılarını kendine özgü ve ayırt edilebilir bir tasarım dili kullanarak metaforik olarak imzaladıkları, böylece marka mimarlar olarak kavrama ait tüm gereksinimler bakımından kendi içlerinde tutarlı oldukları fark edilmiştir.

Anahtar Kelimeler: marka mimar, tasarım kimliği, Pritzker Mimarlık Ödülü

INTRODUCTION

Branding, a major keystone of marketing, is evolving and has become a part of almost all domains of business life. It is gaining more and more significance day by day. Being a brand can not be defined as a result, it is a process.

It is probable to recognize the brand of some product just via its package, color or font, which means there is no need to look at the logo or an imprint displaying the name of the brand on the product. This is a result of the continuity and awareness of the brand identity. Branding process has begun to come to the fore in the construction sector and design as well as making a difference in every product or service field. Some structures introduce themselves with their specific features, granting a chance to guess or know the architect of it. The specific features can be considered as signatures. The architect's signature can be discerned through clues such as the design language, form, positioning, material selections and joints, space division, circulation, and even the graphics of the structure. This signature is formed by brand architects. The aim of this study is to investigate the design language of brand architects and to discuss criteria behind being a brand as an architect.

Becoming a brand architect entails the fact that the branding of the architect adds value not only to him/herself, but also to his/her designs. Thanks to the strong associations between these values inscribed and the inscribed designs that can be figured out, the awareness regarding and memorability of their designs increase. In addition, this situation increases the demand for such brand architects in the construction sector, increases the permanence of the brand created by the architect and strengthens the business networks and customer portfolio. The field of architecture is intertwined with many sectors, and the effect of recognition is apprehended in many structures designed and built. There exist several famous architects known as starchitects. The recognition of an architect as a brand depends on many different parameters such as his/her network in working and social life, his/her relations with media, power of his/her customer(s), the location of the structures s/he has designed, his/her working partners and institutions etc. However, the study focuses on the branding of the architect instead of recognition. The formation and development of a brand in architecture stands out with designs and construction methods. Thus, a brand can be examined through the light shed by his/her consistency with regard to the continuity of designs, such as the line of designs and his/her orientation related with the design approach by the discipline of architecture.

Within the scope of the study, first, literature review on the development of the brand concept and the branding process was conducted, and the concept of branding since 1920 was discussed, as 1920 was when it started to gain prominence, and the issue was researched over a period of about 100 years. Studies in the field of design and architecture were examined. The term "brand architect" was handled through the world-renowned Pritzker Architecture Award-winning architects. To keep it up to date, the architects chosen for the case were limited to the award recipients of 2021 and 2022. 2 distinct projects and websites of each architect were examined. The case was conducted for both architects, and upon the acquisition of the findings for the individual architects, each corresponding finding obtained was compared. Finally, the common results acquired from the case study were discussed, and the criteria(s) underlying the concept of brand architect were endeavored to be revealed.

CONCEPTUAL FRAME

The Definition to “Brand”

There appear various definitions some of which are similar to one another while there exist some diverging from each other to specify the concept of brand. Most of the definitions focus on recognizability, identifiability or differentiability of a product, place, or service.

According to Hirsch, a brand is an identification symbol formed by characteristic signs (Hirsch, 1948). Preston defines brand as encompassing both observable and inherent characteristics, such as its visual design, measurable capabilities, packaging, and any assurances or agreements associated with it (Preston, 1996). Moreover, there is also the view asserting that a brand, beyond its tangible features, includes aspects attributed to it by the consumer such as emotional connections, beliefs, and other intangible aspects (Farquhar, 1989).

Besides, a brand is essentially a seller's commitment to consistently deliver a specific set of features, benefits, and services to buyers. The brand name associated with a quality product is one of the most valuable assets a company can have (Kotler & Keller, 2014). Like Kotler and Keller, Etzel argues that a brand should include a name, term, sign, symbol, or design, or even a combination of these, intended to identify the goods or services of a seller or group of sellers and distinguish it from its competitors and establish a unique identity (Etzel, 2007). In this context, as an indicator of this value, the brand should be able to prove its uniqueness. Therefore, a brand can command a high price in the market and is the only element of a product that competitors sometimes cannot copy even if they try (Rachman & Mescon, 1996).

The prominence of the brand concept can be associated with the change in the focus of marketing since the 1970s. Marketing strategies which were only product-oriented have turned into consumer-oriented ones. This situation has led to the development of brand value, identity, and image, which are the cornerstones of the brand concept. The mentioned values are the most important factors considering the recognition, differentiation, and most importantly the association the brand arouses. Recognition of the brand or brand recognition is the consumer's familiarity with a product that s/he has experienced or seen, heard of, and perceived utilising the products in the same category. Recognition of the brand transitions into being permanent through the recall of the product or service. This means that the brand is associated with the consumer in a situation related to the product or service (Keller, 2012). Brand association constitutes an eminent element regarding the differentiation of the brand from its competitors.

“Brand” in the Discipline of Design

The discipline of design has been greatly influenced by the concept of branding. As buildings gained prestige with their designs in the 19th century, architects started to focus on creating unique designs that would bring recognition and prestige to their work. However, today, it is not just the design of the building that brings recognition and prestige, but also the signature of the architect. This has led to the emergence of the concept of the architect as a brand. (Rybczynski, n.d.). Researchers have applied various methods to comprehend how branding occurs in the process of architectural design. One of these methods has been investigating the processes that star architects go through to reach their level of success.

For instance, Michael o'Brien chose an architect (Frank Lloyd Wright) to research how the architect progressed towards stardom. Having looked into his biography, he analyzed the formal strategy of his works between 1982-1900 (milestone) with sketch plans and diagrams. In the conclusion section, Wright's process of creating his own spatial formation language with practice-based research in architectural design was briefly discussed and his strengths and weaknesses could be determined in this process.

Hakan Sağlam selected and examined the architects that are known by everyone, based on the covers of the times magazine. The conclusion of the study is while architects become starchitects, their design approaches have a crucial effect on this. However, their communication with firms, political power, economic situation, and self-promotion efforts pose almost the same impact as their creativity

Another study was carried out by Tuğba Cestel. The reflections of art movements on architecture were examined through examples by including the views of architectural critics. It is clear that the branding process of architects in architecture and architectural design generally emerges with the effect arising from the location of their buildings, promotion, environment, and what buildings they have built.

Architecture Awards

High-quality award programs allow to reflect the course of architecture, our architectural culture and what is valued. Awards can be considered as a backdrop to discuss, support, and publicize emerging thoughts of the profession (Mihaly, 2019). They can be shaped in harmony with current demands, concerns, and developments.

When it comes to architecture awards granted across the world, the most significant one that springs to mind is the Pritzker Architecture Prize, which has an international status. The Pritzker architecture awards are international awards having been given annually to the best architects since 1979. It was started to be given to strong, responsible, socially conscious architects with the aim of showing that their success is supported (“The Pritzker Architecture Prize,” n.d.).

THE METHODS EMPLOYED IN THE RESEARCH

First, the basic concepts that make up a brand were determined by the literature scrutiny. To examine the concept of brand in the field of architecture, it was decided to elaborate certain architects. For the selection of the architects whose works would be analyzed during this study to be objective and to reflect the present, the architects who received the globally accepted Pritzker Prize in 2021 and 2022 were selected. A case study was conducted by considering the structures on the architects' pages on Pritzker Prize's website., where the awarded architects are introduced, along with their philosophies and architectural project theme distributions. Furthermore, the architects' approach to design, the form and material choices they created were analyzed in detail. According to the analysis, a table was created examined architects, and common and distinctive aspects in their projects were determined. In the conclusion part, a possible set of criterias was determined via discussing the implications of branding with regard to both architects upon the study.

CASE STUDY

1. Kere Architecture (2022)

Francis Kéré, who was born in Burkina Faso, is an internationally renowned architect and the 2022 Laureate of the Pritzker Architecture Prize. Burkina Faso is one of the least educated and poorest countries in the world, and lacks clean drinking water, electricity, and infrastructure. His aim in architecture was influenced and inspired by his personal commitment to serving the society he grew up in and his belief in the transformative potential of beauty. He is known for his pioneering approach to design and construction sustainability.

Website

The architect reflects the simplicity of his designs onto his logo. The logo, which consists of simple lines and a clear and simple font selection, reveals the principle of “less is more” (Fig.1).

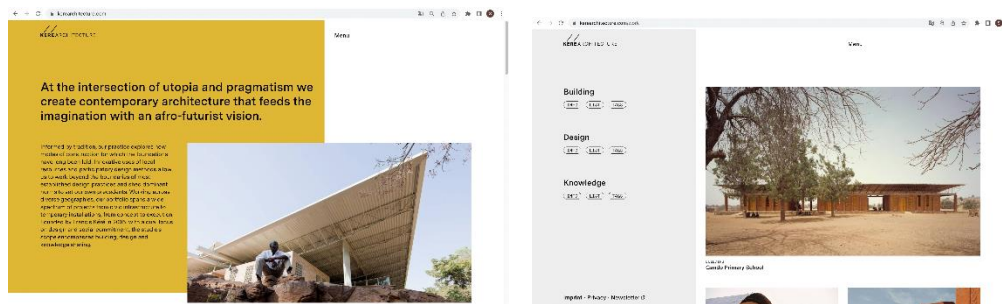


Figure 1. Images from Kere Architecture Website

The design of the website is simple, has an easy-to-understand interface. Only three different colors were preferred in the design of the website. Color choices have soft tones and are evocative of nature. Solid-void balance and the use of rhythm in his architectural approach are reflected on the design of the website.

The Philosophical Approach of The Architect

He defines his own philosophy as follows; "Architecture is primarily a service to humanity, to create an environment where a human being, whether s/he is rich or poor, can develop itself, can be happy, can have what I call wellbeing." I want my building to inspire the user and to make the user happy." (Ravenscroft, 2022). He focuses on the benefit of society and structures being environmentally friendly rather than expensive/luxury or eye-catching. He aims to raise the welfare of the community by means of his works.

He spread his approach in his designs to every part of his professional life. He is inspired by nature, uses natural materials, and realizes his designs in collaboration with the society. He

shares his knowledge with the society and his colleagues. In addition, he regularly follows innovations in architecture and related disciplines and constantly improves himself.

Architectural Project Theme Distribution

He is known for designing numerous schools and medical centers in Africa, particularly in Burkina Faso. All of these structures are compatible with the region and the people of the region and respond to their needs. Apart from these, he has designed many permanent and temporary installations and structures in various countries. His designed buildings or structures are not private like a house; they are designed to be used by the public and society.

Selected Works

1- Gando Primary School

It is a 520 sqm building which was built in Gando/Burkina Faso in 2001 with the collaboration of the community of Gando (Fig.2) (ArchDaily, 2016). It tries to solve the main problems, which are lighting and ventilation, of the educational buildings in the close environment.



Figure 2. Gando Primary School (Duchoud, n.d.)

The building is a quintessence of sustainable architecture employing local construction methods. The design of the school exhibits an integration of local and contemporary approaches. The integration is not only related with construction methods but also the collaboration of the architect with the local community.

A modest design language is marked. The building, which seems to be in harmony with its environment, has a simple design exempt from decorations. To describe it in the simplest way, the building consists of a simple rectangle, a sloping roof, and narrow openings. It is a single-storey building with rhythmic and symmetric openings.

The choice of materials directly reflects the region. Clay, which is abundant in the region and used in traditional house construction, was preferred as the main material. Clay-cement admixture was used for increasing structural strength (ArchDaily, 2016). The choice of material also determines the roof form. A wide and sloping roof was preferred to prevent rain damage.

2- Health and Social Welfare Center

The center, which is located at Laongo, Burkino Faso, encompasses 1340 sqm and was completed in 2014 (Fig. 3). It is constituted of three separated areas for different departments connected with each other by courtyards. Courtyards have a strong relation with the outside of the building. The facade has rhythmic openings to create a dynamic motif on the walls and to preserve the communication with environment.

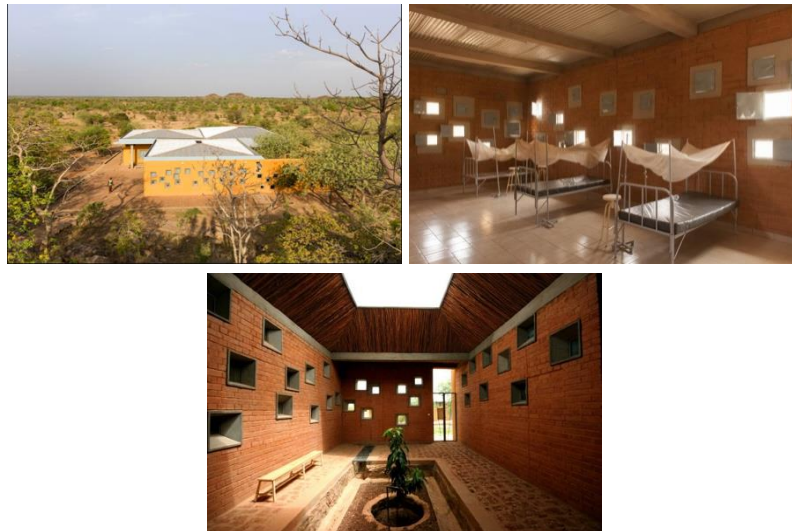


Figure 3. An Overview of the Health and Social Welfare Center

The building was designed in a harmony with the region and is in constant interaction with the environment. This approach is supported by both the plan and the choice of materials.

While planning the building, natural ventilation was prioritized. Cold air enters through low openings in the outer walls and exits the courtyards through openings. In the simplest explanation, it consists of 4 orthogonal parts 3 of which are used as indoor spaces with courtyards and 1 of which as an open space. The structure, which has a basic form, is diversified via openings.

Locally produced clay bricks were utilized as the main construction material. Laterite stones found in the area were applied to pave the floor. Materials such as eucalyptus wood, which are easily found in the region, were used for the roof.

For Kere Architecture, as it can be realized, the architect has a design approach that has simple forms and cares for function. In addition, the buildings harmonize with the region from many perspectives such as solid-void relations and material selection. The harmony between design and region was also supported by the scale of the buildings and their functions. The minimalist and sustainable design approach is also reflected on the website, which is the architect's gateway to the world.

In short, the architect's buildings reflect his design approach, architectural choices and brand identity given every detail. In this case, it can be mentioned that the architect reveals the recognizability of the brand created by him.

1. Lacaton-Wassal Architects (2021)

The office was founded in Paris in 1987 by Anne Lacaton and Jean-Philippe Vassal. The team designing private and social housing, cultural and academic institutions, public spaces and urban strategies prioritizes ensuring free space utilizing economic and ecological materials. Their designs have traces of social justice and sustainability (“Anne Lacaton and Jean-Philippe Vassal,” 2021) .

Website

The website has a simple and formal interface. There are a few colours, texts and shapes applied. It is functional rather than aesthetic, as its design is based more on concern for functionality rather than aesthetics (Fig. 4).

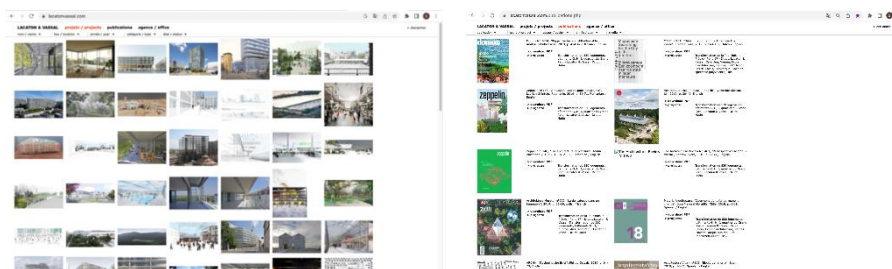


Figure 4. An Image from Lacaton-Wassal Architects website

Philosophical Approach of The Architect

They explain their philosophy as an approach to architecture based on principles of generosity, economy, serving life and usage (“Anne Lacaton & Jean-Philippe Vassal: Design Approach

and Process,” 2018). They regard architecture as a reflection of freedom on the use of space. They prioritize the creation of innovative and functional space. The users can be organizing spaces to allow many types of functionalities in their designed buildings of the architectural office.

The project must also be efficient and smart in its innovative approach to sustainability – an approach based not only on an economy of material and energy, but also on the superior quality of space and the engagement of the users in sustainable relations to their comfort within the building. Another focus of their philosophical approach regards physical entities and continuous relationship. They not only wish to ensure sustainability in terms of the issues such a materials and energy, but also the relationship and communication among the people utilizing the building.

Architectural Project Theme Distribution

Lacaton-Vassal Architects work on social and private housing in general. They do not only design new buildings but also renew old ones. They attach importance to transformation projects pursuing an innovative perspective. Besides social housing, they have been designing projects for urban strategies, public space, and cultural-academic institutions.

Selected Works

1- Maison Latapie

The house, which synchronizes with the street it is on, was planned for a small family with a low budget based on the aim to facilitate the transformation of the facades in terms of residential needs. The house, constructed in 1993, is 185 sqm and located in Floirac, France (Fig.5).



Figure 5. Maison Latapie (Philippe Ruault, n.d.)

The house, which can adapt to all seasons, can be opened in hot weather in the summer and closed in the winter. It means the house has a flexible design. In this way, energy saving methods were further provided as an addition to comfort. It can be stated that the house built

on a low budget allows the inhabitants to lead a life continuously saving money as it reduces the costs of living.

The house can be described as two intertwined rectangles. The fact that its façade is mobile provides a dynamic and variable appearance. It can even be described as a mass alive.

Metal frame, opaque fiber-cement sheeting, transparent polycarbonate, and wood materials were employed in the construction of the building. In line with the different parts of the house and their varying functions, the materials were chosen specifically for each part and combined considering function.

2- 53 habitations HLM

It is a collective housing project built in 2011. The Project is located in Saint-Nazaire, France. The housing project, designed for low-income groups, covers an area of 6013 sqm (Fig. 6).



Figure 6. 53 Habitations (Philippe Ruault, n.d.)

The aim of the architects is to create a flexible, modern and spacious place that is far from standard apartments despite its nature as a collective living space. It intends to offer the opportunity to escape collective spaces equipping each home with its individual space through verandas and exterior spaces that expand the rooms. Usage capacity, variety of space and climatic atmosphere can be altered in synchrony with arisen needs.

Rectangularly planned houses organize residential blocks in a way to resemble strips, which creates an instantly recognizable dynamic rhythm ensured via variable space sizes and terrace use. The cycle breaks the formal and straight form of the structure.

The building system is composed of steel frame and concrete slab flooring. Transparent polycarbonate creates exterior façade and sliding aluminum joinery creates interior faces. And also, thermal curtains are used as insulation material at windows.

For Lacaton-Wassal Architects; rectangular form, flexible façade and space designs are the main properties regarding the projects under examination. Besides concrete and metal, they are noted to also opt for making use of glass in their constructions. Just as their structures have the same rhythm, their website designs have a single interface on almost every page. Another foreground detail noticed is that the photographs were taken by the same photographer, which allows seeing these projects from a similar perspective. In this case, we can assume that the team embeds a similar design language into its structures and prefers employing the same materials. Those having viewed different structures will probably recognize the owner of the design owing to the fact that the team, which has consistent choices within itself, has transformed into a brand.


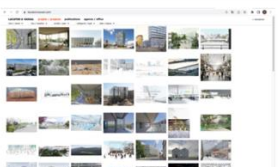
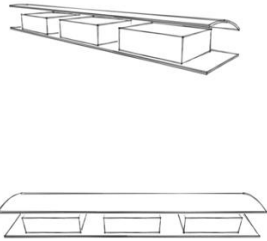
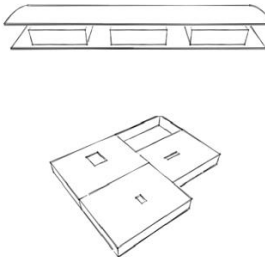
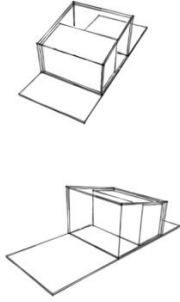
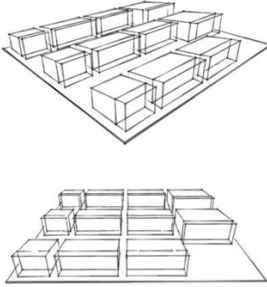




CONCLUSION

The concept of brand architecture and its role in the field of architecture have been examined in the realm of this article. The study has revealed that the branding of an architect is a significant factor in creating a unique identity for their designs and in increasing the demand for their work. The Pritzker Architecture Award-winning architects were analyzed as case studies, and commonalities and differences with respect to their approach to design were determined. This study also proposed a set of criterias to be a brand architect including continuity of pursued design decisions, and increased awareness and memorability of designs. It is important to note that this study focused on the branding of an architect, not on their recognition. The recognition of an architect as a brand depends on various parameters such as their work and social environment, media personality, and the institutions they work with (Table 1). However, the branding of an architect adds value not only to themselves but also to their designs, strengthens their business networks and increases their customer portfolio.

Upon the examination of both cases, it was found that they have common and different aspects when they are compared to each other. First of all, both cases agree on issues such as design language, material selection, and unit scale. For instance, Kere prefers building his buildings utilizing the natural materials of the region, while Lacaton-Wassal chooses to use today's construction materials such as metal, glass, and concrete together. While Kere Architecture designing fixed spaces for needs, Lacaton-Wassal Architects creates flexible spaces that can be altered in accordance with different and instant needs. Moreover, what they are designing

have similarities with their other works. Another point is the website; Kere design reflects its architectural understanding which has inspirations of nature, Lacaton-Wassal reflects their minimal and function focused design concept. The mentioned points have in line with their own philosophical approaches.

Table 1. Comparison of the cases

	Kere Architects		Lacaton-Wassal Architects	
Website	 color choices are evocative of nature, simple and holistic design that created via small parts		 least color selection (b-w), purely functional, simple	
Philosophy	attaches importance to function in harmony with nature collaborative approach with community local		flexible space ergonomic and economic design sustainability unornamented	
Project Distribution	schools medical centers gathering places installations		social housing public spaces cultural-academic institutions renovation	
Abstraction of Form	Gando Primary School 	Centre for Health and Social Welfare 	Maison Latapie 	53 habitations 
	forms are created by combining small parts balanced solid-void relation repetitive rhythmic spaces		double-walled entire form orthogonal design	
Facade				
	continuous connection between indoor and outdoor rhythmic openings natural texture		adaptive facade double-skin gridal	
Material	clay-cement hybrid	locally produced clay bricks, laterite stones, eucalyptus wood	metal, fiber-cement, polycarbonate, wood	steel, concrete, transparent polycarbonate, aluminum

The consistency and continuity discussed here are not only related to the establishment of the architectural language, but also to the formation of the brand. Anyone who knows about these architects can guess whom these structures are by upon viewing one of them. Also, they are aware of whom they may be confused by.

Consequently, the findings of this study suggest that the branding of an architect is a crucial factor in creating a unique identity for their designs and increasing their demand in the construction sector. Therefore, architects should focus on developing a distinct design language and style that reflects their unique perspectives and approaches, as this will help them build strong brands that are recognized and valued by clients and peers alike. To conclude, while architects transform into a brand, they create similar recall features in their designs to create similar spatial cognition.

REFERENCES

- Anne Lacaton and Jean-Philippe Vassal. (2021). Retrieved January 12, 2023, from <https://www.pritzkerprize.com/laureates/anne-lacaton-and-jean-philippe-vassal>
- anne lacaton & jean-philippe vassal: design approach and process. (2018, February). Retrieved April 13, 2023, from Aut website: <https://aut.cc/magazin/aut-feuilleton/anne-lacaton-jean-philippe-vassal-design-approach-and-process>
- ArchDaily. (2016, April 22). Gando Primary School / Kéré Architecture . Retrieved January 11, 2023, from <https://www.archdaily.com/785955/primary-school-in-gando-kere-architecture>
- Duchoud, S. (n.d.). Gando Primary School. Photo. Retrieved January 10, 2023, from Kere Architecture website: <https://www.kerearchitecture.com/work/building/gando-primary-school-3>
- Etzel, M. J. (2007). *Marketing* (14th ed.). Irwin/McGraw-Hill.
- Farquhar, P. H. (1989). Managing Brand Equity. *Marketing Research*, 1(3), 24–33.
- Hirsch, E. (1948). *Ticaret Hukuku Dersleri* (3rd ed.). İstanbul: İsmail Akgün Matbaası.
- Keller, K. (2012). *Strategic Brand Management: Building, Measuring, and Managing Brand Equity* (4th ed.). London: Pearson.
- Kotler, P., & Keller, K. (2014). *Marketing Management* (15th ed.). Pearson.
- Mihaly, W. (2019, September 9). Redefining the metrics of success. Retrieved January 14, 2023, from <https://parlour.org.au/opinion-analysis/redefining-the-metrics-of-success/>
- Preston, I. (1996). *The Great American Blow-Up: Puffery in Advertising and Selling* (2nd ed.).
- Rachman, D., & Mescon, M. (1996). *Business Today*. McGraw-Hill.
- Ravenscroft, T. (2022, March 16). “Architecture is primarily a service to humanity” says Pritzker Architecture Prize-winner Diébédo Francis Kéré. Retrieved April 10, 2023, from Dezeen website: <https://www.dezeen.com/2022/03/16/pritzker-architecture-prize-diebedo-francis-kere-video/>
- Ruault, Philippe. (n.d.). 53 habitations HLM. Retrieved January 10, 2023, from <https://www.lacatonvassal.com/index.php?idp=58>
- Ruault, Philippe. (n.d.). Maison Latapie. Retrieved January 10, 2023, from <https://www.lacatonvassal.com/index.php?idp=25>
- Rybczynski, W. (n.d.). *Architectural Branding*. Philadelphia.
- The Pritzker Architecture Prize. (n.d.). Retrieved January 10, 2023, from <https://www.pritzkerprize.com/about>

AIR CATHODE AND GEL ELECTROLYTE CONSTRUCTION FOR METAL AIR BATTERIES

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ABSTRACT

The air cathode and electrolyte play an important role in metal air batteries. The air cathode is one of the essential components of a metal air battery. It usually consists of a gas diffusion layer, current collector and active catalyst. The gas diffusion layer consists of a carbon material and a binder. The diffusion layer only needs to be made air permeable and prevent water permeability. Current collectors are usually external. The catalytic active layer is where an electro catalyst, carbon material and binder are located, where the reduction reaction of oxygen takes place. We have demonstrated that graphite sheets coated with activated carbon (AC), manganese dioxide (MnO₂) and other additives are a promising cathode for metal air batteries. We achieved superior performance at significantly higher than the liquid alkaline electrolyte by using gel electrolyte. Gel electrolyte production containing different additives have been studied in order to increase the efficiency of aluminum air battery. Soft and firm gels have been obtained depending on the water retaining polymer ratio.

Keywords: Metal air battery, air cathode, graphite, current collector, gel electrolyte

INTRODUCTION

Metal-air batteries have attracted considerable attention for the last five decades due to the fact that they have a much higher specific energy than most currently available primary and secondary batteries as the cathodic reaction-oxygen comes from the air rather than inside the battery (Li and Lu, 2017). A typical metal-air battery (Rahman et al., 2013) is composed of a metal or metal alloy anode, an air cathode and an alkaline or brine electrolyte.

The cathode and electrolyte play an important role in these batteries (Danner et al., 2016). The materials used in the air-breathing conductive layer of air cathodes must have a porous structure allowing the passage of air and be lightweight (Pino et al., 2015). In metal-air batteries, although the cathodic oxygen reactions are airborne, there must be an air permeable cathode in order to support the fast kinetics of oxygen reduction reaction (ORR) (Flegler et al., 2016; Cao et al., 2003; Gao et al., 2014; Ge and He, 2015; Wu et al., 2016; Yang et al., 2017; Zhang et al., 2009; Zhang et al., 2014; Fu et al., 2016; Li et al., 2016; Songa et al., 2015; Zhang et al., 2017). Generally, in these batteries the cathode constitutes the highest percentage of the total cost and the structure of the cathode limits higher power production. For this reason, it is important to improve the performance of air cathodes using low-cost and environmentally-friendly materials.

The fundamental components of the future energy network are electrochemical energy storage devices. It is important for supporting unaccounted for energy production and supply from renewable sources. Lithium-ion batteries have played an important role since their creation. they entered all areas of our lives. Efforts are made to continually improve energy and power densities despite significant performance. This need has become increasingly important in recent years to electrify transport and increase stationary energy storage. (Dunn et al., 2011; Lue et al., 2016). Traditional Li ion technology is now approaching the limits of 15 performance. Recent developments to the Li ion battery may supply up to an extra 30% rise in energy density (Van Noorden, 2014). If traditional Li ion batteries are utilized to power electrical vehicles, the top of express that it can be competitive to receive extended driving distance. Thus, new systems and new chemistry are being searched for an aimed energy density actively.

Metal air batteries have gotten stimulated interest between a few potential applicants. Metal air batteries are collected with a metal anode, an air cathode and an electrolyte. The alkali metals can be metal anode such as Lithium (Li), Sodium (Na) and Potassium (K) or such as Zinc (Zn) and Iron (Fe) which are first row transition metals. And electrolyte can be aqueous

or non aqueous (Li and Lu, 2017). According to structure of the anode the air cathode frequently has a light spongy structure that allows permanent oxygen providing from enclosure air.

Air catalyst and cathode design plays important role to increasing battery performance. In metal air batteries, air cathode determines performance of electrode since ORR is a highly severe reaction. This reaction fundamentally becomes the three stage at the air cathode where the solid electrode is at the same time interfaced with liquid electrolyte and O₂. As a result, producing active air catalysts to accelerate the ORR kinetics and designing proper electrode structures to expand the three stages would properly advantage the battery efficiency.

RESEARCH AND FINDINGS

Construction of Air Cathode

The air cathode is one of the essential components of an Al air battery. It usually consists of a gas diffusion layer, current collector and active catalyst. The gas diffusion layer consists of a carbon material and a binder such as hydrophobic Polytetrafluoroethylene (PTFE). The diffusion layer only needs to be made air permeable and prevent water permeability. Current collectors are usually external. It can made of a Ni metal mesh that can be connected to the circuit and enhances the electron transfer process. The catalytic active layer is where an electro-catalyst, carbon material and binder are located, where the reduction reaction (ORR) of oxygen takes place.

Air electrode has major problems. The slowing down of the oxygen reduction reaction will lead to inefficiency of the electrode. This problem can be improved by choosing the appropriate catalyst. Closing the air-permeable pores of the air cathode cuts the contact with air, so the battery stops working, so a gas diffusion layer should be created so as not to block the system. Carbonate precipitation is another problem. Atmospheric CO₂ can react with alkaline solution and precipitate. It reduces the conductivity of the electrolyte and the air cathode activity. Using pure oxygen or low-CO₂ air reduces this risk. One of the most important problems is leakage of battery solution into the outside environment. It will cause the solution to evaporate and the battery to stop working. If it is can be prevented by hydrophobic air cathode (Mutlu, 2018).

Air cathodes, fuel cells, metal air cells and some have been proven that they are essential electrodes in electrolyzers (Siroma et al., 2003), (Kliskic et al., 1998), (Shibata et al., 2003). In the gas diffusion electrode, the contact zone with the reactant, electrolyte and catalyst as

the three-phase zone is named. Porous electrode structure, binder such as PTFE spread on high surface area carbon black held with materials It consists of an electrocatalyst.

The air cathode for a metal air battery is one of the necessary component. In this study, graphite-based cathode has been used.

In this work, the air cathode consists of a conductive layer, a catalytic layer providing the formation of reactions, and a layer that allows gas passages but does not allow water passage. The material to be used in the conductive layer used in air cathodes must have a porous structure allowing air passages and be lightweight. The catalyzer shows the layer containing activated carbon, manganese dioxide. This layer is made on the surface of the conductive plate which will come into contact with the electrolyte.

The catalyzer to be made (activated carbon, manganese dioxide) is weighed on a precision scale and placed in a container of the appropriate size according to the amount of material is shown that in Figure 1. Add 1 ml of the previously prepared powdered polyvinyl alcohol (PVA) for each gram of material and mix with glass mixer for 1 hour. The cabin mouth is closed and left to rest for 5 hours. During this time, it is stirred for 10 minutes every 1 hour.



Figure 1. PVA adhesive in the syringe is added to the container with AC and MnO₂.

The previously prepared conductive graphite is placed on a properly placed plate. the prepared solution is sprayed on the graphite sheet by dropping and allowed to dry for 24 hours at room temperature is shown in Figure 2. Solvents that dry at room temperature form a thin film on the graphite sheet.

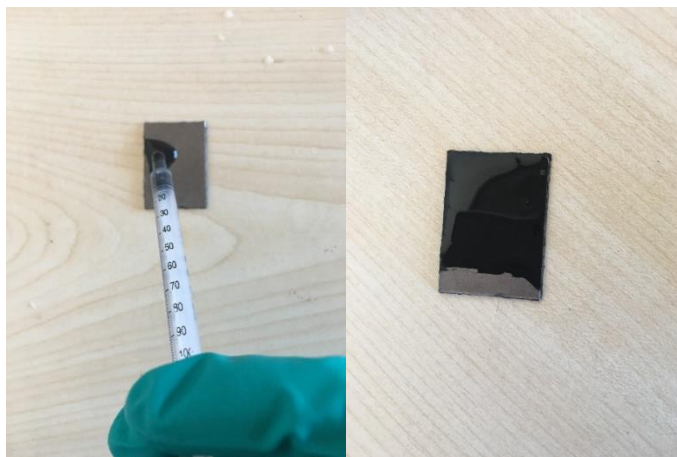


Figure 2. Prepared solution is sprayed on the graphite sheet by dropping.

Construction of Gel Electrolyte

Such power sources are basically an alkali or a saline electrolyte uses. Regarding alkali electrolytes, solutions of Potassium hydroxide (KOH) and Sodium hydroxide (NaOH) at 3,5 M concentrations have been shown to be the best in terms of the solubility of the reaction product $Al(OH)_3$. NaOH is recommended as the preferred electrolyte because it does not allow the KOH solution to be recovered by the industrial Hall Hérault process, because potassium ions have deleterious effects on the cathode of the electrolysis cell (Doche et al., 1997). Air cells powered by such electrolytes provide higher power / energy density compared to saline electrolytes.

Gel electrolyte production containing different additives have been studied in order to increase the efficiency of aluminum air battery. Soft and firm gels have been obtained depending on the water retaining polymer ratio.

Solutions containing sodium hydroxide (NaOH) and zinc oxide (ZnO) in an aqueous solution were prepared and added with water retaining polymer for gelation. A commercially available water-retaining polymer to be used in agriculture is used here.

Alkaline gel electrolyte was obtained by preparing a mixture of 6M NaOH solution containing ZnO additive (Liu et al. 2016) as a corrosion inhibitor and water retainer. NaOH (3.148 g) was dissolved in 12 ml of distilled water is shown in Figure 3, and ZnO (10% of NaOH weight) was then added.



Figure 3. Images of weight of NaOH in distilled water, after addition ZnO in solution (before mixing of solution), and then one hour mixing of solution.

The solution is transferred to a glass or plastic container that does not react with NaOH. For the gel agent, 0.6 g of water-retaining grains were added. After water-retaining grains were added, solution began to become gel form. That solution transferred to syringe for using easily on metal-air battery. And the solution took the form of a gel was shown in Figure 4.



Figure 4. The gelling process of solution.

CONCLUSION

Metal air batteries, which take their place among the energy storage systems, are in the development stage. Air cathode and electrolyte are two very important elements for metal air batteries. The aluminum air cell, which is one of the metal air cells, has promising results for the air cathode and gel electrolyte we have prepared.

In this study, a simple method for producing cheap and environmentally-friendly air cathode and NaOH gel electrolyte were prepared for metal air batteries.

The cathode was cost-effective, easy to produce, time-saving and environmentally-friendly, thus meeting the basic requirements for scaling up air cathode technology.

Gel electrolyte based on water-retaining polymer was prepared to improve the capacity and energy densities of the alkaline metal air cell by avoiding leakage of electrolyte from the cell. The softness or hardness of the gel electrolyte depends on the amount of water-retaining polymer used.

REFERENCES

- Cao, Y. L., Yang, H. X., Ai, X. P., Xiao L. F. (2003). The Mechanism of Oxygen Reduction on MnO₂-catalyzed Air Cathode in Alkaline Solution, *Journal of Electroanalytical Chemistry*, 557, 127-134.
- Danner, T., Eswara, S., Schulz, V. P. and Latz, A. (2016). Characterization of Gas Diffusion Electrodes for Metal-air Batteries, *Journal of Power Sources*, 324, 646- 656.
- Doche, M. L., Novel-Cattin, F., Durand R., Rameau, J. J. (1997). Characterization of Different Grades of Aluminum Anodes for Aluminum/air Batteries, *Journal of Power Sources*, 65, 197-205.
- Dunn, B., Kamath, H., Tarascon, J.M. (2011). Electrical Energy Storage for the Grid: A Battery of Choices, *Science*, 334, 928.
- Flegler, A., Hartmann, S., Weinrich, H., Kapuschinski, M., Settelein, J., Lormann, H. and Sextl, G. (2016). Manganese Oxide Coated Carbon Materials as Hybrid Catalysts for the Application in Primary Aqueous Metal-Air Batteries, *Journal of Carbon Research*, 2(1), 4-17.
- Fu, Z., Li, K., Pu1, L., Ge, B. and Chen, Z. (2016). Waterproof Breathable Membrane Used as Gas Diffusion Layer in Activated Carbon Air Cathode Microbial Fuel Cells, *FUEL CELLS* 16(6), 839–844.
- Gao, M., Sheng, W., Zhuang, Z., Fang, Q., Gu, S., Jiang, J., Yan, Y. (2014). Efficient Water Oxidation Using Nanostructured α -Nickel–Hydroxide as an Electrocatalyst, *J. Am. Chem. Soc.* 136, 7077–7084.
- Ge, Z., and He, Z. (2015). An Effective Dipping Method for Coating Activated Carbon Catalyst on the Cathode Electrodes of Microbial Fuel Cells, *RSC Advances*, 5, 36933-36937.
- Kliskic, M., Radosevic, J., Gudic, S, Smith, M., (1998). Cathodic Polarization of AlSn Alloy in Sodium Chloride Solution, *Electrochimica Acta*, 43, 3241-3255.
- Liu, J., Wang, D., Zhang, D., Gao, L., and Lin, T. (2016). Synergistic Effects of Carboxymethyl Cellulose and ZnO as Alkaline Electrolyte Additives for Aluminium Anodes with A View Towards Al-air Batteries, *Journal of Power Sources*, 335, 1-11.
- Liu, Y., Sun, Q., Li, W., Adair, K. R., Li, J. and Sun X. (2017). A Comprehensive Review on Recent Progress in Aluminum-air Batteries, *Green Energy & Environment*, 2, 246-277.
- Mutlu R. N. (2018). Al-hava pili için verimli elektrot-elektrolit araştırılması, Çukurova University, PhD Thesis.
- Pino, M., Chacón, J., Fatás, E., and Ocón, P. (2015). Performance of Commercial Aluminium Alloys as Anodes in Gelled Electrolyte Aluminium-air Batteries. *Journal of Power Sources* 299,195-201.
- Rahman, M. A., Wang, X. and Wen, C. (2013). High Energy Density Metal-Air Batteries: A Review, *Journal of Electrochemical Society*, 160(10), A1759-A1771.
- Shibata, M., Furuya, N., (2003). Simultaneous Reduction of Carbon Dioxide and Nitrate Ions at Gas-Diffusion Electrodes with Various Metallophthalocyanine Catalysts, *Electrochimica Acta*, 48, 3953-3958.
- Siroma, Z., Sasakura, T., Yasuda, K., Azuma, M., Miyazaki, Y., (2003). Effects of Ionomer Content on Mass Transport in Gas Diffusion Electrodes for Proton Exchange Membrane Fuel Cells, *Journal of Electroanalytical Chemistry*, 546, 73-78.
- Songa, S., Wu, M., Liu, Y., Zhu, Q., Tsiakaras, P. and Wang, Y. (2015). Efficient and Stable Carbon-coated Nickel Foam Cathodes for the Electro-Fenton Process. *Electrochimica Acta*, 176, 811–818.
- Van Noorden, R. (2014). The Rechargeable Revolution: A Better Battery. *Nature*, 507, 26.

- Wu, G., Santandreu, A., Kellogg, W., Gupta, S., Ogoke, O., Zhang, H., Wang, H. L., and Dai, L. (2016). Carbon Nano Composite Catalysts for Oxygen Reduction and Evolution Reactions: From Nitrogen Doping to Transition-Metal Addition, *Nano Energy*, 29, 83-110.
- Yang, W., Kim, K. Y., Saikaly, P. E. and Logan, B. E. (2017). The Impact of New Cathode Materials Relative to Baseline Performance of Microbial Fuel Cells All with the Same Architecture and Solution Chemistry, *Energy and Environmental Science*, 10, 1025-1033.
- Zhang, F., Cheng, S., Pant, D., Bogaert, G. V. and Logan, B. E. (2009). Power Generation Using An Activated Carbon And Metal Mesh Cathode In A Microbial Fuel Cell. *Electrochemistry Communications*, 11, 2177–2179.
- Zhang, P., Li, K. and Liu, X. (2014). Carnation-Like MnO₂ Modified Activated Carbon Air Cathode Improve Power Generation In Microbial Fuel Cells, *Journal of Power Sources*, 264, 248-253.
- Zhang, E., Wang, F., Yu, Q., Scott, K., Wang, X. and Diao, G. (2017). Durability And Regeneration Of Activated Carbon Air-Cathodes In Longterm Operated Microbial Fuel Cells, *Journal of Power Sources*, 360, 21-27.

**PERFORMANCE OF ALUMINUM AIR BATTERY FOR DIFFERENT
DEMONSTRATED CATHODES**

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ABSTRACT

Aluminum (Al) air batteries use ambient air that reduces their weights have a significant role in energy storage with their high energy density. Aluminum based batteries that convert chemical energy into electrical energy. Al anode is light, high energy density, safe, inexpensive, abundant, non-toxic, high energy storage capacity, high theoretical power density and easily recycled. We have demonstrated that promising cathodes for metal air batteries. Several low-cost, environmentally-friendly air cathodes were fabricated and their performances were tested by constructing Al air batteries whose electrolyte was gelled by adding a cost-effective water retainer. The results obtained from the measurements made using the battery testers. At all measurements discharge current is $1.5\text{mA} / \text{cm}^2$. The experimental results showed that this new Al air battery had a good discharge performance.

Keywords: Aluminum air battery, cathode, electrolyte, discharge

INTRODUCTION

Al air batteries are devices that produce electrical energy from chemical energy. Al air batteries are superior to other recently popular batteries has properties. The biggest factors in this; easy design, durability, safety concerns, environmental friendliness, aluminum resources are abundant and can be considered to be recycled. Studies have been going on for many years. Al air battery is a device that converts chemical energy of the reaction between oxygen present in the air with Al as fuel into electrical energy. In an Al air battery, all energy is stored at the anode, and oxygen is usually it is provided from the surrounding air. A cell consists of three main components. The first one is anode which oxidized during discharge and generates electrons to transmit them to an external circuit. The second one is cathode with reduction reactions during discharge and the part that accepts electrons from the external circuit. The last one is electrolyte that provides the medium for the transfer of ions between the anode and cathode.

Once discharge of the battery was activated Al anode was oxidized, provided the required electrons generates electric energy as shown in Figure 1. Due to reaction of Al(OH)_3 and NaOH , aluminate was also produced and cause passivation of anode and end of battery life because of accumulation of aluminate on the surface of the anode (Pino et al., 2015).

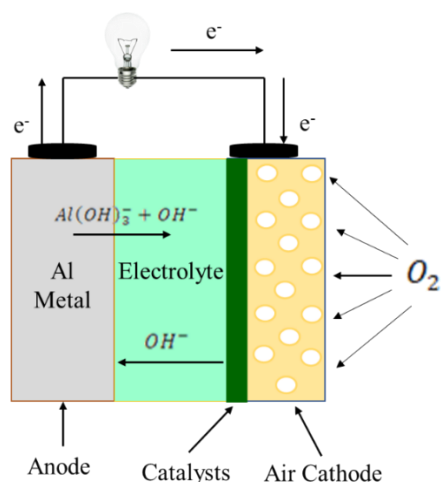


Figure 1. Schematic illustration of Al-air battery

The importance of aluminum as an anode was first described in the late 19th century. It was realized when it was used in Buff Cell (Tommasi, 1889). Alkaline Al-air One of the vital properties of an anode to be used in the battery system is that impurities are features. An example of this is iron which can cause rapid corrosion in open circuits. can be given (Zhao and Frankel, 2007). Doche et al., 1997 different purity degrees of aluminum anodes and iron impurity in 1 M NaOH showed that aluminum anode causes higher corrosion rate. As a result, aluminum as pure as possible it is recommended to use. However, by Souza and Vielstich, (2003) As stated, due to the high cost and corrosion of this grade pure aluminum, the overall thermodynamic efficiency of the battery they said. According to the same authors, significantly reducing the cost of the battery high purity (99.8%) water resistant metal anode instead of super purity it is recommended to use.

Aluminum alloys as anode materials in energy sources they are widely used and are also the most widely used alloys for cathodic protection of ships and other marine metallic structures. Considering the use of aluminum alloys in power supplies applications, it should be noted that Al air batteries are the most tested power supplies as described.

Aluminum anode in a battery application must have some properties. It should have high electronegativity to ensure a sufficient current flow. There must be a high electricity production per gram of anode consumed and the metal should have a low cost. Also it must be resistant to open circuit corrosion must have a low hydrogen density ratio during discharge should supply high voltage to the battery (Reding et al., 1966).

Aluminum alloys are also widely used for cathodic protection in sea water. An alloy anode material for an Al-Air battery in seawater electrolyte, it can also be used for cathodic protection in sea water. Pure aluminum is partially suitable for alkaline batteries, but in salt water It never ensures proper use and therefore each application requires the development of a specific alloy range (Mutlu, 2018).

DESIGN OF AL AIR BATTERY

In this work, many studies have been conducted to obtain an efficient Al air battery. In the first phase of the work, a great deal of time is devoted to design. There have been many design attempts made by us. After deciding on the design, our second focus was on electrolyte. We have designed many batteries using liquid electrolyte but we could not get the result we wanted from this electrolyte. As a result of this, we made gel electrolyte and greatly contributed to our efficiency. Our third important work topic was air cathode construction. The air cathode for an Al air battery is one of the necessary component. In this study, graphite-based cathode has been used. On the graphite-based cathode, different types of additives for catalyzer have been made as thin film. Additives are; Active Carbon (AC), Manganese Dioxide (MnO_2), Carbon Black (CB), Borax, Phosphour (P), Nickel (Ni).

1050 aluminum alloy sheets were used as anodes is shown in Figure 2. Aluminum plate is used rectangular form and gel electrolyte part is used in circular form for our test battery in Figure 2.



Figure 2. Anode part of test battery, gaskets and the air-contact face is covered with commercial teflon tape film.

First, the gaskets were glued to the front and back of the electrolyte reservoir is shown in Figure 2. An aluminum anode and back support plate were mounted in the electrolyte chamber. 0.30ml of gel electrolyte was placed in the electrolyte reservoir in Figure 3. An air layer and front support plate were placed on the front of the electrolyte reservoir is shown in Figure 3. The bolts were then fastened.

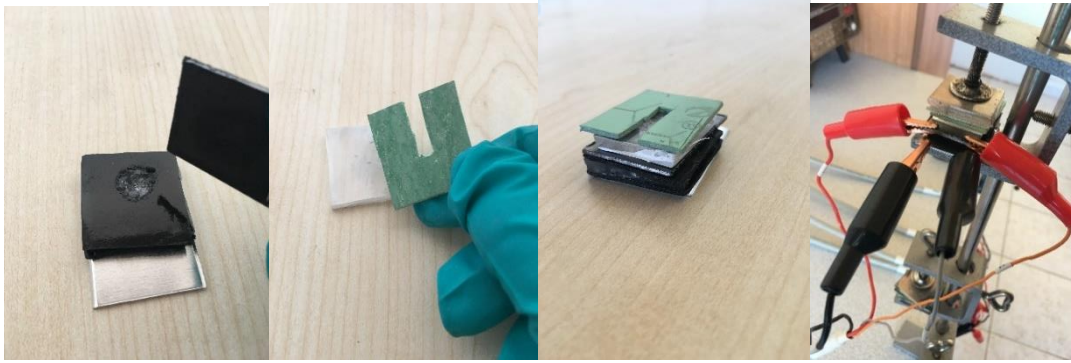


Figure 3. Contact moment of the air cathode, air intake part and test battery.

RESULTS AND DISCUSSIONS

The developed cathode is produced by making a thin film with Polyvinyl alcohol (PVA) in different proportions of additives (Active Carbon (AC), Manganese Dioxide (MnO_2), Carbon Black (CB), Borax, Phosphour (P), Nickhel (Ni)) on a graphite plate containing current collecting tip and by covering the air contacting surface with a thickness of $25\mu\text{m}\sim 75\mu\text{m}$ of teflon tape. The produced gel electrolytes and cathodes have been tested by design in Al air battery. The masses of each additive used in Table1 are given. If the catalyst density is too high, the weight of the battery increases and the gas permeability of the cathode decreases. If the catalyst concentration is low, the reaction rate decreases and the capacity of the battery decreases.

Table 1. Masses of additives for catalyzer

	AC	MnO ₂	CB	Borax	P	Ni	Ag
Cathode 1	1g						
Cathode 2		1g					
Cathode 3	0,5g	0,5g					
Cathode 4			1g				
Cathode 5	0,5g	0,4g	0,1g				
Cathode 6	0,5g	0,4g		0,1g			
Cathode 7	0,4g	0,4g	0,1g	0,1g			
Cathode 8	0,5g	0,4g	0,1g				1 drop
Cathode 9	1g	0,4g	0,2g		0,2g		
Cathode 10	0,9g		0,1g				
Cathode 11	1g		0,2g		0,3g		
Cathode 12						1g	
Cathode 13	0,5g					0,5g	

Discharge experiments were carried out for 13 different cathodes. Each experiment was repeated 2 times. All the batteries used gel electrolyte containing 6M NaOH. The results obtained from the measurements made using the battery tester. At all measurements discharge current is 1.5mA / cm².

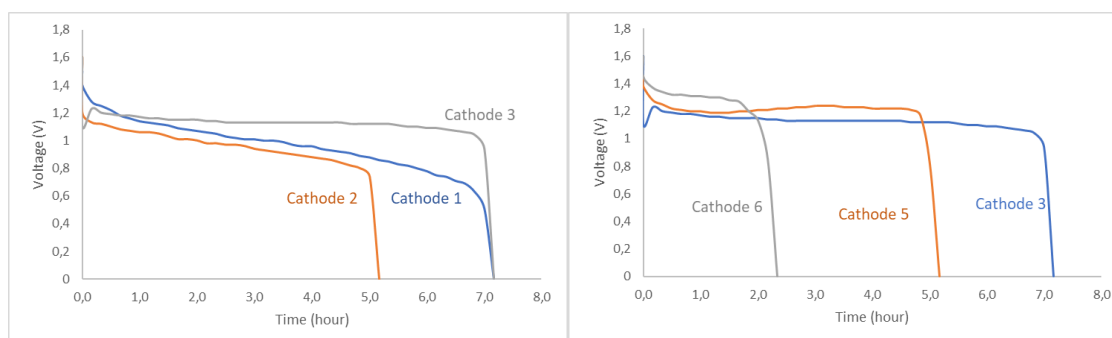


Figure 4. Discharge curves for Cathode 1, Cathode 2, Cathode 3, Cathode 5 and Cathode 6.

Cathode 1 includes 1g AC and its capacity is 10.8 mAh/cm² energy density is 10.62mWh/cm² and discharge time 7,2 hours. Cathode 2 includes 1g MnO₂, its capacity is 7,8 mAh/cm² energy density is 7,72mWh/cm² and discharge time 5,2 hours. And cathode 3 is 0,5 g AC and 0,5 g

MnO₂ its capacity 10,8 mAh/cm² energy density is 12,30 mWh/cm² and discharge time 7,2 hours. These batteries did not drop below 1 volt. From the graph we can see third cathode has good result. Combining AC and MnO₂ contributed to energy density is 12,30 mWh/cm². When CB used alone, battery life and constant voltage value are not promising for cathode 4. Therefore, we used this additive with others.

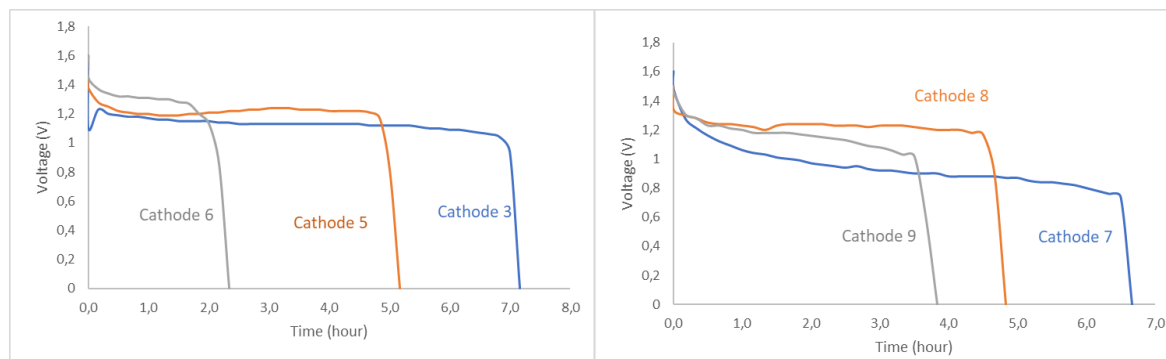


Figure 5. Discharge curves for Cathode 3, Cathode 5, Cathode 6, Cathode 7, Cathode 8 and Cathode 9.

Cathode 5 includes 0,5g AC and 0,4g MnO₂ and 0,1g CB. Its capacity is 7,8 mAh/cm² energy density is 9,55 mWh/cm² and discharge time 5,2 hours. Cathode 6 includes 0,5g AC, 0,4g MnO₂ and 0,1g borax. Its capacity is 3,45mAh/cm² energy density is 4,63 mWh/cm² and discharge time 2,3 hours. Borax additive contributed to constant voltage value but battery life is shorter than before. Figure shows that when AC and MnO₂ are used on the cathode the result is promising for long battery life. CB and Borax contributed constant voltage value but their battery life effects are short. In this experiment effect of Borax, one drop silver adhesive and P has been examined. Ag is effective for constant voltage value in Figure 5. Cathode 7 includes 0,4g AC, 0,4 g MnO₂ 0,1g, CB 0,1g borax. Its capacity is 10,05 mAh/cm² energy density is 9,70 mWh/cm² and discharge time 6,7 hours. Cathode 8 includes 0,4g AC, 0,5g MnO₂ 0,1g, CB and one drop silver adhesive. Its capacity is 7,2 mAh/cm² energy density is 9,03 mWh/cm² and discharge time 4,8 hours. Cathode 9 includes 1g AC, 0,4g MnO₂, 0,2g CB, 0,2 g P. Its capacity is 5,7mAh/cm² energy density is 6,78 mWh/cm² and discharge time 3,8 hours. In this experiment effect of Borax, Ag and P has been examined. Ag is effective for constant voltage value. According to cathode 7, CB and Borax are more effective when used together on that Cathode 7. Cathode 8 and cathode 9 have a higher voltage plateau but lower capacity and energy density.

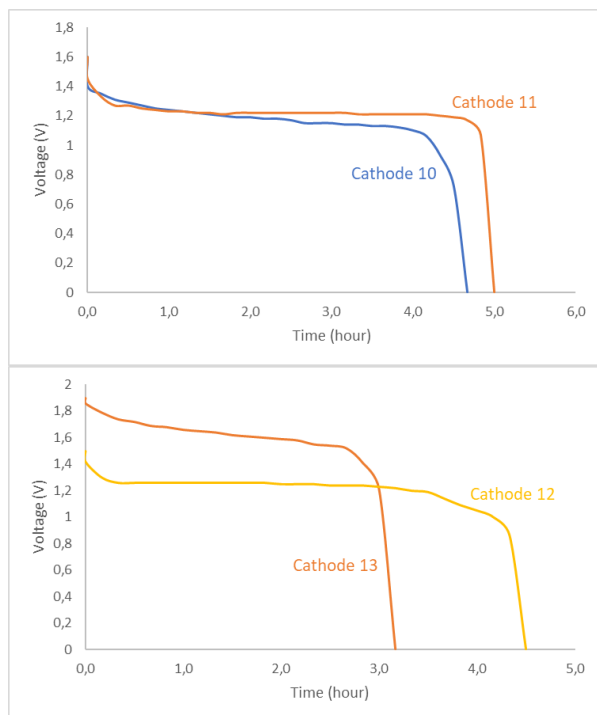


Figure 6. Discharge curves for Cathode 10, Cathode 11, Cathode 12 and Cathode 13.

Cathode 10 includes 0,9g AC 0,1g CB. Its capacity is 7,63mAh/cm² energy density is 8,4 mWh/cm² and discharge time 4,7 hours. Cathode 11 includes 1g AC 0,2g CB and 0,3g P. Its capacity is 7,82 mAh/cm² energy density is 9,39 mWh/cm² and discharge time is 5 hours. Figure 6 shows that CB and P contributed constant voltage value but CB battery life effect is shorter than P. Cathode 10 and Cathode 11 have same voltage plateau. According to Cathode 11, phosphor raised the energy density from 8,4 mWh / cm² to 9,39 mWh / cm². Cathode 12 includes 1g Ni. Its capacity is 4,8mAh/cm² energy density 7,9 mWh/cm² and discharge time 4,7 hours. Cathode 13 includes 0,5g AC and 0,5g Ni. Its capacity is 6,75mAh/cm² energy density is 8,38 mWh/cm² and discharge time 4,5 hours. Ni contributed constant voltage value but Ni battery life effect is short. When using Ni alone, the voltage plateau is quite high, but the energy density and capacity are low. It has been observed that the capacitance and energy density increase from 7,90 4 mWh / cm² to 8,38 4 mWh / cm² when Ni and AC are used together. All results are given in Table 2.

Table 2. Al-air battery capacity, voltage plateau and energy density for all cathodes with additives.

Cathodes with Additives	Capacity (mAh/cm ²)	Voltage Plateau	Energy Density (mWh/cm ²)	Discharge Time (Hours)
Cathode 1	10,8	1,5 volt ~1 volt	10,62	7,2
Cathode 2	7,8	1,6 volt ~1 volt	7,72	5,2
Cathode 3	10,8	1,6 volt ~1,1 volt	12,30	7,2
Cathode 4	1,5	1,48 volt ~1,2 volt	1,82	1
Cathode 5	7,8	1,45 volt ~1,2 volt	9,55	5,2
Cathode 6	3,45	1,6 volt ~1,3 volt	4,63	2,3
Cathode 7	10,05	1,6 volt ~1 volt	9,70	6,7
Cathode 8	7,2	1,5 volt ~1,2 volt	9,03	4,8
Cathode 9	5,7	1,5 volt ~1,1 volt	6,78	3,8
Cathode 10	7,05	1,6 volt ~1,2 volt	8,4	4,7
Cathode 11	7,5	1,6 volt ~1,2 volt	9,39	5
Cathode 12	4,8	1,9 volt ~1,6 volt	7,90	3,2
Cathode 13	6,75	1,5 volt ~1,2 volt	8,38	4,5

CONCLUSION

The production of Al based batteries will be aligned along a research-development-production-market chain, from physics to chemistry, from chemistry to material science and from material science to technology. Innovation chain should also include recycling, component and system developments. This chain is completed by a patenting strategy that is necessary for a market placement.

A simple method for producing cheap and environmentally-friendly air cathodes and NaOH gel electrolyte were prepared.

Cathode 1 and Cathode 3 have the same capacitance. Cathode 1 contains only AC, and Cathode 3 contains 50% AC and 50% MnO₂ by weight. The MnO₂ cathode catalyzer increased the potential plateau and the energy density increased from 10,62 mWh / cm² to 12,30 mWh / cm². Cathode 2 only contains MnO₂, the energy density is lower than the Cathode 1. AC and MnO₂ are effective additives for efficiency Al air battery.

REFERENCES

- Doche, M. L., Novel-Cattin, F., Durand R., Rameau, J. J. (1997). Characterization of Different Grades of Aluminum Anodes for Aluminum/air Batteries, *Journal of Power Sources*, **65**, 197-205.
- Mutlu R. N. (2018). Al-hava pili için verimli elektrot-elektrolit araştırılması, *Çukurova University, PhD Thesis*.
- Pino, M., Chacón, J., Fatás, E., and Ocón, P. (2015). Performance of Commercial Aluminium Alloys as Anodes in Gelled Electrolyte Aluminium-air Batteries. *Journal of Power Sources* **299**,195-201.
- Reding, J. T., Newport, J. J., (1966). The Influence of Alloying Elements on Aluminium Anodes in Sea Water. *Materials Protection*, **12**, 15-18.
- Souza, J. P., Vielstich, W., (2003). Seawater Aluminium / Air cells , Handbook of Fuel Cells Fundamentals Technology and Applications, *Wiley and Sons, New York*, **1**, 409-415.
- Tommasi, D., (1889). Traite des Piles Electriques, *Online Books, Paris*, 1071-1097.
- Zhao, Z., Frankel, G. S., (2007). On The First Breakdown In AA7075-T6, *Corrosion Science*, **49**, 3064-3088.

İKLİM DEĞİŞİKLİĞİNİN MİKOTOKSİN RİSKİ ÜZERİNE ETKİSİ

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ÖZET

1988 yılından beri yapılan Hükümetlerarası İklim Değişikliği Panellerinde (Intergovernmental Panel on Climate Change, IPCC) belirlendiği üzere, küresel iklim sisteminin ısınması, deniz seviyesinin yükselmesi, azalan buz ve kar miktarları ve artan okyanus ve atmosfer sıcaklıkları ile ilişkilendirilmiştir. Küresel ısınma ile gıda yetersizliği ve açlık, küresel yağış düzenindeki değişiklikler, bitki ve hayvan popülasyonlarındaki değişiklikler ile ciddi sağlık etkileri de dahil olmak üzere zaman içinde önemli sonuçlara yol açan tehditli bir süreçtir. Yaşadığımız yüzyılda sera gazı üretimine bağlı olarak, son 40 milyon yılın en sıcak periyodunu yaşamamız beklenmektedir. Küresel ısınmanın enfeksiyon hastalıklarında önemli etkiler oluşturacağı ön görüldüğünden, özellikle vektör kaynaklı hastalıklar, gıda ve su kaynaklı hastalıklar, bakteriyel ve viral enfeksiyonlar üzerine araştırmalar yoğunlaşmıştır. Bu tür iklim değişiklikleri, toksijenik mantar gelişimine ve oranları üzerinde önemli bir etkiye de sahiptir. Konakçı direncini ve konakçı-patojen etkileşimlerini değiştirebilir. Ayrıca her bir patojen için değişen mikotoksin üretimi koşullarını da fazla bir şekilde etkileyebilir. Bu nedenle son yıllarda mikotoksinler/konakçı bitkiler/coğrafi alanlar ilişkileri bilim insanlarının dikkatini çekmektedir. Özellikle yeni analizler ve toksijenik mantarların hem biyolojisi hem de genetiği hakkında daha güncel bilgiler edinilmektedir. Bu tebiğde gıda güvenliği açısından özellikle Avrupa'da üretilen mısırlarda *Aspergillus flavus* riski ve yine Avrupa'da buğday üzerindeki mikotoksijenik *Fusarium* türlerinin profili, *F. graminearum* kontaminasyonunun iklim değişikliği ile ilişkisi irdelenmiştir. Diğer yandan mikotoksin mücadelesinde kullanılan pestisidler yükselen sıcaklıklarla buharlaşmasına yol açarak etkinliklerini azaltır. Zararlıların artmasıyla beraber, pestisid kullanımının söz konusu yetersizliği ile tarımsal üretimde daha fazla pestisit kullanımını teşvik edebileceği de ayrıca değerlendirilmiştir.

Anahtar Kelimeler: İklim değişikliği, Mikotoksin, mikotoksijenik küf, toksin

IMPACT OF CLIMATE CHANGE ON MYCOTOXIN RISK

ABSTRACT

As determined by the Intergovernmental Panel on Climate Change since 1988, warming of the global climate system has been associated with rising sea levels, decreasing amounts of ice and snow, and increasing ocean and atmospheric temperatures. Global warming is a threatening process with significant consequences over time, including food shortages and hunger, changes in global precipitation patterns, changes in plant and animal populations, and serious health effects. Depending on the greenhouse gas production in the century we live in, we are expected to experience the hottest period of the last 40 million years. Since it is predicted that global warming will have significant effects on infectious diseases, research has focused on vector-borne diseases, food and water-borne diseases, bacterial and viral infections. Such climatic changes also have a significant impact on toxigenic fungal growth and rates. It can alter host resistance and host-pathogen interactions. It can also greatly influence the varying conditions of mycotoxin production for each pathogen. Therefore, in recent years, mycotoxins/host plants/geographical areas relationships have attracted the attention of scientists. In particular, new analyzes and more up-to-date information are obtained on both the biology and genetics of toxigenic fungi. In this paper, the risk of *Aspergillus flavus* in corn produced in Europe, the profile of mycotoxigenic *Fusarium* species on wheat in Europe, and the relationship of *F. graminearum* contamination with climate change were examined in terms of food safety. On the other hand, pesticides used in mycotoxin control cause evaporation with rising temperatures, reducing their effectiveness. Along with the increase in pests, it has also been evaluated that the insufficiency of pesticide use can encourage more pesticide use in agricultural production.

Keywords: Climate change, Mycotoxin, mycotogenic molds, toxin

GİRİŞ

İklim deęişiklięi hepimizin bildięi üzere gezegenimize ve yařamımıza çok büyük bir tehdit oluřturan karmařık bir sorundur. Artan sıcaklıklar, okyanusların ısınması, asidifikasyonu, kuraklıklar, kontrol edilemeyen yangınlar, zamansız yoğun yaęıřlar ve asit yaęmurları, eriyen buzullar ve buna baęlı olarak yükselen deniz seviyeleri ve ekstrem hava olaylarının artması bizim gıda sistemlerimize de ciddi hasarlar vermektedir (FAO, 2020). Dünya genelinde gıdanın % 14’u tüketicilere ulařmadan üretim basamaęında kaybolmaktadır. Bu kaybın önemli bir kısmı gıda kontaminasyonu ile iliřkilidir. Dünya Saęlık Örgütü 1 yıl içinde 600 milyon insanın çeřitli nedenlere baęlı olarak gıda kaynaklı hastalıklara yakalandıęını ve bunun 420 bininin ölümlerine sonuęlandıęını belirtmiřtir (FAO, 2019).

İklim deęişiklięi

İklim deęişiklięi, Hükümetlerarası İklim Deęişiklięi Panellerinde (Intergovernmental Panel on Climate Change, IPCC) iklimin ortalama durumunda veya bu deęişkenlikte, uzun süre devam eden (tipik olarak on yıl veya daha uzun) istatistiksel olarak anlamlı bir deęişiklik olarak tanımlanmaktadır. İklim deęişiklięi konusu dünya nüfusunun en önemli üçüncü küresel sorunu olarak kabul edilmektedir (Tang, 2019). En etkili iklim deęişiklięi faktörleri, küresel ısınma, aşırı ısınma ve aşırı soęuma periyodları, kalıcı ve yoğun yaęıřlar, doęal afet seviyesinde hava olayları (kasırgalar, siklonlar, seller) kuraklık, kötü hava kalitesi, stratosferik ozon tabakasının incilmesi ve ultraviyole (UV) radyasyonundaki deęişikliklerdir (Mateeva, 2020).

Dünyamızın ortak problemi olan küresel ısınma, ilk kez 1896 yılında Kimyager Svante Arrhenius tarafından öngörölmüřtür. Küresel ısınma yeryüzündeki sıcaklık artışı olarak tanımlanmaktadır. Küresel ısınma başta olmak üzere sera gazlarındaki artışa neden olan her türlü etkinin, iklim deęişiklięine neden olduęu bilinmektedir. Güneřten gelen sıcaklık sera gazları aracılıęıyla tutularak, yerkürenin ısınmasını saęlanmaktadır. Atmosferde tutulan sera gazlarının ve özellikle CO₂ gazı konsantrasyonundaki artış iklim olaylarında deęişiklięe sebep olmaktadır (Hatipoęlu ve ark. 2019).

Karbondioksit salınımı genel olarak fosil yakıtlar, insan aktiviteleri, ormansızlařma, kentleřme, tarım ve endüstriyel süreçler sonucunda oldukça yüksek seviyeye ulařmıřtır. Günümüzde atmosferik CO₂ gazı konsantrasyonu 441 ppm ile geętięimiz 800.000 yıl içerisindeki en yüksek seviyeye ulařmıřtır. Son on yıldakiyle aynı oranda devam eden sera gazı emisyonları ile küresel ısınmanın 2030 ve 2052 yılları arasında 1,5°C’lik bir sıcaklık

artışına ulaşacağı tahmin edilmektedir. Önümüzdeki 2100 yılına kadar 1.1°C ile 6.4°C sıcaklık artışı beklenmektedir. Yine 2100 yılında atmosferdeki CO₂ gazı konsantrasyonun 421-936 ppm arasında olması öngörülmektedir. Ayrıca 1961 yılından beri, deniz seviyesinde her yıl 1,8 mm artış görülmüştür Hükümetler iklim değişikliğinin insan sağlığı ve refahı için büyük riskler oluşturduğu giderek daha fazla kabul etmektedir (Dumont et al., 2015).

Mevcut küresel ısınmanın bir sonucu olarak; 1993-2019 yılları arasında dünya yaklaşık 148 milyar ton buz kaybetti, buna bağlı olarak deniz seviyesi 20 cm yükselmiş ve okyanus 0,33°C'den fazla ısınmıştır. Gelecek 100 yılda 1,4-5,5°C'lik ısınmanın gerçekleşeceği ve CO₂ konsantrasyonunun artacağı beklenmektedir (IPCC, 2007). Bu nedenle önümüzdeki 25-50 yılda gerekli nitelik ve miktarda gıda sağlama kapasitesinin sorgulanması kapsamında Dünya Gıda Güvenliği Otoritesi (EFSA) iklim değişikliğinin Avrupa'daki etkisini incelemiş ve etkilerin coğrafi bölgeye bağlı olarak zararlı veya avantajlı olacağını öne sürmüştür (Medina et al., 2017).

Bu yönde;

- Kuzey Avrupa'da iklim değişikliğinin etkilerinin olumlu olabileceği,
- Akdeniz havzasında ise gıda üretimini olumsuz etkileyen yağış ve kuraklık miktarındaki aşırı değişiklikler, yüksek sıcaklık ve artan CO₂'e bağlı olarak olumsuz etkiler sonucu sıcak nokta oluşabileceği,
- Güney ve Orta Avrupa'da iklim değişikliğinin bitkilerdeki olgunlaşma sürecini kısaltacağından bunun tahıllar üzerinde önemli zararlı etkilere neden olacağı düşünülmektedir.

Bu temel değişiklikler küresel bazda temel mallarda farklı kıtalarda gıda güvenliği üzerinde derin etkiler yaratacaktır. Mevcut verilere göre iklim değişikliği sonucunda gelecek 25-50 yılda atmosferik CO₂ miktarının 2-3 katına çıkması beklenmekte (350-400 ppb'den 800-1200 ppb'ye). Bu nedenle Avrupa'nın bahsedilen farklı bölgeleri hem artan CO₂ hem de 2-5°C'lik sıcaklık artışından etkilenecektir. Bu durum da zararlılar, hastalıklar ve sonuçta verim üzerinde derin etkiler yaratacaktır. Küresel bazda gıda ve yem açısından çok önemli olan buğday, mısır, soya fasulyesi üreticisi olan Asya'nın bazı bölgeleri ve Orta ve Güney Amerika içinde benzer etkiler öngörülmektedir. İklim değişikliği etkilerinin gelecek yakın bir zamanda hem beslenme, hem kalite kayıpları, hem de mikotoksinlere maruziyet açısından özellikle düşük ve orta gelirli ülkelerde daha da büyük önem taşıyacağı düşünülmektedir (Medina et al, 2017).

MİKOTOKSİNLER

Mikotoksinler bazı küf türleri tarafından sentezlenen insan ve hayvanlarda çeşitli hastalıklara neden olabilen sekonder metabolitlerdir. İnsanlar mikotoksinlere ya toksinli gıdanın tüketimiyle veya toksinli yemle beslenen hayvanların et, süt, yumurta gibi ürünlerinin tüketimiyle maruz kalırlar. Dünyada bilinen 300'den fazla mikotoksin bilinmektedir. Bunların insan ve hayvan sağlığı açısından en önemli olanları *Aspergillus*, *Penicillium*, *Alternaria*, *Fusarium* gibi küf cinslerin tarafından sentezlenirler.

Mikotoksijenik küfler arpa, mısır, pirinç gibi temel gıda maddeleri ve ayrıca fındık, kahve, tahıllar, kuru meyveler, baharatlar, yem bitkileri, meyveler ve sebzeleri enfekte edebilir ve gıda güvenliğini etkileyen toksinler üretebilirler. Bu küfler tarlada verim kaybına neden olmak yanında, aynı zamanda besin zincirine toksinlerin de dahil olması ile sağlık açısından da çok önemli bir tehlikeyi gündeme taşımaktadır.

Tablo 1'de dünyada gıda zincirinde en çok rastlanan bazı mikotoksinler, bunların en yaygın olduğu gıda grupları ve insanlarda neden oldukları hastalıklar verilmiştir.

Tablo 1. Önemli bazı mikotoksinler, sentezleyen küfler ve insan ve hayvanlarda neden olduğu hastalıklar.

Mikotoksin	Sentezleyen küfler	Ürün çeşidi	Neden olduğu hastalıklar
Aflatoksinler (B1, B2, G1, G2)	<i>Aspergillus</i> , <i>Penicillium</i>	Tahıllar, yemler, yağlı tohumlar, kuru meyve	Karaciğer hasarı ve kanseri, sarılık, immun sistemin baskılanması
Alternariol	<i>Alternaria</i>	Domates, ketçap, pekan cevizi	İmmun sistemin baskılanması
Ergot alkaloidleri	<i>Claviceps</i>	Tahıllar, sorgum	Uyku, uyuşukluk, kuru kangren, abort, nörotoksosite
Fumonisinler	<i>Fusarium</i>	Mısır, tahıl	Ensefalomalazi, karsinojenite, nörotoksosite, karaciğer hasarı, kalp yetmezliği
Fusarik asit	<i>Fusarium</i>	Tahıllar	Karaciğer hasarı, mutajenite
Kojik asit	<i>Aspergillus</i>	Mısır	Kalp kası hasarı
Okratoksinler	<i>Aspergillus</i> , <i>Penicillium</i>	Tahıllar, yağlı tohumlar, incir, kurutulmuş et, kurutulmuş meyveler	Böbrek ve karaciğer hasarı, iştah kaybı, immun sistemin baskılanması, Balkan Endemik Nefropatisi
Patulin	<i>Aspergillus</i> , <i>Penicillium</i>	Silaj, elma, elma ürünleri, buğday, yemler	Sinirsel sendromlar, beyin kanaması, deri kanseri, mutajenite
Sitrinin	<i>Aspergillus</i> , <i>Penicillium</i>	Tahıllar, mısır, arpa, karma yemler	Sinirsel belirtiler, gelişme geriliği, karaciğer, böbrek nekrozu, mutajenite
Trikotesenler (T2, HT2, DON, DAS)	<i>Fusarium</i> , <i>Sefalosporium</i> , <i>Trikoderma</i>	Tahıllar, silaj, yemler, baklagiller, meyve, sebze	Dermatit, deri nekrozu, anemi, kanamalar, hemapoetik etki, alimentaria toksik aleukia, immun sistemin baskılanması
Zearalenon	<i>Fusarium</i>	Tahıllar, mısır, silaj, çayırotu saman	Östrojenik etki, reproduktif problemler, abort,

İKLİM DEĞİŞİKLİĞİNİN MİKOTOKSİNLER ÜZERİNE ETKİSİ

İklim şartlarında meydana gelen değişiklikler mikotoksijenik fungal patojenler için; mikotoksin baskılayıcı koşullardan, mikotoksin sentezi için elverişli koşullara geçişle sonuçlanabilir. Çevresel stres sekonder metabolitlerden özellikle mikotoksinler için önemli sonuçlara neden olabilecektir. (Pitt and Miller, 2017).

Mikotoksijenik küflerin oluşumu ve yaygın hale gelmesinde temel iklimsel faktörler sıcaklık, nem ve yağıştır. Ayrıca sıcaklığın yükselmesi ve nemin artışı, biraz yüksek bir CO₂ seviyesi de benzer etkiye sahiptir. Çalışmalar yüksek CO₂ varlığının, bitkilerin mantar duyarlılığında artış oluşturabileceğini göstermiştir. Yüksek CO₂ koşulları altında mısırın *Fusarium verticillioides* saldırısına karşı savunmasızlığını arttırdığı gösterilmiş, 800 µmol CO₂/mol hava koşulunda *Fusarium* biyokütle üretiminde 2,5 kat artış olduğu bulunmuştur. Diğer

yandan iklim deęişikliğine baęlı olarak meydana gelen sellerin de özellikle silo hasarına neden olma sonucu ürün hasarı ve toksin oluşumu için uygun ortam hazırladığı da bildirilmektedir (Vaughan ve ark., 2014).

Mikotoksin oluşumunu etkileyen sıcaklık, kısmi nem, bitki zararlıları ile ürünün zarar görmesi gibi faktörler, iklim deęişikliğinden etkilenmektedir. Sıcaklıkların artması ile birlikte soęuk bölgeler tarıma elverişli hale gelmektedir ki; bu durumda bitki zararlıları ve fungal türler için yeni habitatlar açılmaktadır. Daha önce kontamine olmayan bölgelerde mikotoksin oluşumuna ilişkin olarak vakalar görülmektedir. Yerel ekonomi ve halk saęlığı bu durumdan olumsuz etkilenmektedir. İklim deęişikliği koşulları altında yetersiz depolama ve uygun olmayan nakliye faaliyetleri mikotoksin oluşumu ve yayılımında çok önemli olmaktadır (FAO, 2020). İklim deęişikliğine baęlı olarak bitki için oluşan olumsuz koşullar (kuraklık stresi, sıcaklık stresi, haşere saldırısının neden olduęu stres, zayıf besin durumu, vb.) küflerin bitkide daha fazla gelişmesini teşvik etmektedir. Bu durum da mikotoksinlerin daha fazla sentezlenmesi olasılığını ortaya çıkarır. Nemli koşullar küf gelişimini desteklese de, bu koşullar konakçının gücü ile bu durum hafifletilebilir. Ancak üretilen mahsullerin coęrafi ve iklim koşullarındaki deęişiklikler, yeni mantar bitki birliklerinin ortaya çıkması için fırsat sağlayabilir ve belki de şu anda halk saęlığı için bir tehdit olarak görülmeyen mikotoksinler, örneğin sterigmatocystin, cyclopiazonic asit, moniliformin veya *Penicillium* türleri tarafından üretilen nörotoksinler için yeniden bir deęerlendirme gerektirebilir. (Tirado ve ark, 2010)

Büyüme sezonunda çok fazla veya çok az su varlığı, sıcaklıklardaki deęişimler, zararlılar, kurutma ve depolama esnasında hijyenik olmayan koşullar fungal enfeksiyonların çoęalması; sonuç olarak da mikotoksin oluşumu için en temel faktörlerdir. İnsanların mikotoksinlere maruziyeti gıdalar yolu ile olmaktadır. Global popülasyonun beslenmesinde en temel gıdalar olan nişasta içeren ürünler ve yağlı tohumlar; mikotoksinlere karşı da oldukça hassastırlar. Bu durum gıdalarda ve yemlerde en önemli mikotoksinleri sentezleyen türler olan *Aspergillus*, *Fusarium*, *Penicillium*, *Claviceps*'i temel bir gıda güvenliği sorunu haline getirmektedir (Marras et al 2008).

Tarımsal olarak en önemli 5 tane mikotoksin aflatoksinler, okratoksin A, fumonisinler, deoxynivalenol ve zearalenone'dur. Yemlerdeki durum da benzerdir. Genel olarak mikotoksinler gıda işleme esnasında elimine edilemezler yalnızca seyreltilirler. Bu durum gıda güvenliği açısından işin ciddiyetini ortaya koymaktadır. Mevcut mikotoksinlere ilaveten modifiye olan ve yeni ortaya çıkan mikotoksinler de mevcuttur. Bunlar ilk hallerine kıyasla farklı kimyasal yapılara, fizikokimyasal özelliklere, biyokimyasal hareket mekanizmalarına

sahip olabilir. Artan CO₂ seviyelerinin buğday ve mısırdaki hastalıklara olan hassasiyet yaratması, mikotoksin oluşumunu ve enfeksiyonların şiddetini artırdığı görülmüştür. Bu durum gıda güvenliği açısından önemli bir tehdittir. Sonuç olarak mikotoksin oluşumu insanların güvenli ve yeterli gıdaya ulaşımını engellemektedir (FAO, 2020).

Hükümetlerarası İklim Paneli'nde iklim sisteminin ısınmasının kesin olacağı belirtilmiş, gelecekte sıcaklığın 2-6°C artacağı ve bu durum yükselen deniz seviyesi, azalan buz ve kar miktarları ve artan okyanus ve atmosfer sıcaklıkları ile ilişkilendirilmiştir. Bu tür iklim değişiklikleri toksijenik mantarların da gelişimleri üzerine önemli etkiye sahiptir ve mikotoksin oluşumunu da derinden etkileyecektir. Örneğin Güney ve Orta Avrupa'da mısırdaki aflatoxin kontaminasyon riskinin önümüzdeki 30 yıl içinde artma olasılığı dikkat çekmektedir. Ayrıca Avrupa'da mısır ve buğday gibi küçük daneli tahıllardaki *Fusarium* türlerinin Kuzey, Orta ve Güney Avrupa'da endişe verici boyutta artacağı da ön görülmektedir. Orta ve Kuzey Avrupa'da *F. graminearum*, Güney Avrupa'da *F. verticillioides* önemli riskler olarak değerlendirilmektedir. (Moretti, 2021)

Çalışmalar farklı mikotoksinlerin farklı bölgelerdeki ürünlerde yüksek miktarda bulunduğunu göstermektedir. Orta ve Güney Amerika, Afrika, Orta Doğu ve Güney Asya'nın nemli ve sıcak iklimi mısır, yer fıstığı ve baharatlar gibi gıda ürünlerinde sıkça aflatoxin oluşumuna dikkat çekmektedir. Yine Kuzey Avrupa ve Kuzey Amerika'nın daha soğuk ve nemli iklimlerinde özellikle *Fusarium culmorum* tarafından üretilen deoksinivalenolün bulunduğu; İtalya, Sırbistan ve Macaristan'da özellikle mısırdaki aflatoxin kontaminasyonunda artış olduğu rapor edilmiştir. (Dobolyi vd., 2013; Giorni vd., 2007; Kos vd., 2020). Ürünlerde mikotoksin kontaminasyonu çok ciddi bir sağlık sorunu olup, uluslararası ticarete engel oluşturmaktadır. Avrupa'daki Gıda ve Yemler için Hızlı Uyarı Sistemi (RASFF, Rapid Alert System for Food and Feed) mikotoksinlerin yalnızca Avrupa Birliği ülkeleri için değil; üye olmayan ülkeler için de gıdalarda bildirilen ilk 10 tehlike arasında yer aldığını ortaya koymuştur (RASFF, 2019). Diğer yandan Kugu ve ark., (2022) 2021 yılı RASFF bildirimlerinde gıda ve gıda ile temas eden veri analizinde aflatoxin ve okratoksinlerin, pestisit kalıntısı ve gıdalarda mikrobiyal problemlerden sonra 3. sırada yer aldığını bildirmişlerdir.

Geleceğe dair +2°C'lik sıcaklık artışı senaryosunun Orta ve Güney İspanya, Güney İtalya, Yunanistan, Kuzey ve Güneydoğu Portekiz, Bulgaristan, Arnavutluk, Kıbrıs ve Türkiye gibi bölgelerdeki aflatoxin riskinde de ciddi bir artışa neden olacağı öngörülmektedir. Bu ülkelere ilave olarak dünyada önemli mısır üreticisi ülkeler olan Romanya, Fransa, Macaristan ve

Kuzeydoğu İtalya’da düşük hasat ve orta düzeyde aflatoksin riski de öngörülmektedir (Moretti vd 2019).

SONUÇ

Küresel iklim değişikliğinin dünya genelinde önlenmesi için tüm ülkelerin katılımını sağlayacak şekilde aşağıda sıralanmaya çalışılan önemli noktaların dikkate alınması gereklidir.

- ✓ Sürdürülebilir tarıma destek olmak.
- ✓ Yeşil alanları korumak
- ✓ Petrol, karbon, doğal gaz gibi fosil yakıtları kullanımını sınırlamak
- ✓ Yenilenebilir ve temiz enerji kaynaklarına yönelmek
- ✓ Rüzgar ve güneş enerjisinden daha fazla yararlanmak
- ✓ CO₂ salınımını azaltmak
- ✓ İsrafi önleyerek daha az tüketmek

Yapılan çalışmalar iklim değişikliğinin etkileyeceği bilimsel olarak ortada olan mikotoksin oluşumunun engellenmesinin de çok önemli olduğunu ortaya koymaktadır. Mikotoksinlerin giderilmesi bağlamında dünyada şu ana uygulanmakta olan geçerli bir yöntem maalesef yoktur. Bu nedenle önemli olan mikotoksin oluşumunun önlenmesidir. Bu amaçla tarlada hasat öncesi ve özellikle hasat sonrası kurutma ve depolama aşamalarında mikotoksin oluşumunun önlenmesi amacıyla öncelikle sıcaklık ve nem koşullarının dikkate alınması, optimize edilmesi ve kontrol altında tutulması çok önemlidir.

Gelecek yıllarda gıda ürünlerinde artması muhtemel mikotoksin oluşumuna karşın Avrupa’da bu konuda aşağıdaki başlıklara önem verilmesi planlanmıştır;

1. Mikotoksinlerin surveyansının ve izlenmesinin iyileştirilmesi.
2. Mikotoksinlerin coğrafi dağılımı ve önleme yöntemlerine ilişkin veri tabanlarının iyileştirilmesi ve geliştirilmesi.
3. Yeni biyocoğrafi tarım senaryolarında tahmini mikotoksin kontaminasyonu için modellemeler yapılması.
4. Tarıma ve çiftçiye desteğin artırılması.
5. Kontrol ve analiz yöntemlerinin geliştirilmesi.

KAYNAKÇA

- Dobolyi, C., Sebok, F., Varga, J., Kocsub' e, S., Szigeti, G., Baranyi, N., Sz' ecsi, A., T' oth, B., Varga, M., Kriszt, B., Szoboszlay, S., Krifaton, C., & Kukolya, J. 2013. Occurrence of aflatoxin producing *Aspergillus flavus* isolates in maize kernel in Hungary. *Acta Alimentaria*, 42(3), 451–459.
- Dumont B, Andueza D, Niderkorn V, et al. 2015. A meta-analysis of climate change effects on forage quality in grasslands: specificities of mountain and Mediterranean areas. *Grass Forage Sci.* 70(2):239-254.
- FAO. 2019. The State of Food and Agriculture. Moving forward on food loss and waste reduction. Rome, FAO. 182 pp. (also available at <http://www.fao.org/3/ca6030en/ca6030en.pdf>).
- FAO. 2020. Climate change: Unpacking the burden on food safety. Food safety and quality series No. 8. Rome. <https://doi.org/10.4060/ca8185en>
- Giorni, P., Magan, N., Pietri, A., Bertuzzi, T., & Battilani, P. 2007. Studies on *Aspergillus* section *Flavi* isolated from maize in northern Italy. *International Journal of Food Microbiology*, 113(3), 330–338. <https://doi.org/10.1016/j.ijfoodmicro.2006.09.007>
- Hatipođlu R, Avcı M, Çınar S. 2019. Effects of Climate Change on the Grasslands. *Turkish JAF Sci Tech.*7(12):2282-2290.
- Kos, J., Jani' c Hajnal, E., Malachov' a, A., Steiner, D., Stranska, M., Krska, R., Poschmaier, B., & Sulyok, M. 2020. Mycotoxins in maize harvested in Republic of Serbia in the period 2012–2015. Part 1: Regulated mycotoxins and its derivatives. *Food Chemistry*, 312(May 2019), 126034. <https://doi.org/10.1016/j.foodchem.2019.126034>.
- Kugu, N. I., Yılmaz, K. Şirinyıldız, D. Y. 2022. Analysis of rasff notifications: 2021 food and food contact material data review. *Gıda*, 47 (6) 962-970.
- Marras, W. F. O., Gelderblom, W. C. A., Shephard, G. S., & Vismer, H. F. 2008. Mycotoxins: A global problem. In J. F. Leslie, R. Bandyopadhyay, & A. Visconti (Eds.).
- Mateeva Z, 2020. Climate Change: Human Health-Related Risks and Vulnerability-jSome Global and Local Nedkov S, Zhelezov G, Ilieva N (Editors). *Smart Geography. (Bulgarian) Pictures*. Switzerland: Springer, pp: 75-89.
- Medina, A., Gonzalez-Jartin, J. M., & Sainz, M. J. 2017. Impact of global warming on mycotoxins. *Current Opinion in Food Science*, 18, 76–81.
- Moretti, A. 2021. The impact of climate change on mycotoxin and related fungi risks in Europe: Current scenario and future perspectives. *Toxicology Letters* 350: S34
- Moretti, A., Pascale, M, Logrieco, A. F. 2019. Mycotoxin risks under a climate change scenario in Europe. *Trends in Food Science & Technology* 84: 38–40.
- Pitt, J.I., Miller, J.D. 2017. A concise history of mycotoxin research. *Journal of Agricultural and Food Chemistry*, 65(33): 7021–7033.
- Tang E. C. 2019. *Global Warming, Climate Change and World Environmental Degradation. Mycotoxins: Detection methods, management, public health and agricultural trade* (pp. 29–40). Wallingford, Oxfordshire, UK: CABI.

- Tirado M.C., Clarke R., Jaykus L.A., McQuatters-Gollop A., Frank J.M. 2010. Climate change and food safety: A review. *Food Research International*. 43 1745–1765.
- Vaughan, M. M., Huffaker, A., Schmelz, E. A., Dafoe, N. J., Christensen, S., Sims, J., Martins, V. F., Swerbilow, J., Romero, M., Alborn, H. T., Allen, L. H., & Teal, P. E. A. 2014. Effects of elevated [CO₂] on maize defence against mycotoxigenic *Fusarium verticillioides*. *Plant, Cell and Environment*, 37(12), 2691–2706.
- Yu FL, Kwan D (Editors). *Contemporary Issues in International Political Economy*. In: Palgrave Macmillan, Singapore: Springer, pp:307-329

FATIGUE PROPERTIES FOR 3D PRINTED PLA WITH CARBON FIBRE

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Abstract

FDM 3D printing is one of the most popular and widely used methods, allowing the construction of lightweight products with various filling densities. In this study, fatigue tests were applied to pure PLA and PLA reinforced with carbon fibers to study key 3D printing parameters that affect the fatigue of PLA products. The pattern was designed using a fill density percentage of 70% and three materials: pure PLA, 15% carbon fiber-reinforced PLA, and PLA reinforced with 20% carbon fiber. The results of the study concluded that using PLA reinforced with 15% carbon fiber provides the highest mechanical properties, while when the carbon fiber content reaches 20%, the mechanical performance of the material deteriorates due to the effect of carbon fibers on the adhesion of material layers in 3D printing.

Keywords: PLA, Polylactic Acid, Fatigue, 3D Printer

1- Introduction:

Additive Manufacturing (Additive Manufacturing) is the process of creating a 3D pattern by adding layers of materials. It has been successfully used in numerous technical applications. (Gupta, V.2019).

Fatigue Testing is a test where a material is subjected to structural change, which can lead to cracks or fracture. It involves repeated loading and unloading in pressure, contraction, bending, torsion, or combinations of these stresses. (Raoult, I.2020).

Polylactic Acid (PLA) is the most widely used 3D printing material due to its odorless and safe use, environmental friendliness, and lower energy consumption. It is made from renewable resources and requires less energy for processing. (Deshmukh, K.2017).

our study aims to learn about the effects of adding carbon fiber to PLA 3D printing materials. Determine optimal carbon-fiber tension ratio.

2-MATERIALS AND METHODS

Samples were made using the following three types of 1.75 mm diameter Filament material:

- Pure PLA (With 0% carbon fiber).
- PLA reinforced with 15% carbon fiber.

PLA reinforced with 20% carbon fiber. The fatigue samples were designed at the Solidworks program. Then extracted it by STL format. STL Files opened by slicing 3d printing software Cura.

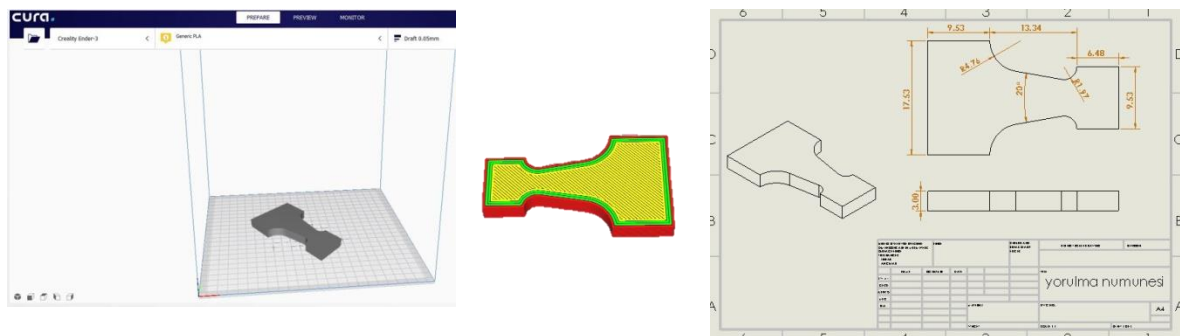


Figure 1 Drawing samples through SolidWorks

3-RESULTS

Fatigue test was done at room temperature and SEM images were taken of the PLA samples printed by 3D printer by “FDM” method.

3-1 Fatigue RESULTS

In table 1, the results of the Fatigue test were taken, and the values of:

E: Young's modulus [N/m²].

δ: Maximum amount of bending deformation [m].

b: Width of the sample [m].

h: Thickness of the sample [m].

L: Distance between supports [m].

$$\sigma = E \frac{6\sigma h}{L^2}$$

SAMPLE	TEST NO.	E	Đ	H	L	NO. OF CYCLE	σ
0% CP 70% INFILL	1	1911.422181	0.5	2.6	12.5	306,874	95.418195
	2	1911.422181	0.6	2.6	12.5	38,177	114.501834
	3	1911.422181	0.75	2.6	12.5	10,691	143.127293
	4	1911.422181	0.84	2.6	12.5	8,638	160.302568
15% CP 70% INFILL	1	2659.463768	0.4	2.6	12.5	450,000	106.208345
	2	2659.463768	0.5	2.6	12.5	228,444	132.760431
	3	2659.463768	0.6	2.6	12.5	126,899	159.312518
	4	2659.463768	0.75	2.6	12.5	79,637	199.140647
	5	2659.463768	0.84	2.6	12.5	56,259	223.037525
20% CP 70% INFILL	1	1540.257374	0.2	2.6	12.5	747,788	30.755859
	2	1540.257374	0.35	2.6	12.5	64,211	53.822754
	3	1540.257374	0.4	2.6	12.5	35,373	61.511718
	4	1540.257374	0.5	2.6	12.5	28,381	76.889648
	5	1540.257374	0.75	2.6	12.5	18,233	115.334472

Table 1. Fatigue test results for 3D-printed PLA at 70% Infill

Figure 2 (Fatigue Test) shows the Stress amplitude - Number of cycles to failure diagram of PLA Sampels:

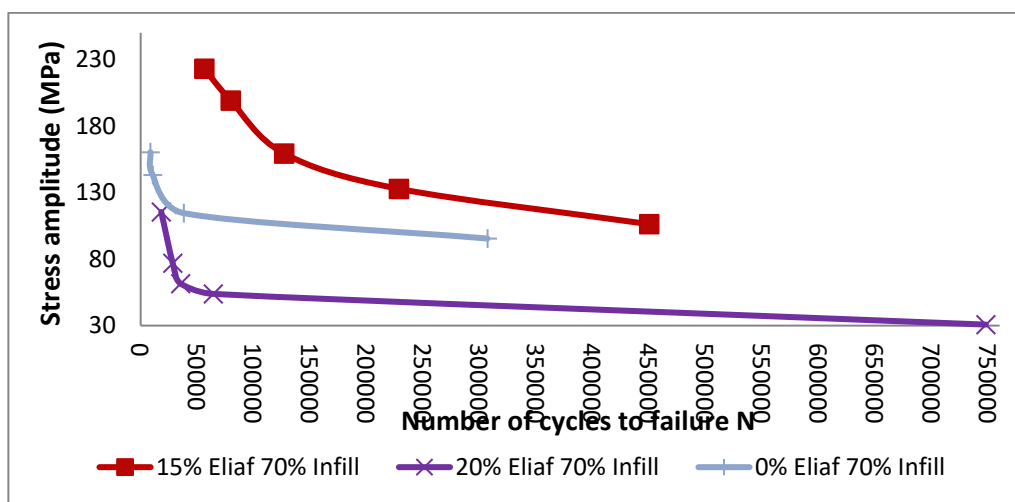


Figure 2 (Fatigue Test) shows the Stress amplitude

3-2 Scanning Electron Microscopic (SEM)

In table 2, shows SEM images of PLA samples at different magnification

SAMPLE	200X
0% CP 70% INFILL	
15% CP 70% INFILL	
15% CP 70% INFILL	

Table 2.SEM images of PLA samples

4- DISCUSSION

The sample with the highest fatigue strength is (15% cf), and The sample with the lowest fatigue strength is (20% cf).

The main reason for the low mechanical properties of PLA with 20% carbon fiber, is the poor adhesion of the plastic layers during printing. Where carbon fibers cause weaknesses in the adhesion of the layers.

In other words, the increase in the ratio of carbon fibers in the material led to weak interfacial bonding between the layers.

This scientific explanation is consistent with several other studies such as Nabeel's et al paper study (Maqsood, N.2021).

5- CONCLUSION

Through the results of the tests that we obtained and after referring to books, sources, research papers and reference studies, we recommend the following

Using PLA reinforced with 15% carbon fiber in 3D printing leads to obtain and higher stress amplitude.

We do not recommend using of PLA reinforced with 20% carbon fiber in 3D printing (with the parameters we used) because a weakness of the mechanical properties of the material in fatigue tests.

Using pure PLA (without carbon fibres) in 3D printing (with the parameters we used) has better results than sample (20% cp) and weaker than sample (15% cp).

Based on this study, we recommend:

Studying the tensile and fatigue properties of 3D printed PLA samples, with different percentages of carbon fibers (>15% and <20%) in order to determine the highest efficiency ratio.

Study of fatigue properties of 3D printed PLA material, with changing infill pattern and infill density ratios.

Study of the same material (PLA) and the same ratios of carbon fibers, but with the change of carbon fiber pattern from short fibers to continuous fibers.

Studying other polymeric materials used in 3D printing other than PLA (such as ABS and PETG), with the addition of different ratio of carbon fibers to it.

Studying the factors affecting the adhesion of layers in 3D printing on polymeric materials reinforced with carbon fibres.

7-REFERENCES

- Deshmukh, K., Ahamed, M. B., Deshmukh, R. R., Pasha, S. K., Bhagat, P. R., & Chidambaram, K. (2017). Biopolymer composites with high dielectric performance: interface engineering. In *Biopolymer composites in electronics* (pp. 27-128). Elsevier.
- Gupta, V., Nesterenko, P., & Paull, B. (2019). An introduction to 3D printing. *3D printing in chemical sciences: applications across chemistry*. London, UK: The Royal Society of Chemistry, 1-21.
- Raoult, I., & Delattre, B. (2020). Equivalent fatigue load approach for fatigue design of uncertain structures. *International Journal of Fatigue*, 135, 105516.
- Travieso-Rodriguez, J. A., Jerez-Mesa, R., Llumà, J., Traver-Ramos, O., Gomez-Gras, G., & Roa Rovira, J. J. (2019). Mechanical properties of 3D-printing polylactic acid parts subjected to bending stress and fatigue testing. *Materials*, 12(23), 3859.
- Maqsood, N., & Rimašauskas, M. (2021). Characterization of carbon fiber reinforced PLA composites manufactured by fused deposition modeling. *Composites Part C: Open Access*, 4, 100112.

DYNAMIC IMAGE SCALING FOR IMBALANCED BRAIN MRI DATASET

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Abstract—With the increasing population, more and more people are affected by brain tumor disease. When compared to other diseases, survival rate is extremely less. Also brain tumor disease affects people's daily life and mortality rate of brain tumor is very high. This study presents a dynamic image scaling for brain MR image segmentation problem. Recently, deep learning models are widely used for brain tumor segmentation task because manual segmentation of brain tumor is hard and false positive rate is high. Also image processing part is so important for deep learning tasks. This study focused on image processing part with the dynamic image scaling algorithm. Proposed method contains two parts, the first part of the proposed method is designed for finding the minimum coordinates of all labels, second part of the proposed model is designed for deciding the global minimum coordinates and finally proposed method finds the left-bottom corner's coordinate, image is rescaled with this starting coordinate. This proposed method both figures out imbalanced dataset problem and increases the deep learning model success rate. Proposed method is compared with traditional image scaling algorithms such as inter cubic, inter nearest and inter linear. Inter cubic offers %67 average dice score, inter nearest offers %75 average dice score and inter linear offers %69 average dice score. Proposed method offers %77 dice coefficient score. When compared to proposed method with other traditional image scaling algorithms, proposed method offers better results.

Keywords — Image Scaling, Image Processing, Deep Learning, Brain Tumor Segmentation.

I. INTRODUCTION

Today, humans struggle with a lot of important diseases. This type of diseases affects human daily life like brain tumors. Brain tumor disease directly affects human brains. The brain of each person is considered a complicated part of his physique. Information is recalled, gathered and assessed by the brain [1]. Once a disease occurs, the mortality and disability rate is extremely high. In China, the annual incidence of gliomas is 50,000 to 100,000 [2]. Also, brain tumor segmentation is a critical task in medical imaging because it allows physicians to accurately identify the location and size of tumors. When physicians use traditional segmentation methods, it is extremely hard and exhausting. Moreover, this may result in a high false rate because physicians use a screen for detecting tumor areas [3].

Accurate and reliable brain tumor segmentation is a critical component in cancer diagnosis, treatment planning, and treatment outcome evaluation [4]. With the advent of machine learning, the process of MR images to have a fast and accurate detection of brain tumors has become a matter [5]. To this end, some research in literature uses machine learning and deep learning models for increasing the accurate detection rate. Also, while some researches emphasize that hybrid models are increasing the machine learning and deep learning models' success rate [6,7], other researches take attention to the importance of preprocessing and feature extraction phases [8,9].

In this study, some traditional image scaling methods are tested on brain tumor segmentation images and observed their contribution to the segmentation model's success rate. Also, a dynamic image scaling method is proposed and some image scaling methods are compared with our dynamic image scaling method on brain MR images dataset called "BRATS". This paper is organized as follows: material and methods are described in Section 2, results are described in section 3 and finally, a conclusion is given in Section 4.

II. MATERIAL AND METHODS

A. Dataset

The BraTS20 (Brain Tumor Segmentation Challenge 2020) dataset is a publicly available dataset of multi-modal magnetic resonance imaging (MRI) scans for the segmentation of brain tumors. The dataset was created for the 2020 edition of the BraTS challenge, which aims to promote research in the development of automated methods for brain tumor segmentation. BraTS utilizes multi-institutional pre-operative MRI scans and focuses on the segmentation of intrinsically heterogeneous brain tumors, namely gliomas [10].

The BraTS20 dataset includes 369 cases of MRI scans, each consisting of T1-weighted, T1-weighted contrast-enhanced, T2-weighted, and T2-weighted fluid-attenuated inversion recovery (FLAIR) MRI images. The scans were acquired from multiple centers and have been manually annotated by experts to provide ground truth segmentations of the brain tumors.

The BraTS20 dataset include 4 type of label; 0 is not a tumor region, 1 is enhancing tumor, 2 is tumor core and 4 is whole tumor. Also MR images have 155 slices shown in Fig 1.

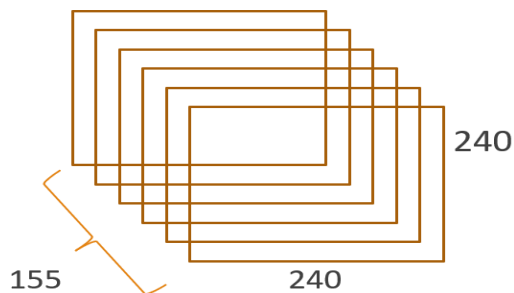


Fig. 1. MR images structure in BraTS20 dataset

B. Dynamic Image Scaling Algorithm

BraTS20 dataset contains 4 different type of label and these labels unevenly distribute. 0 label is sign that this region is not a tumor region and also indicate the background. For this reason, this label most common label in all labels. %85 percent of all data is 0 label so that BraTS20 is imbalanced dataset. Also our MR images shape are 240 x 240 x 155 so we have 155 slices in one MR image and totally we have 369 MR images.

We need to apply image scaling method for some reasons; firstly we don't have any powerfull gpu device for running deep learning model with this dataset, secondly we have to decrease the time consuming while model training, and finally we can increase the model success rate with image scaling methods. So that, we proposed a dynamic image scaling methods for increasing the model success rate and figure out to imbalanced dataset problem.

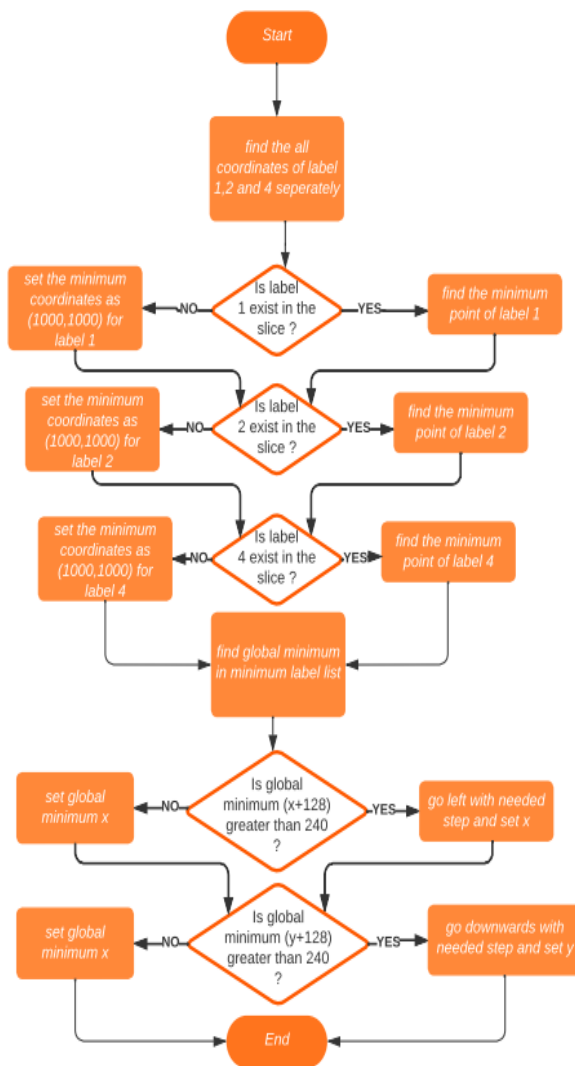


Fig. 2. Flowchart of proposed dynamic image scaling algorithm.

Proposed method is shown in Fig. 2. as flowchart. Proposed algorithm is contains if-else statements and firstly check that the label 1 exist in the slice, if yes we find the minimum point of label 1, if no we set (1000, 1000) as minimum point for label one because our image has 240x240 shape so global minimum never be (1000,1000) and repeat this step for all labels. Then we find global minimum in the minimum points list. Our scaled image will have 128x128 so we add 128 to our global minimum point and finally check whether this result is bigger than 240. If this result bigger than 240, we rearrange our result point.

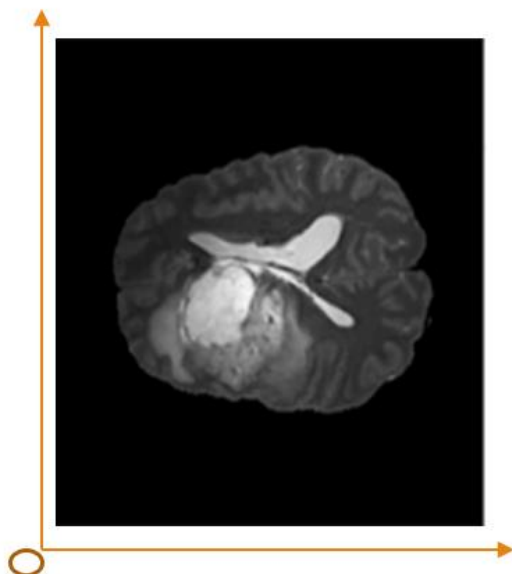


Fig. 3. One slice in MR image before dynamic image scaling

Our proposed method contains 2 part, the first part of the method is used for finding the minimum coordinates of all labels. For this purpose we divide our image into two dimension as x and y shown in Fig. 3. We search minimum x and y coordinates for each label and save the results in two different array, first array for minimum x coordinates and other for minimum y coordinates.

After first part of proposed method is done, the second part is used for finding the minimum of minimum x and y coordinates. After finding the global minimum x and y coordinate, we choose our starting point shown in Fig. 4. Then we go through up and right with given new image size (we use 128 x 128 for this study) and finally new image is created. As a result of this we can find a most concentrated part of image and discard the background label 0 as soon as possible.

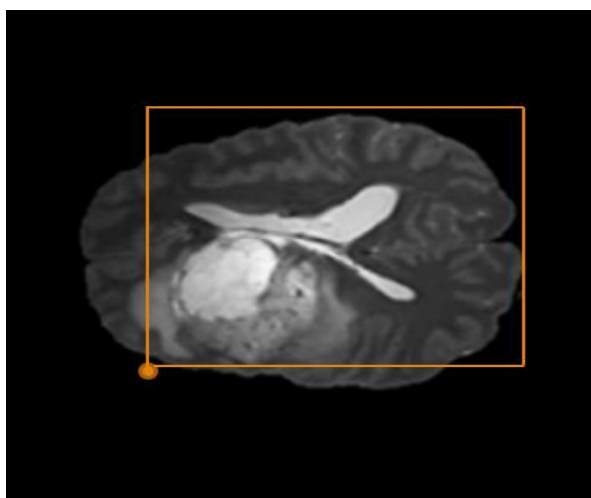


Fig. 4. One slice in MR image after dynamic image scaling.

After two step is done, we obtained new scaled imaged shown in Fig. 5.

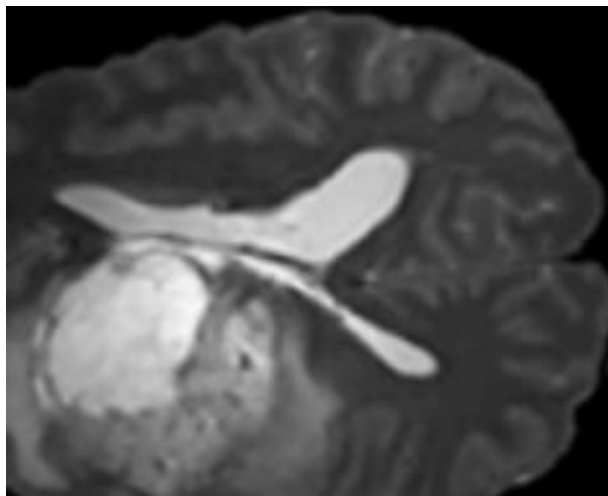


Fig 5. Dynamically scaled 128x128 MR image.

C. Evaluation Metrics

Dynamic image scaling algorithm is designed for brain tumor segmentation problem. When we evaluate our proposed algorithm, we used dice coefficient metric that is the most popular metric for segmentation problems.

Dice coefficient is a statistical measure used to compare the similarity of two samples. It is commonly used metric for evaluating the performance of image segmentation, where it is used to compare the similarity of the segmentation result to a ground truth.

The Dice coefficient is defined as the ratio of the size of the intersection between two sets to the size of their union [11]. Mathematically, it can be expressed as:

$$\text{Dice coefficient} = 2 * |A \cap B| / (|A| + |B|) \quad (1)$$

where A and B are the two sets being compared, |A| and |B| represent their respective sizes, and |A ∩ B| represents the size of their intersection.

The Dice coefficient ranges between 0 and 1, with 1 indicating perfect overlap between the two sets and 0 indicating no overlap. BraTS20 dataset has 4 different labels so that we use dice coefficient metric for each labels and avg dice coefficient score for these 4 labels, these can be expressed as:

$$\text{Dice coefficient nontumor} = 2 * |A(0) \cap B(0)| / (|A(0)| + |B(0)|) \quad (2)$$

$$\text{Dice coefficient necrotic} = 2 * |A(1) \cap B(1)| / (|A(1)| + |B(1)|) \quad (3)$$

$$\text{Dice coefficient edema} = 2 * |A(2) \cap B(2)| / (|A(2)| + |B(2)|) \quad (4)$$

$$\text{Dice coefficient enhancing} = 2 * |A(4) \cap B(4)| / (|A(4)| + |B(4)|) \quad (5)$$

$$\text{Dice coefficient average} = 2 * |A(0,1,2,4) \cap B(0,1,2,4)| / (|A(0,1,2,4)| + |B(0,1,2,4)|) \quad (6)$$

III. RESULTS

BraTS20 dataset has 369 MR images and each image has 240x240x155 dimensions. Proposed dynamic scaling method decrease the first two dimension with given size and figure out the imbalanced label problem.

TABLE I. LABEL COUNT BEFORE SCALING

Instance Slice	Label 0 before scaling	Other label before scaling	Rate before scaling
1	47499	299	0,99
2	49536	354	0,99
3	50189	315	0,99
4	49884	338	0,99
5	44984	333	0,99

Some label counts selected randomly in MR images are listed in table 1 before scaling process. Table 1 show that 0 label is cover %99 percent of one slice before scaling process. This is an example of imbalanced dataset problem. For instance; we have 47499 as 0 labels and 299 as 1,2 and 4 labels.

After applying the proposed dynamic image scaling method we obtain 128 x 128 image and decrease the 0 label count while preserving other 1,2 and 4 labels. In this way we decrease the rate of 0 label in all pixels. Table 2 shows that after applying the proposed dynamic image scaling algorithm, 0 rate is dropped from %99 to %95 for image slace 1.

TABLE II. LABEL COUNT AFTER SCALING

Instance Slice	Label 0 after scaling	Other label after scaling	Rate after scaling
1	6283	299	0,95
2	8320	354	0,95
3	8973	315	0,96
4	8668	338	0,96
5	4705	299	0,94

Proposed dynamic image scaling algorithm is compared with other traditional image scaling algorithm. We used dice coefficient scores for metric evaluations. The results are shown in table 3.

TABLE III. MODEL PERFORMANCES WITH DIFFERENT IMAGE SCALING ALGORITHMS

Algorithm	Average Dice Score	Dice Score for label 0	Dice Score for label 1	Dice Score for label 2	Dice Score for label 4
INTER_CUBIC	0.67	0.99	0.41	0.67	0.61
INTER_NEAREST	0.75	0.99	0.60	0.74	0.67
INTER_LINEAR	0.69	0.99	0.44	0.69	0.64
PROPOSED DYNAMIC IMAGE SCALING	0.77	0.99	0.63	0.77	0.69

Proposed dynamic image scaling algorithm is the best compared to other traditional image scaling algorithms. It reached the best dice coefficient score for each label.

IV. CONCLUSION

Brain tumor diseases is spreading rapidly around the world therefore avoiding this type of diseases is important for physicians however segmentation of brain tumors is too hard task. Recently, deep learning models are widely used for brain tumor segmentation. This study proposed a novel dynamic image scaling algorithm for brain MR images. Proposed method aims to reduce imbalanced data problem and allows the model to focus only on the region of tumor area.

There are a lot of traditional algorithms for image scaling. Proposed method is differ from traditional image scaling algorithm because proposed method reduces the imbalanced data set affect while focusing the related tumor area. Traditional image scaling algorithm is achieved an average %72 dice coefficient score using BraTS20 dataset for same deep learning model. On the other hand proposed method is achieved %77 dice coefficient score. Proposed method not only increase the model performance but also figure out imbalanced dataset problem.

REFERENCES

- [1] Ankur Gupta, Apurv Verma, Dushyant Kaushik, Muskan Garg,” Applying deep learning approach for brain tumor detection,” in Materials Today: Proceedings, 2020
- [2] Min Jiang, Fuhao Zhai, Jun Kong,” A novel deep learning model DDU-net using edge features to enhance brain tumor segmentation on MR images,” in Artificial Intelligence in Medicine, 2021
- [3] Jakub Nalepa, Pablo Ribalta Lorenzo, Michal Marcinkiewicz, Barbara Bobek-Billewicz, Pawel Wawrzyniak, Maksym Walczak, Michal Kawulok, Wojciech Dudzik, Krzysztof Kotowski, Izabela Burda, Bartosz Machura, Grzegorz Mrukwa, Pawel Ulrych, Michael P. Hayball, “Fully-automated deep learning-powered system for DCE-MRI analysis of brain tumors,” in Artificial Intelligence in Medicine, 2020
- [4] Xiaomei Zhao, Yihong Wu, Guidong Song, Zhenye Li, Yazhuo Zhang, Yong Fan,” A deep learning model integrating FCNNs and CRFs for brain tumor segmentation,” in Medical Image Analysis, 2018
- [5] Raheleh Hashemzahi, Seyyed Javad Seyyed Mahdavi, Maryam Kheirabadi, Seyed Reza Kamel,” Detection of brain tumors from MRI images base on deep learning using hybrid model CNN and NADE,” in Biocybernetics and Biomedical Engineering, 2020
- [6] Tiejun Yang, Jikun Song, Lei Li,” A deep learning model integrating SK-TPCNN and random forests for brain tumor segmentation in MRI,” in Biocybernetics and Biomedical Engineering, 2019
- [7] Dingwen Zhang, Guohai Huang, Qiang Zhang, Jungong Han, Junwei Han, Yizhou Yu,” Cross-modality deep feature learning for brain tumor segmentation,” in Pattern Recognition, 2021
- [8] Weijin Xu, Huihua Yang, Mingying Zhang, Zhiwei Cao, Xipeng Pan, Wentao Liu,” Brain tumor segmentation with corner attention and high-dimensional perceptual loss,” in Biomedical Signal Processing and Control, 2022
- [9] Mohamed A. Naser, M. Jamal Deen,” Brain tumor segmentation and grading of lower-grade glioma using deep learning in MRI images,” in Computers in Biology and Medicine, 2020
- [10] D. Rammurthy, P.K. Mahesh,” Whale Harris hawks optimization based deep learning classifier for brain tumor detection using MRI images,” in Journal of King Saud University - Computer and Information Sciences, 2022
- [11] Mostefa Ben naceur, Mohamed Akil, Rachida Saouli, Rostom Kachouri, “Fully automatic brain tumor segmentation with deep learning-based selective attention using overlapping patches and multi-class weighted cross-entropy,” in Medical Image Analysis, 2020
- [12] Metrics to evaluate your Semantic Segmentation Model,Access:09.04.2023,
<https://towardsdatascience.com/metrics-to-evaluate-your-semantic-segmentation-model-6bcb99639aa2> .

**IOT SUPPORTED PREDICTIVE MAINTENANCE APPLICATION USING
MACHINE LEARNING**

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ABSTRACT

The developments in technology and informatics at the beginning of the 20th century also positively affected the machinery industry. With the discovery of controllers, machines that can perform mathematical and logic operations were invented and took their place in factories. With the integration of wireless internet and embedded systems into machines, machine parks that can communicate with each other and operate autonomously have started to be used. The use of large number of machines with high added value in factories has increased the costs of maintenance performed using classical maintenance methods (planned and preventive maintenance), and alternative strategies have begun to be explored. The concept of just-in-time maintenance (predictive maintenance) has emerged in order to prevent the change of still usable valuable materials in periodic maintenance. Thanks to this method, some inferences can be made and actions can be taken by observing the running system data. Observing systems manually poses a threat to sustainability and objectivity. To develop this approach and to eliminate these threats, sensors are placed at critical control points of the systems and numerical data is obtained. These numerical data can enable us to make more objective and consistent observations using the Internet of Things (IoT) and Machine learning algorithms, and can help users for just-in-time maintenance. This approach was also used in previous studies, by observing the parameters, analyzing the collected data with analytical methods, predicting their useful life and taking action by the maintenance teams. In this study, we will be able to make an effective maintenance plan by processing the data we receive from the sensors measuring different values that we place at the critical control points of the system in machine learning algorithms, comparing the relationships between the parameters.

Keywords : Internet of Things (IoT), Embedded Systems, Cloud, Endustriy 4.0, Predective Maintaince, Machine Learning

INTRODUCTION

The beginning of the industrialisation race in order to meet the needs of human beings has led to the development of machine technology and as a natural consequence, the concept of machine maintenance has taken its place in the literature. In the early periods, maintenance and repair activities, which were carried out as incidental without being connected to any system, were systematically applied to reduce downtime in production lines in facilities that had difficulty in meeting the demand for fast-moving consumer goods; statistical and experience-based maintenance strategies began to be created.

Following the invention of the PLC and the adoption of communication protocols in the machinery industry, machine parks that can work autonomously together have led to a significant increase in production quantities. This situation has made it more difficult to compensate for downtimes in production lines and has increased spare parts and machine maintenance costs. In order to reduce line downtimes and maintenance costs, the importance of design and applications for maintenance is increasing and even taking its place in university curricula.

During maintenance and repair work in case of failure, production plans are disrupted and the amount of rework product increases. Although maintenance work performed at the time of failure is one of the maintenance techniques, today's conditions have gained popularity in the understanding of intervention before the machine fails. In this way, it is aimed to get the highest efficiency from the machine and to prevent time and production losses in unexpected failures. The method of predicting the time of failure for condition monitoring in machines by processing and interpreting the data we receive from the operating system is called predictive maintenance technique.

Predictive Maintenance Related Works

In the predictive maintenance approach, the failure time is estimated by monitoring the status of the running machines. Intervention is made by making a maintenance and stock plan. In this approach, it is necessary to evaluate the data received from the machines correctly. There may be an increase in maintenance work due to incorrect evaluation of data.

Arslan (2007), recorded and processed the defects formed on the working surfaces of the ball bearing elements and the shaft vibrations in the radial direction. He created a theoretical model for the system. According to this model, a simulation program has been developed that can analyze the vibration spectra of intact and defective bearings.

Orhan et al. (2010), investigated the operability of bearings of a centrifugal pump with the help of vibration analysis. Due to the increase in the vibration amplitudes in the pump bearings, the pump bearings have changed and it has been determined that the useful life of the bearings is almost completed as expected.

Wakiru et al. (2019), have included hybrid approaches in their studies of maintenance approaches. Hybrid approaches have been applied in several studies using a combination of two or more approaches:

- Statistical + Artificial intelligence
- Statistical + Model-based
- Model-based + Artificial intelligence
- Model-based + Artificial intelligence + Statistics

Li et al. (2020), studied cross-modality medical image synthesis between MR images and Computed Tomography. He modulated using U-Net and CycleGAN methods, which are typical networks of supervised and unsupervised learning in image processing, to generate MR/CT images. Experimental results were analyzed using the U-Net (Supervised Learning) method with lower error and higher accuracy. In this study, it was seen that supervised learning method performed better than unsupervised learning in MR/CT synthesis.

S. Parul et al. (2015), compared the performance of K-NN and SVM algorithms to find the most efficient method with the classification technique. He wanted to keep the causes of chronic kidney disease under control by using machine learning algorithms. By using the classification techniques of data mining, KNN and SVM, the estimated accuracy and precision were compared and the F-score was checked. It was seen that the K-NN algorithm gave better results.

Vishwanath Bijalwan et al. (2014), compared Naive Bayes classifier, Term Graph model and K-NN algorithms to automatically classify text documents in different categories. It classifies according to the relationship between the probability operations taught in the naive bayes algorithm and the new test data presented to the system.(Saritas et al. 2019), The Term Graph model, on the other hand, does not perform as well as K-NN in text documents.

R. Dündar et al. (2021), conducted a literature review examining machine learning and deep learning algorithms to improve predictive maintenance work in industrial facilities. In modern production systems, studies on keeping the system in the best working condition have been examined. Fault monitoring and data processing techniques are explained and machine learning algorithms are examined.

G. Calayır et al. (2021), and his colleagues tried to estimate the remaining machine life calculation studies by using the linear regression method by processing the data they received from the machine.

H.Ceyhan et al. (2022), processed the spectrum values obtained from PLC to predict mixer motor driver failure and created a model using random forest algorithm for calculation of time to failure.

Bülbül et al. (2016), examined the working principles of industrial vacuum pumps and vacuum pump types. Ünal et al. (2015), examined the performance criteria of the vacuum pump in the milking machine.

They observed that the vacuum performances decrease as they rise above sea level. Regression relationships were found for airflow-altitude and airflow-pump vacuum altitude levels.

R. Minaz et al. (2021), examined the short-circuit fault analysis of brushless direct current motor with classification methods. For fault diagnosis, k-NN, decision tree (RT) and multilayer perceptron (MLP) classification methods are used. Although the K-NN algorithm needs a larger learning data set, it has been seen that it works with a higher percentage of accuracy.

MATERIAL and METHOD

Vacuum Pumps

Vacuum pumps, which are widely used in the industrial sector today, are tools that have a wide application area and are used to evacuate the gas in a region. Vacuum pumps draw gas molecules from an enclosed volume to leave a partial vacuum, within capacity a relative vacuum; It is used to produce negative pressure or low pressure. A mechanism inside the pump expands a small cavity in order to reduce the pressure below the atmosphere, and the air molecules filled in the expanding volume are discharged from the exhaust with the narrowing of the width.

Vacuum Pumps can be generally categorized into three types of vacuum techniques. These are positive displacement, momentum transfer and trapping vacuum pumps. Positive displacement pumps expand a cavity, allowing the gases in the chamber to flow through that cavity, closing the cavity again and venting the gas in the chamber to the atmosphere. It uses mechanism to do this process over and over. Momentum transfer pumps, also called molecular pumps, use high-speed jets of dense liquid or high-speed rotating blades to remove gas molecules from the chamber. Trap pumps catch solid or adsorbed gases; this includes cryopumps, receivers and ion pumps.(F. Adams, 2015)

Most modern vacuum pumps are positive displacement pumps. They remove air molecules, or other gasses, from a vacuum chamber to create vacuum.(Vakum Pompaları: Busch R5 RA 1000/1600 B Rotorlu Yağlı Tip Vakum Pompası, n.d.)

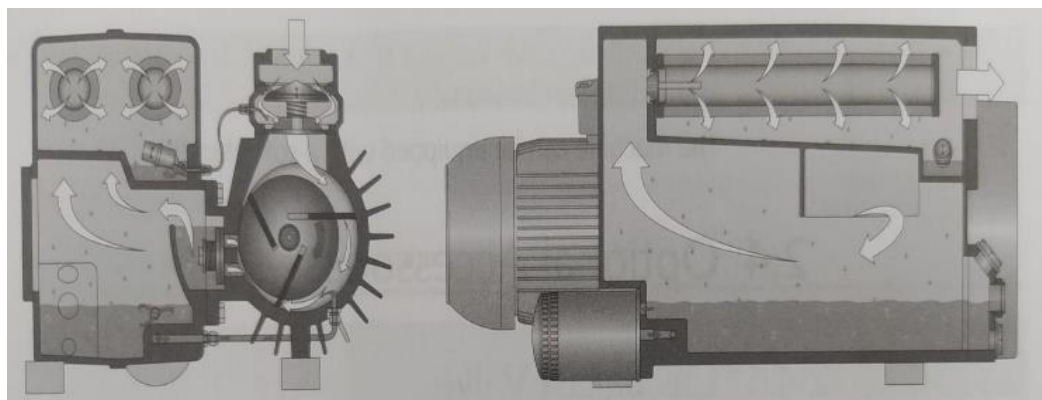


Figure 1: Positive Displacement Pump
Operating Principle

- The Machine Works on the rotary vane principle (Types of Positive Displacement Pump).
- The oil seals the gaps, lubricates the vanes and takes away compression heat.
- The oil filter cleans the circulating oil.
- Exhaust filters separate the oil from the discharged gas.

Sensors

In order to realize the machine learning predictive maintenance project, we had to collect data on the system we would use. Analog sensors are used to measure temperature, vibration, pressure and flow spectra from the machine. As a result of our research, we have seen that industrial type sensors are not suitable for the project budget. That's why we started researching cost-effective sensors that could provide the same data range and resolution.

Vibration sensor is also called piezoelectric sensor. These sensors are flexible devices used to measure various processes. A piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting it to an electrical charge. The sensor converts the physical size it measures into a digital signal. The DFRobot Piezo Vibration Sensor is a piezoelectric sensor that responds to voltage changes by producing a measurable output voltage difference that is proportional to the vibration intensity. Therefore, you can measure the size of the vibration via the sensor. Unlike its digital counterparts, it is possible to measure the intensity and length of vibration. It is preferred because its supply voltage (3.3V-5V) and interface are suitable for the system. (O. Oral et al. 2019)

Pressure sensor, with volumetric magnitude; It is a device used to measure the pressure degree of gas and liquid components. Today, it has a very common usage area in production and control stages. With this type of sensor, the pressure is converted into electrical signals and the collected data is converted into tracking, analysis and statistical data. The pressure of components in a confined space can be both monitored and controlled by pressure sensors. It is used in the project to observe the negative pressure in the vacuum chamber. It has been observed that we can make our measurements that the MPS20N0040D sensor, which has a measuring range of 0-40kPa, to use in the project, the ambient and storage temperature (-40 °C ~ + 125 °C) parameters are also suitable.

Current sensors are a type of sensor that creates a signal suitable for the purpose by measuring the current passing through a conductor. With the current sensor connected in series with the motor phase, it is observed how much current the motor draws. It has been measured that our system draws up to 5 Amps. To monitor current changes, the ACS712 Current Sensor Board is an inexpensive and reliable solution for current control. (İsmail Arıcı, 2014) The card can read current up to 5 amps. Since hall sensor is used in this product, which you can use in motor control circuits, power management and power supply

circuits, electrical and electronic circuits are separate from each other. Therefore, the possibility of interference is minimized. The product can be used in both DC and AC circuits and is designed to allow bidirectional current flow.

The temperature sensor measures the amount of heat energy produced by the system, allowing us to detect the physical change in temperature producing an analog output. In this way, the operation of the fans and the engine load can be monitored. AHT10 sensor operating voltage (1.8V-6V) compatibility and operating temperature range (-40 °C - 85 °C) we choose because it is suitable for our system.

The Experimental Setup

We make use of sensors and controller to establish the maintenance strategy of the vacuum pump based on condition monitoring. The places where the sensors are mounted are shown in Figure 2.

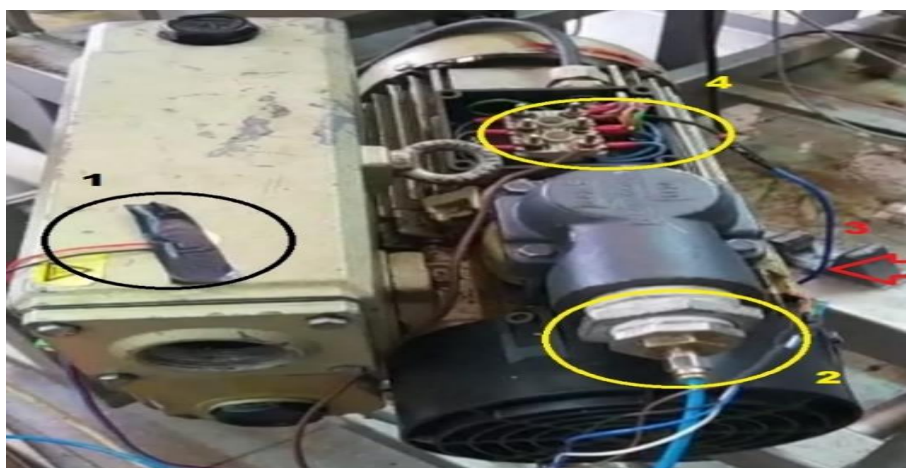


Figure 2: Placement of Sensors on the Pump

It is the vibration sensor marked with the number 1. We need to place the vibration sensor in the bearing of the motor shaft. However there was no suitable place, it was placed on the filters, which was the most suitable place for the sensor.

It is the pressure sensor used for vacuum measurement marked with number 2. We mounted the pressure sensor to the vacuum chamber with a socket connection. In this way, the pressure sensor will be able to measure negative pressure.

The temperature sensor used for temperature measurement is marked with number 3. The temperature sensor mounted on the motor stator windings is used to measure the motor temperature.

The current sensor we use to measure the change in the amount of current passing through the motor is marked with number 4. Motor currents are measured by the current sensor connected in series to one of the motor phases. (İ. Çolak and R. Bayındır, 2005)

The Data Collection

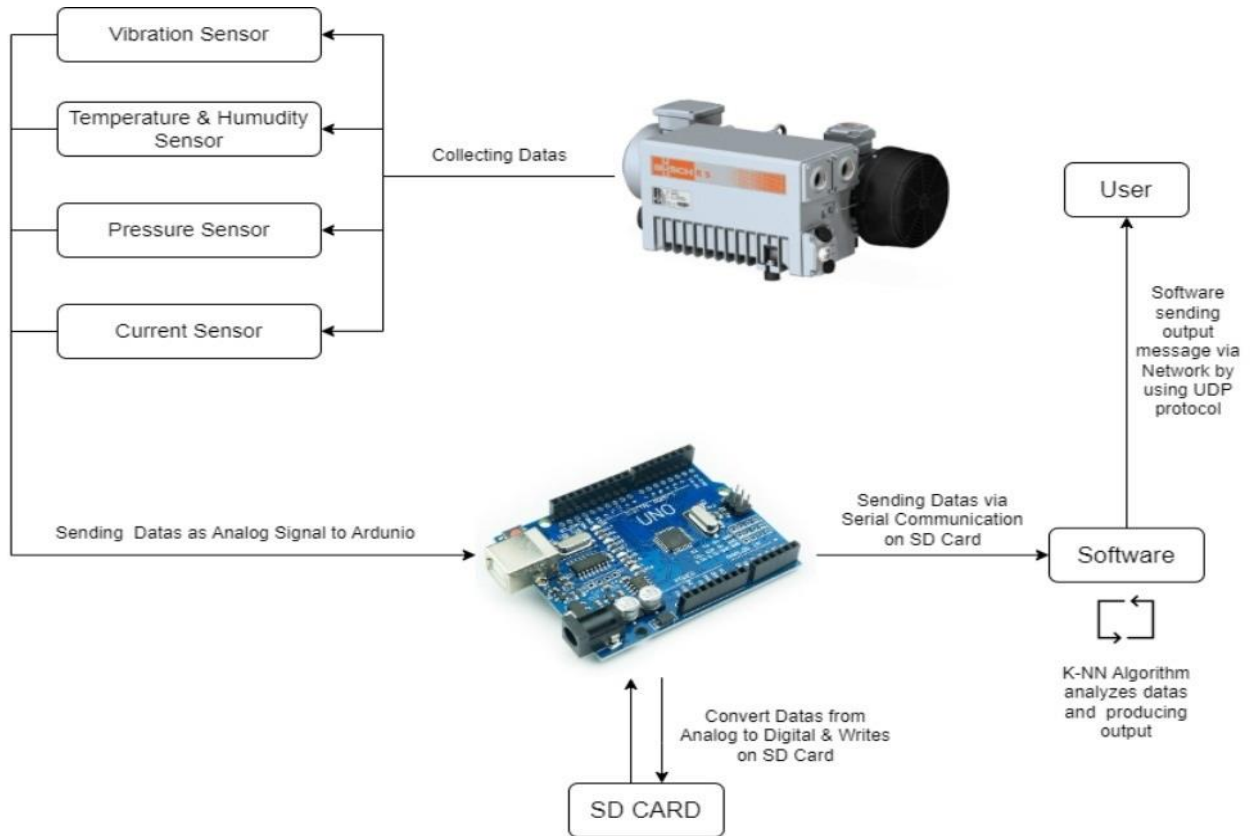


Figure 3: Diagram of Data Collection

In order to realize this project, data was collected from the system through 4 different types of sensors. These sensors are vibration, pressure, temperature & humidity and current sensors. These sensors produce analog signal as output. The range of the analog signal is (0-5)V. Analog signals are transmitted to the arduino by cable. Arduino converts incoming analog signals to digital signals by using the ADC module. It saves digital signals in a text file and stores it on the SD card. It transmits the data stored on the SD card to the computer where the K-NN algorithm is running with the RS232 serial communication protocol. The K-NN algorithm processes the incoming data and creates an output state. This status is transmitted to the user as a message via the UDP protocol.

Predictive Maintenance

In predictive maintenance, the machines in the factory are monitored from certain points. For this, a number of measuring devices are used. Periodic observation is made with the inspection and record monitoring system. It determines the maintenance-repair requirements for intervention without causing major malfunctions. Predictive maintenance data processing steps are given in Figure 3.

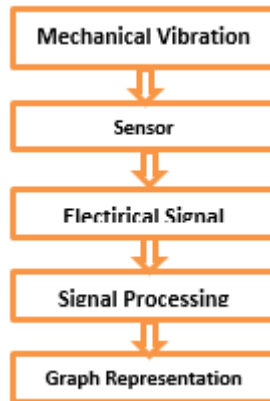


Figure 3 : Predictive Maintenance Flow Chart

Different methods are used to use the predictive maintenance technique in the business. (G. Yaman and H. Karadayı, 2014) The most commonly used of these methods are;

- 1- Thermal Monitoring
- 2- Oil Analysis
- 3- Ultrasonic Monitoring
- 4- Motor Current Monitoring
- 5- Trap Monitoring
- 6- Vibration Analysis

Machine Learning

It uses machine learning, mathematics and statistical science. It is modeling with computers by processing the data taken from the machine. The model uses algorithms to make predictions from the processed data.

Three types of machine learning approaches can be used to predict with maximum performance depending on the "signal" or "feedback" available to the learning system:

Supervised learning: Sample inputs given to the computer by a "teacher" and their desired outputs are presented, and the goal is to learn a general rule that maps inputs to outputs.

Unsupervised learning: No labels are given to the learning algorithm. It leaves the algorithm alone to find structure in its input. Unsupervised learning can be a goal in itself (discovering hidden patterns in data) or a means to an end (feature learning).

Reinforced learning: A computer program interacts with a dynamic environment that must accomplish a specific goal (such as driving a vehicle or playing a game against an opponent). As

the program navigates the problem space, it provides feedback similar to the rewards it seeks to maximize.

Frequently used Machine Learning algorithms;

1. Linear Regression :

Regression determines the relationship between one dependent variable and several other independent variables. Regression analysis helps to understand how the dependent variable changes when some of the independent variables change. This method is used to predict and find the cause and effect relationship between variables.

2. Support Vector Machines:

Support Vector Machines are one of the supervised learning techniques and are very useful for data classification. SVM was developed from statistical learning theory. SVM builds a model based on the training set and this model predicts the targeted values for the test data.

3. Decision Trees

Decision trees classification is a classification method that creates a model in the form of a tree structure consisting of decision nodes and leaf nodes according to feature and target. The decision tree algorithm is developed by dividing the data set into smaller or even smaller pieces. A decision node may contain one or more branches. The first node is called the root node. A decision tree can consist of both categorical and numerical data.

4. Random Forest Algorithm

The algorithm aims to increase the classification value during the classification process by producing more than one decision tree. Random forest algorithm is the process of choosing the highest score among many decision trees that work independently of each other. As the number of trees increases, our rate of obtaining a precise result increases. The main difference between the decision tree algorithm and the random forest algorithm is that the process of finding the root node and splitting the nodes is random.

5. Convolutional Neural Network (CNN)

CNN is a deep learning algorithm that is generally used in image processing and takes images as input. This algorithm, which captures and classifies the features (features) in the visuals with different operations, consists of different layers. The visual, which passes through these layers, which are Convolutional Layer, Pooling and Fully Connected, is subjected to different processes and reaches the consistency to enter the deep learning model.

6. k Nearest Neighbor Algorithm (k-NN)

It is one of the simplest Machine Learning algorithms based on the Supervised Learning technique. The algorithm is used by making use of the data in a sample set with certain classes. K-NN can be used for both classification and regression. In implementations for regression, the output is calculated by $y^2 R$ and the mean of k nearest neighbors. In classification with K-NN, the output y is the name of the most encountered class, that is, the new data point is assigned to the most common class among the k nearest neighbors. K-NN does not make any assumptions about the underlying data distribution, so it is a non-parametric algorithm. The training phase of k -NN is fast. However, the time and memory requirement for the testing phase is high due to the use of all training data. The algorithm assumes the similarity between the new state/data and the existing states and puts the new state in the category most similar to the existing categories. All existing data is stored and classifies a new data point based on similarity. This means that when new data emerges, it can be easily classified into an appropriate category using the K-NN algorithm. Data points are numbers or multidimensional vectors. Training data includes both data points and classes. Data points are in a metric space and generally 3 types of distance functions are used for distance calculations between points:

“Euclidean” Distance

“Manhattan” Distance

"Minkowski" Distance.

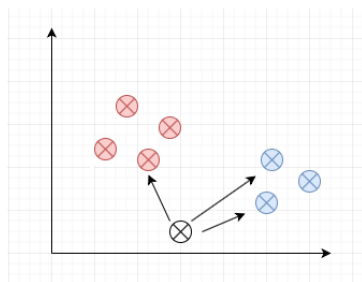


Figure 3: k Nearest Neighbor Distances

The training set, test point, and k are the inputs of the algorithm. k is the number of neighbors that are influential in determining the outcome. k should be chosen carefully. If k is chosen high, the computational cost increases. If k is chosen small, the noisy part in the data will be decisive in the result. A simple and widely used choice for k is \sqrt{n} .

K-NN study can be explained on the basis of the following algorithm:

Step-1: Choose the K number of neighbors

Step-2: Calculate the Euclidean distance of K neighbors.

Step-3: According to the calculated Euclidean distance, get the K nearest neighbor.

Step-4: Count the number of data points in each category among these k neighbors.

Step-5: Assign the new data points to the category with the maximum number of neighbors.

Step-6: The model is ready.

METHOD

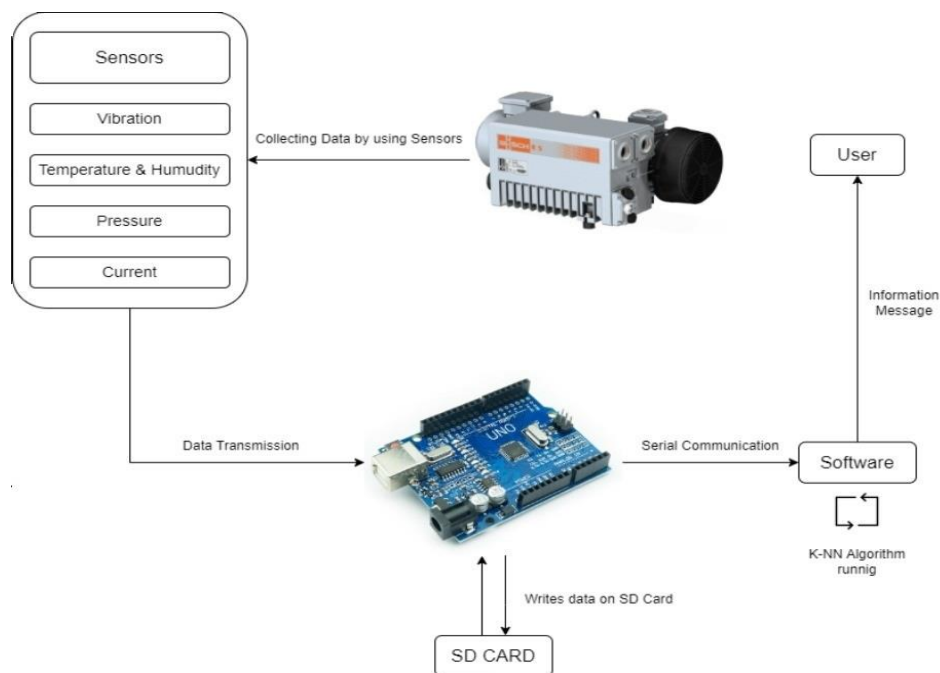
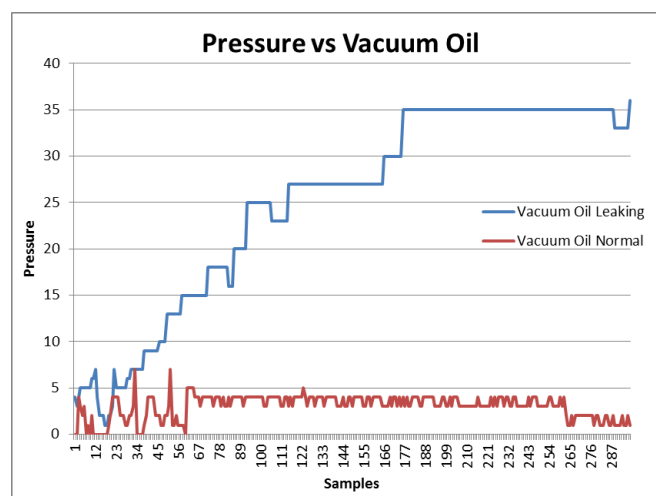


Figure 4: Overall Diagram of prediction maintenance system

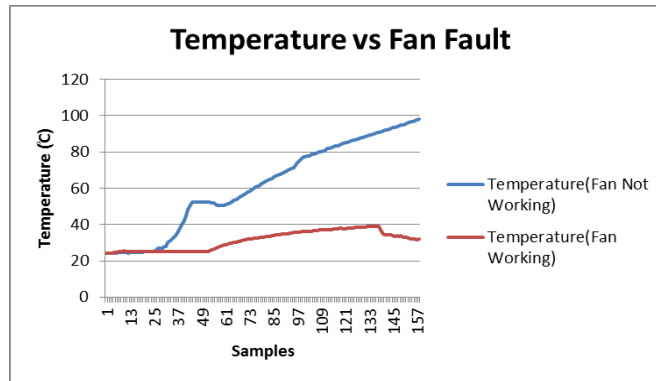
Predictive maintenance is the interpretation of the data obtained from condition monitoring and estimating the exact time of required maintenance. Sensors will be placed at critical points of the machine for condition monitoring.

The vibration sensor will be positioned on the motor shaft bearing in order to measure the machine vibration; Estimation will be made according to the amount of increase in vibration spectra. One of the important parameters for the healthy operation of the pumps is engine oils. The reduction of engine oil, which affects the heating rate in the engine, may be caused by mechanical wear or the deterioration of the fan. If the motor is not drawing excessive current and there is no obvious increase in the vibration specs, we will understand that it is possible that the engine oil may be low. With the current sensor connected to the motor, we will be able to monitor the current values drawn by the motor. The data received from the sensors will be processed in the machine learning algorithm and the user will be informed about the operation of the vacuum pump.

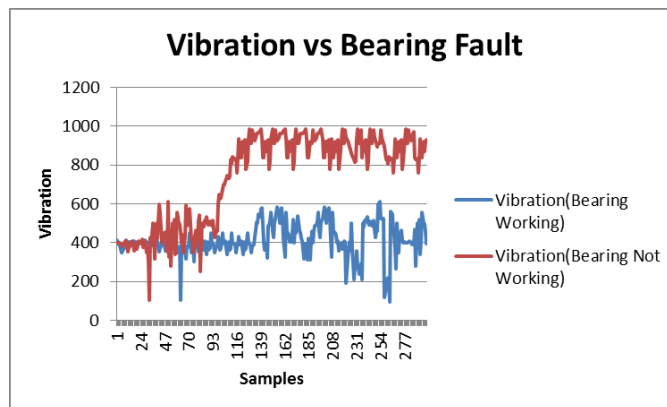
Data Processing Methods



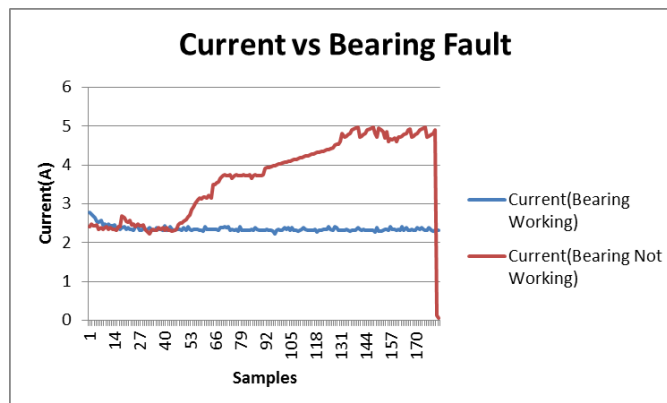
When the oil level is normal, Pressure sensor measure the pressure on vacuum pump between 0-5 pascals. As the vacuum pump oil level decreases, the vacuum pump decreases power of the and the pump so that pump cannot vacuum. According to graph, when the vacuum oil decreased, the pressure value measured increased from 0-5 to 35-40 pascal levels.



In the graphics, the temperature values when the cooling fans of the pump are intact and when they are broken are compared. The pump temperature has increased due to the fan impeller broken. It has been observed that when the pump power is cut off, the pump temperature still increasing while the main fan try to cool it.



The graph shown above depicts the relationship between vibration and bearing. When comparing these vibration data, it is evident that as the bearing degrades, it puts additional stress on the rotating joints of the system, which in turn causes a disturbance in the axis balance of the mechanism. Due to this disturbance in the axis balance, an increase in vibration has been observed in the mechanism.



The graph shown above illustrates the relationship between current and bearing. When comparing the collected data, an increase in current has been observed from the moment the bearing starts to degrade. This is due to the fact that as the bearing degrades, it causes a disturbance in the axis balance of the mechanism. By analyzing the data in the graph, it is possible to see that the electric motor begins to struggle to maintain movement due to the disturbance in the axis balance.

Supervised learning technique will be used for machine learning algorithm. All data will be collected and recorded from the moment of healthy operation until the pump switches to a complete failure state. The collected data will be grouped according to 1 independent and 4 dependent variables affecting the performance of the pump. The K-NN algorithm was chosen to use the grouped data. The data will be evaluated as teacher data in the algorithm.

In the new case, the pump will process the values it receives from the sensor at the time of operation and assign them to the algorithm. The distances between the values processed in the algorithm and the teacher data will be calculated as vectors. The new data will be included in the closest distance group.

The user will be informed by e-mail in order to intervene in the determined malfunctions and causes.

RESULT AND DISCUSSION

The accuracy of the data received from the sensors is important for the success of the project. Since the vacuum pump works in combination with the machines, the machines in the machine park may be affected by sound and vibration frequencies. We do not think that the current sensor connected in series to the motor phases and the pressure sensor connected to the vacuum chamber will be affected by this situation. Vibration and temperature sensors can be affected by the noise and temperature difference in the outside environment. We have chosen to take discrete samples instead of continuous samples due to these reasons and the time required for the recording process. The main reason for this is the time required to record the collected data. In addition, taking into account that the sensors may send incorrect values due to external factors or a momentary anomaly, we predicted that it would be efficient to associate consecutive data with each other and provide information to the user according to the situation resulting from the association. Filters can be used to block out interference frequencies. Data from the vibration sensor may give inaccurate results as it is affected by other machines. We are

considering designing a filter to prevent this situation and to improve the project. Thanks to the filter, we aim to prevent being affected by other machine sounds. Even though the temperature and vibration sensors are filtered, we had to take this precaution due to the external factor. However, it is not enough to make a filter in our system, as it will be affected by the temperature increase of the pump motor. If the temperature increase is critical, an external cooling unit can be added to the system if there is no change in other parameters. High vibration values can be harmful for the machine's construction. A vibration damper can be designed so that the high vibrations on the machine construction do not damage the pump.

After receiving the data from the sensor, it was taught to the k-NN algorithm. Serial port communication was used when sending the data to the algorithm. From this situation and saving the data to the memory card required us a long processing time. For this, we set our data acquisition interval to 6 seconds. The reason we did this was that when we set the time to less than 6 seconds, the system could not meet the required speed and the algorithm was executing itself. As a result, when we ran this algorithm, we analyzed the data we obtained in 4 different clusters. These; the fan is broken, the bearing is broken, it is working properly and the vacuum oil is missing. Some of these data are shown in the table below.

Bearing Fault

Vibration	Pressure	Temperature	Humidity	Current
829.0	43.0	56.46	12.52	3.14
808.0	41.0	56.4	12.54	3.12
872.0	34.0	61.31	13.26	4.16
919.0	38.0	62.41	14.07	4.52
930.0	39.0	63.78	14.62	4.54
777.0	33.0	64.59	14.8	4.54
982.0	32.0	68.89	10.57	4.81

Fan Impeller Broken

Vibration	Pressure	Temperature	Humidity	Current
315.0	23.0	51.7	15.22	2.29
278.0	24.0	50.58	16.07	2.25
293.0	25.0	54.41	13.8	2.19
350.0	26.0	55.12	13.44	2.23
379.0	18.0	64.34	9.09	2.27
406.0	18.0	64.95	8.89	2.29

Vacuum Oil Decreased

Vibration	Pressure	Temperature	Humidity	Current
514.0	19.0	67.17	8.06	2.27
522.0	27.0	51.7	15.67	2.27
377.0	27.0	54.24	13.92	2.27
520.0	27.0	55.0	13.49	2.31
194.0	27.0	55.73	12.98	2.27
499.0	27.0	56.77	12.41	2.29

Pump Working Properly

Vibration	Pressure	Temperature	Humidity	Current
204.0	5.2	25.07	55.19	2.78
365.0	6.1	25.67	54.22	2.74
297.0	5.4	26.13	53.7	2.69
425.0	4.8	26.67	52.78	2.65
381.0	5.3	27.07	51.9	2.55
341.0	6.0	29.96	45.66	2.44

Note: Pressure datas measured as negative. So when the value increase, it means pressure decreased.

When we examined the above table for bearing error, it was observed that vibration, temperature and current data increased. Due to the increase in temperature, the humidity in the system decreased.

When we examined for the fan impeller error, an increase in temperature was observed. Due to the increase in temperature, there was a decrease in humidity and pressure. It was observed that the vibration and current were constant.

Finally, when we examined for the vacuum oil error, it was observed that the temperature data increased and the pressure and humidity data decreased. This is mainly due to the inability to apply pressure and cooling due to the lack of oil in the pump.

H.Gürsoy et al. (2021), tried to detect bearing damage by vibration and noise analysis. However, this study was done on limited parameters and a single bearing type and tried to find the useful life. In our study, we analyzed the temperature and current values of the approach and examined the effects of different parameters on the bearing life. While doing this review,

we developed it using the k-NN algorithm, which is a machine learning algorithm. Our work, together with the improvements we have made, has enabled us to get more detailed and consistent results from the work of Habibe Gürsoy and her friends.

Parul Sinha et al. (2015), aimed to make an early diagnosis with machine learning using kidney disease symptoms to compare the effect of classification techniques. Although the KNN and SVM algorithms gave close results, the KNN algorithm gave more successful results. While choosing the k value, Parul experimentally determined a k value and used the same value in all test data. However, giving the same k value to the entire data set will reduce the efficiency of the algorithm. To avoid this situation, we can use the correlation matrix. Thus, we can benefit from the entire data set with maximum efficiency. In order to develop this project, we aim to work on the correlation matrix and put it into use.

CONCLUSION

In this Project, rotary vane vacuum pump working with positive displacement technique was investigated mechanically and electrically. It is purposed to ensure production continuity by getting maximum efficiency from the pump, to obtain quality standards and to minimize downtime. At the same time, it is aimed to reduce spare part costs by performing machine maintenance on time. For this purpose, frequent and instantaneous failures of the vacuum pump have been determined based on experimentation and experience. The determined faults cause changes in the vibration, temperature, current and pressure parameter values of the machine. The locations (critical point) where we can best measure the changes in each parameter were determined and the sensors were placed.

Sensor data was accumulate and recorded for the duration of pump efficiency reduction and degradation. The values collected from the sensors were organized and classified for fault codes. A machine learning algorithm was determined to evaluate the sensor data in the system. Machine learning algorithm and controller were selected to process the sensor data in the system. the system was engaged and it was estimated correctly 85 percent. The possible faulty part was reported to user via e-mail about the probable cause of failure.

RESOURCES

- ARSLAN, H. (2007). Bilyalı Rulman Yuvarlanma Elemanı Kusurunun Titreşim Analizi Yöntemiyle İncelenmesi. *Pamukkale University Journal of Engineering Sciences*, 13(2), 151–161. <https://dergipark.org.tr/en/pub/pajes/issue/20517/218448>
- BÜLBÜL, F., & JAFARPOUR, S. (2016). VAKUM POMPALARI. *Ordu University Journal of Science and Tecnology*, 5(2), 42–54. <https://dergipark.org.tr/en/pub/ordubtd/issue/11070/132202>
- Freddy Adams. (2015). Paul van der Heide: Secondary ion mass spectrometry: an introduction to principles and practices. *Analytical and Bioanalytical Chemistry*.
- Gözde Nur CALAYIR, & Mehmet Kabak. (2021). Bakım için makine öğrenme tekniklerinin analizi ve bir uygulama. *Journal of the Turkish Operations Management (JTOM)*, 5(1), 662–675.
- Gülşen YAMAN, & Halil Murat KARADAYI. (2014). Titreşim Analizi ile Pompalarda Arıza Tesbiti ve Kestirimci Bakım İçin Örnek Bir Çalışma. *Tesisat Mühendisliği*, 140, 36–50. https://www.mmo.org.tr/sites/default/files/0fc7ce64e252ead_ek.pdf
- Hakan Ceyhan, & Mustafa Cem Kasapbaşı. (2022). Üretim Sistemlerinde Makine Öğrenmesi ile Kestirimci Bakım Uygulaması ve Modellemesi. *Avrupa Bilim ve Teknoloji Dergisi*, 167–175.
- İlhami ÇOLAK, & Ramazan BAYINDIR. (2005). Klasik Yol Verme Metotlarının Denetleyici Yardımıyla Gerçekleştirilmesi . *F. Ü. Fen ve Mühendislik Bilimleri Dergisi*, 17(1), 10–18.
- İsmail ARICI. (2014). *LABVIEW TABANLI BİR ELEKTRONİK DENEY SETİ GELİŞTİRİLMESİ* [Yüksek Lisans Tezi]. FEN BİLİMLERİ ENSTİTÜSÜ.
- Li, Y., Li, W., Xiong, J., Xia, J., & Xie, Y. (2020). Comparison of Supervised and Unsupervised Deep Learning Methods for Medical Image Synthesis between Computed Tomography and Magnetic Resonance Images. *BioMed Research International*, 2020. <https://doi.org/10.1155/2020/5193707>
- Makalesi, A., Gürsoy Demir, H., & Müştak, O. (2021). Rulman Hasarlarının Titreşim ve Gürültü Analizi ile Tespiti. *Avrupa Bilim ve Teknoloji Dergisi*, 25, 571–581. <https://doi.org/10.31590/EJOSAT.869285>
- Okan Oral, Oğuz Çolak, & Mustafa Bayhan. (2019). Ti6Al4V Malzemesinin Frezelenmesi'nde Oluşan Takım Titreşiminin MEMS İvme Sensörü ile İzlenmesi. *Avrupa Bilim ve Teknoloji Dergisi*, 1134–1144.
- ORHAN, S., AKTÜRK, N., & ÇELİK, V. (2010). DETERMINATION OF CENTRIFUGAL PUMP BEARING HEALTH THROUGH VIBRATION ANALYSIS. *Gazi University Journal of Science*, 16(3), 543–552. <https://dergipark.org.tr/en/pub/gujs/issue/7405/97146>
- Rana DÜNDAR, D., Sariçiçek, İ., Çınar, E., Yazıcı, A., Osmangazi Üniversitesi, E., Fakültesi, M.-M., Mühendisliği, E., & Kelimeler Öz Kestirimci Bakım Makine Öğrenmesi Derin Öğrenme, A. (2021). KESTİRİMCİ BAKIMDA MAKİNE ÖĞRENMESİ: LİTERATÜR ARAŞTIRMASI. *Journal of Engineering and Architecture Faculty of Eskisehir Osmangazi University*, 29(2), 256–276. <https://doi.org/10.31796/OGUMMF.873963>
- Recep MİNAZ, M., Üniversitesi, S., & Elektronik Mühendisliği Bölümü, E. (2021). Sonlu Elemanlar Yöntemi ile Fırçasız Doğru Akım Motorunun (BLDC) Kısa Devre Arıza

- Analizi. *Dicle Üniversitesi Mühendislik Fakültesi Mühendislik Dergisi*, 12(1), 1–21.
<https://doi.org/10.24012/DUMF.859644>
- Saritas, M. M., & Yasar, A. (2019). Performance Analysis of ANN and Naive Bayes Classification Algorithm for Data Classification. *International Journal of Intelligent Systems and Applications in Engineering*, 7(2), 88–91.
<https://doi.org/10.18201/ijisae.2019252786>
- Sinha Parul, & Sinha Poonam. (2015). Comparative Study of Chronic Kidney Disease Prediction using KNN and SVM. *International Journal of Engineering and Technical Research*, V4(12).
- Ünal, H., Kuraloğlu, H., Arslan, S., Faruk BAŞARAN Uludağ Üniversitesi, Ö., Fakültesi, Z., Mühendisliği Bölümü, B., & Tarihi, G. (n.d.). Vakum Pompasının Farklı Vakum Basıncı ve Rakım Seviyelerindeki İşletme Özelliklerinin Belirlenmesi Determination of Operating Characteristics of a Vacuum Pump at Different Vacuum Pressures and Altitudes. *Journal of Agricultural Machinery Science*, 2015(2), 179–185.
- Vakum Pompaları: Busch R5 RA 1000/1600 B ROTORLU YAĞLI TİP VAKUM POMPASI*. (n.d.). Retrieved April 26, 2023, from <https://www.buschvakumpompalari.com/busch-vakum-pompalari/busch-r5-ra-1000-1600-b-rotorlu-ya%C4%9Flu-ti%CC%87p-vakum-pompasi-detail>
- Vishwanath Bijalwan, Vinay Kumar, Pinki Kumari, & Jordan Pascual4. (2014). KNN based Machine Learning Approach for Text and Document Mining. *International Journal of Database Theory and Application*, 7(1), 61–70.
- Wakiru, J. M., Pintelon, L., Muchiri, P. N., & Chemweno, P. K. (2019). A review on lubricant condition monitoring information analysis for maintenance decision support. *Mechanical Systems and Signal Processing*, 118, 108–132.
<https://doi.org/10.1016/J.YMSSP.2018.08.039>

***A.unedo* L. (STRAWBERYY TREE) ISLAHINDA YENİ GELİŞMELER**

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ÖZET

Arbutus unedo L., Akdeniz Bölgesine özgü, Anadolu, Yunanistan, Lübnan, İrlanda ve Güney Avrupa'da yetişebilen, *Ericaceae* familyasında yer alan bir meyve türüdür. 400-1200 m rakımda, yamaçlarda, silisli veya karbonatlı kurak topraklarda yetişebilmektedir. Gelişmesi özellikle ilk gençlik yıllarında oldukça yavaştır. Hafif kurak topraklarda tek gövdeli ağaç şeklinde gelişirken, daha kurak topraklarda çalı şeklinde gelişir. Meyveleri sonbaharda olgunlaşır. Yabani orman meyvelerinden biri olarak yerel halk için ekonomik değer taşımaktadır. Meyveleri alkollü içecek, reçel, jöle ve marmelat yapımında kullanılır. Meyvelerin yerel toplulukların sağlığına ve endüstriyel tıbbı birçok katkısı vardır. Halk hekimliğinde antiseptik, diüretik, müshil, antioksidan, tansiyona karşı etkili olarak iyi bilinir. Türkiye, *Arbutus unedo* L'nin zengin genetik kaynaklarına sahiptir. Ülkenin çeşitli yerlerinde maki ormanlarında yetişen büyük popülasyonu vardır. Bu derleme makalesinde *Arbutus unedo*'nun genel özellikleri, ıslahı ve yetiştiriciliğine yönelik çalışmalar incelenmiştir. Kültürel koşulların daha uygun olması durumunda daha verimli ağaçların ve daha iyi meyve kalitesinin nasıl artırılarak ekonomiye katkı sağlanabileceği konusunda öneriler yapılmıştır.

Anahtar Kelimeler: *Arbutus unedo* L., ıslah, *Ericaceae*, seleksiyon, çoğaltma

NEW TRENDS IN *A. unedo* L. (STRAWBERRY TREE) BREEDING

ABSTRACT

Arbutus unedo L., the strawberry tree (Ericaceae family), is a fruit species native to the Mediterranean, growing in Anatolia, Greece, Lebanon, Ireland, and Southern Europe. It grows at altitudes ranging from 400 to 1200 m on silicious or carbonated dry soil. Development is very slow and grows in the form of single trunk tree in light-arid lands, while developing in the form of a bush in more dry land. Fruits mature in autumn. Locally grown wild edible fruits are important for local cultures, especially in the Mediterranean region. Fruits are used for production of alcoholic beverages, jams, jellies, and marmalade. Fruits have many contributions to the health of local communities and industrial medicine. It is well-known in folk medicine as antiseptics, diuretics, laxatives, depurative and antihypertensive purposes. Turkey has rich genetic resources of *Arbutus unedo* L. There is a large strawberry population in various parts of the country which grow in the maquis forests. Therefore, in this review article, general properties of *A.unedo* and studies on breeding and cultivation were investigated. Suggestions were obtained in case of more appropriate cultural conditions how could be increased more productive trees and better fruit quality to contribute to the economy.

Keywords: *Arbutus unedo* L., breeding, *Ericaceae*, selection, propagation

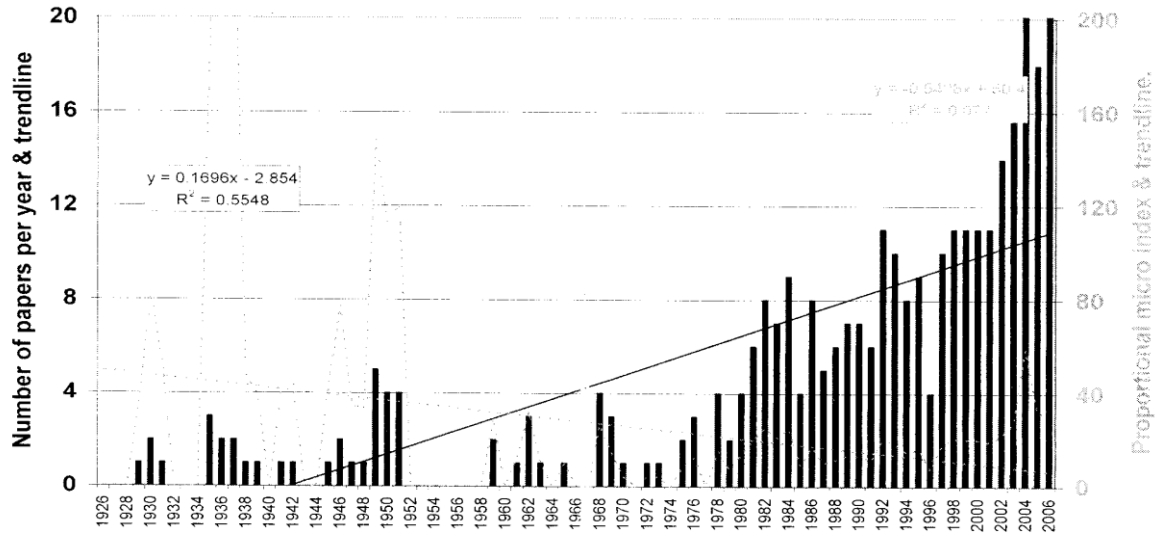
1. GİRİŞ

Kocayemiş Akdeniz iklimine sahip ekolojilerde popülasyonlar oluşturan yetişen bir maki bitkisidir. Her dem yeşil, genellikle 2-8 m kadar boylanabilen çalı ya da ağaç formunda gelişen bir türdür. Yaprakları üst yüzü parlak koyu yeşil, alt yüzü açık yeşil, kenarları dişli yapıda, orta büyüklüktedir (İslam ve Pehlivan, 2002). Kocayemiş çiçekleri beyaz, beyazımsı pembe renkte, çan şeklinde ve salkımlar halinde oluşmaktadır. Çiçeklenme döneminde yeni açan çiçekler ve olgun meyveler aynı anda bitki üzerinde bulunmaktadır (Pekdemir, 2010). Çiçekler geç sonbahar-kış döneminde açar, bu nedenle diğer meyve türlerine göre iklim koşullarından daha çok etkilenir. *A.unedo* maki topluluğu içinde hızlı gelişen bitki grubu içinde sınıflandırılmıştır (Paraskevopoulos ve diğ.,1994). Kuraklık stresine son derece dayanıklı bir türdür (Munne-Bosch ve Penuelas, 2004). *A.unedo* silisli, alkali ve nispeten asidik topraklarda yetişebilmektedir (Takrouni ve Boussaid, 2010). Meyveleri yumuşak çekirdekli olup, klimakteriktir (Ogaya ve Peñuelas, 2004). Kocayemişin olgunlaşmış meyveleri kırmızı renkte, üzerleri girintili çıkıntılı, yuvarlak, oval veya kalp şeklindedir (Sulusoglu ve diğ., 2011). 0.96-13.63 g ağırlığındaki meyveleri çok sayıda taş hücresi içerir (Şeker ve diğ., 2004; Sulusoglu ve diğ., 2011).

2. KOCAYEMİŞİN ANAVATANI VE TARİHÇESİ

Kocayemiş meyvesinin tarihi çok eskilere dayanmaktadır. 1. yy'da Roma'da varlığından bahsedilmektedir. Bitki orijininin bir kısmının Ortadoğu kökenli, bir kısmının Çin kökenli olduğu düşünülmektedir (Malcolm, 2019). Akdeniz Bölgesinde, Kuzey Batı ve Orta Amerika'da, Batı ve güney Avrupa'da, kuzeydoğu Afrika, Kanarya Adaları ve Batı Asya'da yayılım göstermektedir. Türkiye, Yunanistan, Lübnan, İrlanda, Tunus gibi Akdeniz'e kıyısı olan ülkelerde yetişmektedir (Torres et al., 2002, Blanco et al, 2005).

İspanya Madrid Bölgesinde tarihsel değer taşıyan *Arbutus unedo*, Madrid Bayrağında Büyük Pençe olarak bilinen ayı figürü ile birlikte yer almaktadır (Anonim 1, 2019). Kocayemişin 1980'lerden itibaren popüler hale geldiği ve ilginin 2000'lerde artarak çalışmaların hızlandığı görülmektedir (Şekil 1).



Popularity of *Arbutus unedo* over time

Şekil 1. Kocayemiş konusundaki çalışmaların yıllara dağılımı (1926-2006)

(Kaynak: http://www.worldagroforestry.org/treedb2/AFTPDFS/Arbutus_unedo.PDF)

3. *A.unedo*'nun FAYDALARI VE KULLANIMI

Meyvelerinin antioksidan değeri yüksektir (Garcia-Alonso ve diğ., 2004). Meyveleri karbonhidrat içermekte olup, fruktoz yüksektir; ayrıca vitamin C ve fenolik bileşiklerce zengindir (Barros ve diğ., 2010). Salatalarda çiğ olarak kullanılmakta, reçel yapılmaktadır (Lentini ve Venza 2007). Gösterişli yapraklı dalları çiçekçiler tarafından özellikle aranjman ve çelenk yapımında tercih edilmektedir. Ağaçları çok dekoratif olduğu için süs bitkisi olarak da kullanılabilir (Pekdemir, 2010). Birçok hastalığa karşı faydaları vardır. Böbrek taşlarına karşı kullanılmaktadır (Maxia ve diğ., 2008). Kardiyovasküler hastalıkların tedavisinde etkilidir (Abidi ve diğ., 2016).

4. *A. unedo*'nun ÇOĞALTILMASI

Tohumlarıyla ve çelikle çoğaltılabilmektedir. Doğal ekosisteminde meyvelerini tüketen kuşlar ve hayvanlar vasıtası ile tohumlar dağılmaktadır (Aparicio ve diğ. 2008). Yangınlar sonrasında toprakta tohum rezervi kalmadığı durumda toprak altı organları lignotuberlerden yeniden sürmektedir (Gomes, 2011). Tohum çimlenmesi üzerine birçok çalışma gerçekleştirilmiştir (Tilki, 2004; Pipinis et al. (2017). Tohumların çimlenmesi genotiplerde farklılık gösterir. Çimlenme ortamı koşullarından etkilenmektedir. Doğrudan çimlenmeye alınan tohumlarda %18 çimlenme oluşurken (Hammami ve diğ., 2005), soğuklaması karşılanan tohumlarda çimlenme oranı artmış, %80-90'a kadar çıkmıştır (Tilki, 2004; Ertekin ve Kırdar

2010). Sıcaklık ve ışık tohum çimlenmesini etkilemektedir (Mesleard and Pepart, 1991). İn vitro koşullarda da tohum çimlenmesi çalışılmış, çimlenme oranı %85-%99 arasında belirlenmiştir (Ertekin ve Kırdar (2010), Pipinis ve ark.,2017, (Smiris ve ark.,2006),Giordani et al., 2005,Papafotiou et al. (2013),). GA₃ uygulaması ve soğuklama çimlenmeyi artırmaktadır. *A.unedo* çelikleri ile de çoğaltılmaktadır (Şeker ve ark.,2010; Sülüoğlu,2012). Köklenme oranı ve kök sayıları genotiplere göre değişim göstermektedir. Bazı genotiplerde köklenme olmazken veya çok düşük oranda gerçekleşirken, bazı genotiplerde %100 başarı sağlanmıştır (Metaxas ve diğ., 2008; Sulusoglu 2012). *A. unedo*'nun mikro çoğaltımı başarılı sonuçlar vermiştir (Mereti ve diğ., 2002; Gomes 2011; Sulusoglu ve Memis, 2022). Mikro çoğaltımda başarı genotiplere göre farklılık göstermektedir. %36-81 yaşama oranı sağlanmıştır. Mikro sürgünlerde %97'ye varan köklenme sağlanmıştır. Besin ortamının bileşimi, kullanılan hormon çeşidi ve dozu oldukça etkilidir (Gomes ve Canhato 2009). Aklimatizasyon aşamasının geliştirilmesi konusunda çalışmalar devam ettirilmelidir (Sulusoglu ve Memis 2022). İn vitro yaprak eksplantlarından farklı hormon kombinasyonlarını içeren ortamlarda somatik embriyo elde edilmiş, embriyolarda çimlenme sağlanmıştır (Gomes ve diğ., 2009; El-Sayed El-Mahrouk ve diğ, 2010).

5. ISLAH ÇALIŞMALARI

Genetik dağılımı, seleksiyonu ve morfolojik özellikleri konusunda birçok çalışma yürütülmüştür (Sulusoglu ve diğ, 2011; Çelikel ve diğ, 2008). Portekiz'de kocayemiş tiplerinin genetik özellikleri belirlenerek kültüre alınmasına yönelik çalışmalar başlamıştır. Türkiye'de Kocaeli, Samsun ve Çanakkale ekolojisinde bu konuda çalışmalar mevcuttur (Şeker ve diğ, 2004, Çelikel ve diğ., 2008, Sulusoglu ve diğ, 2011). İspanya-Katalonya'da *Arbutus unedo*'da doğal bir popülasyonda sürgünlerin etrafındaki bitkilerle rekabet etme durumu değerlendirilmiş, hızlı gelişen bir tür olduğu sonucuna varılmıştır (Vilà et al., 1994). Meyve türlerinin ıslahında verim önemli bir kriterdir. Kocayemiş ağaçları genellikle dağınık ağaçlar şeklide yetiştiğinden ve kapama bahçe olmadığından verim değerli bulunmamaktadır. İspanya'da yapılmış bir modelleme çalışması ile verim değeri tahmini yapılmıştır. Çalışma sonuçlarına göre bitki verimi 2.6 ile 6.4 kg/ağaç aralığındadır (Molina et al., 2011). 2009-2011 yılları arasında Marmara Bölgesi Samanlı Dağları Bölgesinde yetişen *A.unedo* popülasyonlarında seleksiyon çalışması yürütülmüştür. Seçilen genotiplerin yer aldığı, Kocaeli Üniversitesi Ziraat Fakültesi Bahçe Bitkileri Araştırma ve Uygulama Bahçesinde verim ve

kalite çalışmalarına devam edilmektedir (Sulusoglu ve diğ., 2011). Yunanistan’da yürütülen bir çalışmada, tıraşlama kesimlerden sonra bitkinin yeniden büyüme durumu incelenmiştir. Tahminlere göre *A. unedo* maksimum büyüme hızına 10 yaşında erişmekte, maksimum biyokütleye ise 23 yaşında erişmektedir. Bu sonuca göre hızlı gelişen tür olarak adlandırılmaktadır. Sonraki yıllarda da oransal büyüme hızında minimum azalma ile daha uzun süreli yaşayan bitkidir ve bulunduğu toplulukta baskındır (Paraskevopoulos et al. 1994). Kocayemişlerin büyüme modeli çalışmalarında bir yıl içinde iki büyüme dönemi belirlenmiştir. Herhangi bir zararlanma durumunda lignotuberlerde biriktirdiği nişastayı kullanarak yeniden gelişebilmektedir (Canadell and Lopez-Soria, 1998; Konstantinidsi ve diğ., 2006). Yangın sonrasında lignotuberlerden gelişme gerçekleşmektedir (Mesleard and Lepart, 1991, Gomes, 2011). Kocayemiş dayanıklı bir tür olarak tanınmaktadır. *Arbutus unedo* kuraklığa son derece toleranslı olduğundan kuraklığın mekanizmasının ortaya konmasında model bir bitkidir (Munne-Bosch ve Penuelas, 2004). Kocayemiş küresel iklim değişikliğinin etkisini giderek artırması nedeniyle günümüzde önemli türler arasındadır. Dağılımının ortaya konması ve korunması önemli bir çalışma alanını oluşturmaktadır. *Arbutus unedo* populasyonlarının genetik dağılımı ve yapısı moleküler tekniklerle incelenmiştir (Takrouni ve Boussaid 2010; *A. unedo*’da populasyonlar arasındaki farklılıkların rakım, yağış durumu gibi ekolojik faktörlerle ilişkileri değerlendirilmiştir. Çiçeklenme zamanı, olgunlaşma dönemi, bitkinin yaşam süresi gibi faktörlerdeki değişimin daha çok ekolojik koşullara göre farklılaştığı ortaya konmuştur (Takrouni ve Boussaid, 2010). Bertsoouklis ve Papafotiou 2016). Akdeniz ormanlarında yer alan populasyonlarda büyüme formları, fenolojileri ve morfolojik özellikleri (Ribeiro ve diğ., 2017), kimyasal ve biyolojik özellikleri incelenmiştir (Miguel ve diğ., 2014).

6. SONUÇ VE ÖNERİLER

Kültüre alınmış meyve türlerinin yanında kocayemiş yetiştiricilik açısından büyük katkılar sağlayacak bir tür olarak önem taşımaktadır. Bu nedenle seleksiyon çalışmalarına ağırlık verilmesi, belirlenen genotiplerle çalışmalara devam edilmesi önerilmektedir. Bitkisel materyalin temini bakımından kocayemişin çoğaltımı konusunda çalışmalar artırılmalıdır. Tohum ile çoğaltım ıslah çalışmaları açısından büyük yarar sağlayacaktır. Ticari olarak yetiştiriciliğinin gelişmesi açısından tüm bu öneriler dikkate alınmalıdır. Bu meyve türlerinin besin madde içeriği, en az kültüre alınmış meyvelerinki kadar değerlidir ve bunların kültürünün gelişmesi ile insan beslenmesine önemli katkılar sağlanabilecektir.

KAYNAKLAR

1. Abidia, E., Habibb, J., Yassineb, A., Chahinec, N., Mahjoubd, T., Elkaka, A. (2016), Effects of Methanol Extracts From Roots, Leaves, and Fruits of The Lebanese Strawberry Tree (*Arbutus andrachne*) on Cardiac Function Together With Their Antioxidant Activity, *Pharmaceutical Biology*, 54(6): 1035–1041.
2. Anonim (2019), (<https://thetreeographer.com/2017/09/01/the-bear-and-the-strawberry-tree/>, erişimi: 15.05.2019)
3. Aparicio, A., Albaladejo, R.G., Olalla-Tarraga, M.A., Carrillo, L.F., Rodriguez, M.A. (2008), Dispersal Potentials Determine Responses of Woody Plant Species Richness to Environmental Factors in Fragmented Mediterranean Landscapes, *Forest Ecology and Management* 255: 2894-2906.
4. Barros, L., Carvalho, A.M., Morais, J.S., Ferreira, I.C.F.R. (2010), Strawberry-tree, Blackthorn and Rose Fruits: Detailed Characterisation in Nutrients and Phytochemicals With Antioxidant Properties. *Food Chemistry*, 120: 247–254.
5. Bertsoyklis, K.F., Papafotiou, M. (2016), Morphometric and Molecular Analysis of the Three *Arbutus* Species of Greece, *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 44(2): 423-430.
6. Blanco, E., Casado, M.A., Costa, M., Escribano, R., García, M., Génova, M. Ve diğ. (2005), *Los Bosques Ibéricos. Una Interpretación Geobotánica*. 4th edn. Planeta, Barcelona, Spain.
7. Canadell, J., Lopez–Soria, L. (1998), Lignotuber Reserves Support Regrowth Following Clipping of Two Mediterranean Shrubs, *Functional Ecology*, 12:31–38.
8. Çelikel, G., Demirsoy, L., Demirsoy, H. (2008), The Strawberry Tree (*Arbutus unedo* L.)
9. Selection Studies in Turkey. *Scientia Horticulturae*, 118(2): 227-230.
10. El-Sayed El Mahrouk, M., Dewir Y.H., Omar, A.M.K. (2010), In Vitro Propagation of Adult Strawberry Tree (*Arbutus unedo* L.) Through Adventitious Shoots and Somatic Embryogenesis, *Propagation of Ornamental Plants*, 10 (2): 93-98.
11. Ertekin, M., Kırdar, E. (2010), Breaking Seed Dormancy of The Strawberry Tree (*Arbutus unedo*). *International Journal of Agriculture and Biology*, 12: 57–60.
12. García-Alonso, M., Pascual-Teresa, S., Santos-Buelga, C., Rivas-Gonzalo, J.C. (2004), Evaluation of The Antioxidant Properties of Fruits. *Food Chemistry*, 84:13–18.

13. Gomes, F., Canhoto, J. (2009), Micropropagation of Strawberry Tree (*Arbutus unedo* L.) From Adult Plants. In Vitro Cellular & Developmental Biology–Plant, 45:72–82.
14. Gomes, M.F.F.N. (2011), Strategies for the Improvement of *Arbutus unedo* L. (Strawberry Tree): in Vitro Propagation, Mycorrhization and Diversity Analysis, Departamento de Ciências da Vida Universidade de Coimbra, PhD Thesis, Portugal.
15. Hammami, I., Jellai, M., Ksonti, M., Rejeb, M.N. (2005), Propagation of the Strawberry Tree Through Seed (*Arbutus unedo*), International Journal of Agriculture & Biology, 1560–8530/2005/07–3–457–459 <http://www.ijab.org> .
16. İslam, A., Pehlivan, F. (2016), Marmara Adasında Yetişen Kocayemişlerin (*Arbutus unedo* L.) Pomolojik Özellikleri, Akademik Ziraat Dergisi 5(1):13-20.
17. Konstantinidis, P., Tsiourlis, G., Xofis, P. (2006), Effect of Fire Season, Aspect And Pre-fire Plant Size on The Growth of *Arbutus unedo* L. (Strawberry Tree) Resprouts, Forest Ecology and Management 225: 359–367
18. Malcolm, 15.05.2019 erişim). <https://pioneerthinking.com/history-of-the-strawberry-and-the-strawberry-tree>.
19. Mereti, M., Grigoriadou, K., Nanos, G.D. (2002), Micropropagation of The Strawberry Tree,
20. *Arbutus unedo* L. Scientia Horticulturae, 93:143-148.
21. Mesleard, F., Lepart, J. (1991), Germination and Seedling Dynamics of *Arbutus unedo* and *Erica arborea* on Corsica, Journal of Vegetation Science, 2(2): 155-164.
22. Metaxas, D., Syros, T., Economou, A. (2008), Factors Affecting Vegetative Propagation of *Arbutus unedo* L. By Stem Cuttings, Propagation of Ornamental Plants, 8(4): 190-197.
23. Miguel, M.G., Faleiro, M.L., Guerreiro, A.C., Antunes, M.D. (2014). *Arbutus unedo* L. Chemical and Biological Properties. Molecules, 19:15799–15823.
24. Molina M., Pardo-de-santayana M., Aciteuno L., Morales R., Tardio J., 2011. Fruit Production Of Strawberry Tree (*Arbutus Unedo* L.) In Two Spanish Forests. Forestry, Vol. 84 No.
25. Munné-Bosch, S., Peñuelas, J. (2004), Drought-induced oxidative stress in strawberry tree (*Arbutus unedo* L.) growing in Mediterranean field conditions, Plant Science, 166:1105-1110

26. Ogaya, R., Penuelas, J. (2004), Phenological patterns of *Quercus ilex*, *Phillyrea latifolia*, and *Arbutus unedo* growing under a field experimental drought, *Ecoscience*, 11(3):263-270
27. Paraskevopoulos, S.R., Iatrou, G.D., Pantis, J.D. (1994), Plant growth strategies in evergreen-sclerophyllous shrublands (Maquis) in central Greece. *Vegetatio*, 115:109-114.
28. Pekdemir, M. (2010), Espiye ve Bulancak İlçelerinde (Giresun) Yetişen Kocayemişlerin (*Arbutus unedo* L.) Fenolojik ve Pomolojik Özellikleri, Yayınlanmamış Yüksek Lisans Tezi, Ordu Üniversitesi, Fen Bilimleri Enstitüsü, Bahçe Bitkileri Anabilim Dalı, Ordu.
29. Pipinis, E., Stampoulidis, A., Milios, E., Kitikidou, K., Radoglou, K. (2017)., Effects of Cold Stratification and GA₃ on Germination of *Arbutus Unedo* Seeds of Three Provenances, *African Journal of Traditional, Complementary and Alternative Medicines AJTCAM*, 14(1):318-323
30. Ribeiro M.M., Piotti A., Ricardo A., Gaspar D., Costa R., Parducci L., Vendramin G.G., 2017. Genetic Diversity And Divergence At The *Arbutus Unedo* L. (*Ericacea*) Westernmost Distribution Limit.
31. Sulusoglu-Durul, M., Memis, S. (2022), Optimization of Conditions for In Vitro Culture of Selected *Arbutus unedo* L. Genotypes, *Agronomy*, 12(3):623.
32. Sülüsoğlu, M. (2012), Development of a Rooted Cutting Propagation Method for Selected *Arbutus unedo* L. Types and Seasonal Variation in Rooting Capacity. *J. of Agricultural Science*, 4(11):216–225
33. Şeker, M., Yücel, Z., Nurdan, E. (2004), Çanakkale Yöresi Doğal Florasında Bulunan Kocayemiş (*Arbutus unedo* L.) Populasyonunun Morfolojik ve Pomolojik Özelliklerinin İncelenmesi, *Tarım Bilimleri Dergisi*, 10(4):422–427.
34. Şeker, M., Akçal, A., Sakaldaş, M., Gündoğdu, M.A. (2010), Farklı Çelik Alma Dönemleri ile Oksin Dozlarının Kocayemişin (*Arbutus unedo* L.) Köklenme Oranı Üzerine Etkilerinin Belirlenmesi, *Journal of Agricultural Faculty of Uludag University*, 24 (1): 99-108.
35. Takrouni, M.M., Boussaid, M. (2010), Genetic diversity and population's structure in Tunisian strawberry tree (*Arbutus unedo* L.), *Scientia Horticulturae*, 126:330-337.,
36. Tilki, F. (2004), Improvement in Seed Germination of *Arbutus unedo* L., *Pakistan J. of Biological Sciences*, 7(10):1640–1642.

37. Torres, J.A., Valle, F., Pinto, C., Garcia-Fuentes, A., Salazar, C., Cano, E. (2002), *Arbutus unedo* Communities in Southern Iberian Peninsula Mountains, *Plant Ecology*, 160:207-223.
38. Vilà, M., Weiner, J., Terrades, J. (1994), Effect of Local Competition on Resprouting of *Arbutus unedo* After Clipping, *Journal of Vegetation Science*, 5(2):145-152.

JAPON AYVASINA GENEL BİR BAKIŞ (*Chaenomeles japonica*)

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ÖZET

Japon ayvası (*Chaenomeles japonica* Thunb) Lindl. *Rosaceae* familyası, *Maloidea* alt familyasında yer alan, az bilinen, ama bir o kadar da önemli bir türdür. Doğu Asya orjinlidir; anavatanı Çin, Kore ve Japonya olup, ılıman iklim kuşağında yetişmektedir. Yumuşak çekirdekli bir meyvedir, meyve yapısı elma ve ayvaya benzer. Bitkileri alçak ve orta boylu çalı şeklinde gelişmektedir. İlk olarak Japonya dağlık kesiminde 1784 yılında keşfedilmiştir. Kültürü artan bir ilgi görmektedir. Endüstride iyi bir hammaddedir. Farmakolojik olarak ilaçların üretiminde faydaları fazladır. Besin olarak da değerlendirilmektedir. Fidan üretimi sınırlı olup, adına doğru, verimli fidan bulmak sorundur. Burada sunulan çalışmada Japon ayvasının genel özelliklerinin yanı sıra, değerlendirme şekilleri ele alınmıştır. Sunulan çalışma genetik kaynakların değerlendirilmesi bakımından çok önemlidir.

Anahtar Kelimeler: *Chaenomeles japonica*, seleksiyon, meyve kalitesi, titre edilebilir asitlik, pomoloji

AN OVERVIEW OF JAPANESE QUINCE (*Chaenomeles japonica*)

ABSTRACT

Chaenomeles japonica (Thunb.) Lindl. is one of the lesser-known fruit species belonging to the *Rosaceae* family *Maloidea* subfamily. The homeland of Japanese quince is China, Korea, and Japan in East Asia, and it can be grown in almost every region of temperate climate. It is a shrub-shaped plant that belongs to the group of pome plants such as quince, pear and apple according to its fruit characteristics. The first specimens of *Chaenomeles japonica* were found in the mountains of Japan in 1784, with conspicuous colors such as red, pink, white and orange. Europe met this plant in 1869 and its cultivation as fruit began in northern countries and continue to produce today. *Chaenomeles japonica* L. has a great interest in the world because of common uses in the industrial, pharmaceutical, and nutritional fields. Sapling is limited because of the lack of selection and culture of this fruit. In this work, the properties of *C. japonica* types were evaluated, and differences were got out different characters with other *Chaenomeles* species. The present research is very important because of obtain genetical resources for future studies and sapling production.

Keywords: *Chaenomeles japonica*, selection, fruit quality, titratable acidity, pomology

1. GİRİŞ

Japon ayvası (*Chaenomeles japonica* (Thunb.) 1.2 m kadar gelişebilen bodur çalı bitkilerden, kışın yapraklarını döken/kısmen döken bir türdür. Dalları oldukça dikenlidir. Çiçeklenme erken ilkbaharda, yapraklardan önce oluşmaktadır ve yaklaşık 45 gün kadar sürmektedir. Son derece gösterişli, koyu kırmızı, kızıl, pembe, turuncu, nadiren beyaz renkte çiçekleri vardır. Meyveleri elma şeklinde, üzeri beyaz noktalı, oldukça sert, asidik yapıda ve hoş kokuludur. Taze olarak yenmesi neredeyse olanaksızdır, işlenmesi gerekir. Meyvelerinde 80-100 adet tohum vardır, bu da işlenebilecek nitelikte meyve etini azaltmaktadır.

Rosales takımı, *Rosaceae* familyası, *Maloideae* alt familyası *Chaenomeles* Lindley alt cinsi içinde yer almaktadır. Anavatanı Doğu Asya'da Çin, Kore ve Japonya'dır. Pembe-kırmızı renkli çiçekleri ile ilk olarak 1784'te Japon dağlarında bulunmuştur (Mihova ve diğ.,2012). Avrupa'da 19. yüzyılda kültüre alınarak süs bitkisi değeriyle yetiştirilmeye başlanmıştır. Japon ayvası birçok ülkede süs bitkisi olarak yaygın yetiştirilmektedir. Kuzey Avrupa ülkelerinde ise, sağlık açısından önemli bir meyve olup, çok sayıda projeye konu olmuştur. 3000 yıldan beri Doğu Asya'da Çin tıbbının önemli bitkilerinden biri kabul edilmektedir (Bieniasz ve diğ. 2017).

2. JAPON AYVASININ KİMYASAL BİLEŞİMİ

Japon ayvasında 100 g taze meyvede 30-195 mg C vitamini, 0.65-1.69 g pektin, 0.60-3.98 g şeker, 41.64-110.31 g organik asit bulunmaktadır (Turkiewicz ve diğ. 2020). Yapraklarındaki ana polifenol grubu fenolik asitlerdir. En yaygın polifenol bileşiği ise klorojenik asit olarak belirlenmiştir (Urbanaviciute 2019). Bileşiminde şekerlerden glikoz, fruktoz ve sorbitol bulunmaktadır. Organik asitlerden malik asit ve kuinik asitlerce zengindir. Aspartik asit, asparjin ve glutamik asit içeriğindeki önemli aminoasitlerdir. Mineral maddelerden potasyum ve florid oldukça yüksek değerde bulunmaktadır. Meyve suyu bileşimi japon ayvasının değerini ortaya koymaktadır. Yüksek C vitamini içeriği ve fenolik madde bileşimi, antioksidan karakteri japon ayvasını olağanüstü bir meyve yapmaktadır (Hellín et al., 2020, Chojnacka ve diğ. 2020). Meyvelerinin kutiküler mumları yağ asitleri, alkoller, aldehitler, esterler, eterler ve alkanlar olmak üzere çok sayıda bileşen içermektedir (Lykholat et al. 2021).

3. JAPON AYVASININ TIBBİ ÖZELLİKLERİ

Japon ayvası insan sağlığına olumlu etkileri olan antioksidanlar ve sekonder metabolitler gibi birçok biyokimyasal bileşikler açısından zengin bir bitkidir. Ekstraktları zengin fenol içeriği ve sitotoksik etkisi nedeniyle kansere karşı etken madde olarak değerlidir (Strek ve diğ., 2007;

Gorlach ve diğ., 2011). Kalorisi çok düşüktür; diyeti antioksidanlarca zenginleştirebilecek biyokomponentler bakımından zengindir (Urbanaviciute 2020). Japon ayvasının yaprak ekstraktı sağlıklı hücrelere zarar vermeden kanserli hücrelerin canlılığını azaltabilmektedir. Bu nedenle tıbbi amaçlı kullanımı yüksek değere sahiptir (Zvikas ve diğ. 2021).

Chaenomeles türlerinin ve türler arası melezlerin meyve mumlarında biriken biyoaktif bileşikler antimikrobiyal aktivite göstermektedir. İzopropanolik meyve özleri, disk difüzyon tahlilinde dört gram negatif bakteri, beş gram pozitif bakteri ve bir mantar suşuna karşı doza bağlı antimikrobiyal aktivite sergilemiştir. Bu sonuçlar meyve kütükül mumlarındaki biyoaktif bileşiklerin *Chaenomeles* türlerinin sağlığı geliştirici özelliklerini ortaya koymaktadır (Lykholat et al. 2021).

Japon ayvasının taze ve kurutulmuş meyveleri geleneksel Çin tıbbında yüzyıllar boyunca kansızlık, romatizma, gut ve kalp-damar hastalıklarının tedavisinde kullanılmıştır. Boğaz ve deri enfeksiyonları, ishal, soğuk algınlığı, meme dokusu iltihabı, hepatit gibi birçok rahatsızlığa iyi geldiği düşünülmektedir. Antioksidanlar açısından zengin olmasından dolayı grip, tümörler, karaciğer rahatsızlıkları, Parkinson hastalığı, bakteriyel enfeksiyonlar ve eklem iltihapları için kullanılmaktadır (Shen ve diğ.2020).

Chaenomeles meyveleri iyi bir malik asit kaynağıdır. Meyveleri farmakolojide kullanılma olanağı bulabilecek fonksiyonel bileşenlerin kaynağı olarak ortaya konmuştur. *Chaenomeles* biyoaktif bileşiklerinin biyoyararlanımı ve sindirilebilirliği test edilmiş, faydalı bağırsak bakterilerinin gelişiminin teşvik edilmesinde ve serbest radikallere karşı lipid membran üzerinde koruyucu etkisi belirlenmiştir (Turkiewic 2020). Yapılan araştırmalarda Japon ayvası bileşenlerinin lipid membranlarını etkilediği, serbest radikallerin difüzyonunu engelleyerek oksidatif reaksiyonu azalttığı belirlenmiştir Dolayısıyla kanser tedavisi ve kanserin önlenmesi için umut verici olduğu gösterilmiştir (Strugala ve diğ.2016, Urbanaviciute ve diğ. 2019)

4. JAPON AYVASININ GIDA VE GIDA KATKI MADDESİ OLARAK DEĞERLENDİRİLMESİ

Japon ayvası meyveleri, kimyasal bileşimi ve meyve özelliklerine dayalı olarak meyve suyu, şarap, meyve püresi, doğal meyve aroması, pektin, diyet lifi gibi ürünlerin üretilmesinde kullanılabilir (Thomas ve diğ. 2003; Urbanaviciute 2019). Özellikle Letonya ve Litvanya pazarında Japon ayvasının şurup, likör, gazlı içecekler, marmelat ve çeşit meyve şekerlemelerini görmek mümkündür. Bu bitkiden sağlıklı çaylar, reçeller ve çeşitli yemekler

hazırlanmaktadır. Japon ayvası meyve suyunun yüksek organik asit içeriği, kendine özgü aroması ve diyet lifi içeriğinin yüksek olması, gıda sanayisinde yüksek öneme sahiptir. Meyve suyunun son derece asidik olması ve bulanıklık olmaması, pektin bakımından zengin olması olağanüstü bir gıda bileşeni olmasına olanak sunmaktadır (Hellín ve diğ., 2003). Japon ayva yaprağı tozu, yiyecek veya içecek katkı maddesi olarak kullanılabilir (Urbanaviciute 2019). Kimyasal koruyucu olarak konserve sektöründe yer alabilecektir (Urbanaviciute 2020).

Gıda ve gıda katkı maddesi olarak sadece Japon ayvasının meyvelerini değil aynı zamanda tohum ve yapraklarını da kullanmak mümkündür. Yapraklarının güçlü antioksidan aktivitesi ve yüksek fenol içeriği ile yiyecek ve içeceklerde katkı maddesi olarak kullanılabileceği göstermiştir (Urbanaviciute ve diğ., 2019).

5. JAPON AYVASININ KOZMETİK SEKTÖRÜNDEKİ KULLANIMI

Kimyasal koruyucu olarak kozmetik sektöründe katkı maddesi niteliği taşımaktadır Soğuk preslenmiş *Chaenomeles japonica* tohumu yağı karotenoidler, skualen, polifenoller, fitosteroller, tokoferoller gibi yüksek biyolojik aktiviteye sahip bileşikler içermektedir. Ayva tohumu müsilağı, cildin yenilenme sürecini başlatıcı özellik gösterir (Urbanaviciute 2020). *C. japonica*'nın kallus özütünün, cilt dokusundaki bağları etkilediği, cilt yaşlanmasını geriletmediği belirlenmiştir. Kallus ekstraktındaki triterpenoidler kozmetik cilt ürünlerinin üretiminde kullanılabilir olarak bildirilmiştir (Kikowska ve diğ., 2018).

6. JAPON AYVASINDA YÜRÜTÜLEN ÇALIŞMALARIN GÜNCEL DURUMU

Meyve suyu, aroma ve lif üretimi için yeni bir Avrupa meyvesi (FAIR5-CT97 3894, 1998-2001) başlıklı bir Avrupa Araştırma Projesi olarak 1998 yılında çalışmalar başlatılmıştır. Projede amaç, seleksiyon ıslahı ile bitkinin özelliklerinin iyileştirilmesidir (Rumpunen, 2002). Japon ayvasında bugüne kadar yürütülen çalışmalara baktığımızda meyve ve meyve suyunun özellikleri ve bileşenleri üzerine yoğunlaşmıştır. Şekerler ve organik asitler (Lesinska, 1987), uçucu ve uçucu olmayan aroma bileşenleri (Lesinska ve diğ., 1988), pektik maddeler (Thomas ve diğ., 2003) incelenmiştir. Meyvelerinin işlenme potansiyeli (Hellin ve diğ., 2020), polifenol içerikleri (Kikowska ve diğ., 2019), endüstriyel özellikleri (Lykholat ve diğ., 2019) ile sağlık açısından faydaları (Watychowicz ve diğ., 2017) ele alınmıştır.

Islah çalışmaları ile dikenlilik %4 oranında azaltılabılmış, erken olgunlaşma sağlanmış ve verim artırılmıştır. *C. japonica*'nın üretim materyalinin kalitesinin artırabilmek için Letonya-Litvanya-İsveç 1992 yılında ortak ıslah programı başlatmıştır. Günümüzde seçilen genotiplerin

klonal çoğaltımı ile oluşturulan bahçelerde çalışmalar Finlandiya, İtalya, Letonya, Litvanya ve İsveç’de sürdürülmektedir. Çalışmalarda Japon ayvasının morfolojik, biyolojik ve biyokimyasal özellikleri üzerinde durulmaktadır (Ruisa, 1995; Rumpunen ve diğ., 1998; Rumpunen ve diğ., 2000). Japon Ayvası, meyve suyu ve aroma üretimi için ‘‘New European Fruit Crop’’ projesi kapsamında ’’1998-2001 yılları arasında, ‘Darius’, ‘Rondo’ ve ‘Rasa’ adlı dikensiz çeşitler piyasaya sürülmüş ve yetiştirilmeye başlanmıştır (Kaufmane ve Ruisa, 2020). 2020 verilerine göre Letonya’da 558 ha dikili alan bulunmaktadır.

7. SONUÇ VE ÖNERİLER

Besin içeriği, tıbbi değeri ve endüstride geniş kullanım olanakları ile Japon ayvası önemi artan bir bitkidir. Mevcut genotiplerde seleksiyon çalışmalarının artırılması, bitki özelliklerinin iyileştirilmesine, çoğaltılmasına yönelik çalışmaların geliştirilmesi önemlidir. Ayrıca yetiştiricilik isteklerinin belirlenmesi de verim ve kaliteyi artırabilecektir.

KAYNAKLAR

1. Bieniasz, M., Dziedzic, E., Kaczmarczyk, E. (2017), The Effect of Storage And Processing on Vitamin C Content in Japanese Quince Fruit, *Folia Horticulturae*, 29(1): 83-93.
2. Chojnacka, K., Sosnowska, D., Polka, D., Owczarek, K., Gorlach, K., Oliveira De Verasa, B., Lewandowska, U. (2020), Comparison of Phenolic Compounds, Antioxidant And Cytotoxic Activity of Extracts Prepared From Japanese Quince (*Chaenomeles japonica* L.) Leaves, *Journal of Physiology And Pharmacology*, 71(2): 213-222.
3. Gorlach, S., Wagner, W., Podsedek, A., Szewczyk, K., Koziółkiewicz, M., Dastyh, J. (2011), Procyanidins From Japanese Quince (*Chaenomeles japonica*) Fruit Induce Apoptosis in Human Colon Cancer Caco-2 Cells in a Degree of Polymerization-dependent Manner. *Nutr. Cancer*, 63, 1348–1360.
4. Hellín, M.P., Jordán, M.J., Vila, R., Gustafsson, M, Göransson, E., Åkesson, B., Gröön, I., Laencina, J., Ros, J.M. (2003). Characteristics and Composition of *Chaenomeles* Fruit Juice, 127-140. K. Rumpunen (Ed.) *Japanese Quince – Potential Fruit Crop for Northern Europe*.
5. Hellín, M.P., Jordán, M.J., Rumpunen, K., García, J.M.R. (2020). Chromatographic Characterization of Juice in Fruits of Different Japanese Quince (*Chaenomeles japonica* L.) Genotypes Cultivated in Sweden, *Emirates Journal of Food and Agriculture*, 32(11): 816-825 doi: 10.9755/ejfa.2020.v32.i11.2193
6. Kaufmane, E., Ruisa, S. (2020). Breeding of New Cultivars of The Fruit Crop Japanese Quince (*Chaenomeles japonica*) in Latvia. *Acta Horticulturae*, 1281, 51–57.
7. Kikowska, M.A., Chmielewska, M., Włodarczyk, A., Studzinska-Sroka, E., Zuchowski, J., Stochma, A., Kotwicka, M., Thiem, B. (2018), Effect of Pentacyclic Triterpenoids-Rich Callus Extract of *Chaenomeles japonica* (Thunb.) Lindl. ex Spach on Viability, Morphology, and Proliferation of Normal Human Skin Fibroblasts, *Molecules*, 23, 3009, 1-3.
8. Kikowska, M., Włodarczyk, A., Rewers, M., Sliwinska, E., Studzinska-Sroka, E., Witkowska-Banaszczak, E., Stochmal, A., Zuchowski, J., Długaszewska, J., Thiem, B. (2019), Micropropagation of *Chaenomeles japonica*: A Step Towards Production of Polyphenol-Rich Extracts Showing Antioxidant and Antimicrobial Activities, *Molecules*, 24, 1314.

9. Lykholat, Y.V., Khromykh, N.O., Didur, O.O., Okovytyy, S.I., Sklyar, T.V., Davydov, V.R., Lykholat, T.Y., Kovalenko, I.M. (2021), Soluble Cuticular Wax Composition and Antimicrobial Activity of The Fruits of *Chaenomeles* Species and An Interspecific Hybrid, *Biosystems Diversity*, 29(4): 334–339. doi: 10.15421/012142
10. Mihova, T., Kondakova, V., Mondeshka, P. (2012), Investigations of *Chaenomeles japonica* (Thunb.) Lindl. In The Region Of Central Balkans, *Banat's Journal of Biotechnology*, III (6): 43-44.
11. Ruisa, S. (1995), Breeding of Japanese Quince (*Chaenomeles japonica*) and The Evaluation of Promising Genotypes for Fruit Production. *Proc. Latvian Acad. Sci., Section B*, 49 (5/6), A30.
12. Rumpunen, K., Kviklys, D., Kaufmane, E., Garkava, L. (1998). Breeding Chaenomeles: A new aromatic fruit crop. *Acta Horticulturae*, 484, 211–216.
13. Rumpunen, K., Trajkovski, V., Bartish, I., Ruisa, S., Kaufmane, E., Stanys, V., Kviklys, D. (2000). Domestication of Japanese Quince (*Chaenomeles japonica*). *Acta Horticulturae*, 538, 345–348.
14. Rumpunen, K. (2002). *Chaenomeles*: Potential New Fruit Crop for Northern Europe. In: Janick, J., Whipkey, A. (eds.). *Trends in New Crops and New Uses*. ASHA Press, Alexandria, VA, pp. 385–392.
15. Shen, T., Hu, F., Liu, Q., Wang, H., Li, H. (2020), Analysis of Flavonoid Metabolites in *Chaenomeles* Petals Using UPLC-ESI-MS/MS, *Molecules*, 25, 399, 2-3.
16. Streck, M., Gorlach, S., Podsedek, A., Sosnowska, D., Koziolkiewicz, M., Hrabec, Z., Hrabec, E. (2007), Procyanidin Oligomers From Japanese Quince (*Chaenomeles japonica*) Fruit Inhibit Activity of MMP-2 and MMP-9 Metalloproteinases. *Journal of Agricultural Food Chemistry*, 55, 6447–6452.
17. Strugała, P., Cyboran-Mikołajczyk, S., Dudra, A., Mizgier, P., Kucharska, A.Z., Olejniczak, T., Gabrielska, J. (2016), Biological Activity of Japanese Quince Extract and Its Interactions with Lipids, Erythrocyte Membrane, and Human Albumin, *The Journal of Membran Biology*, 249:393–410.
18. Thomas, M., Guillemen, F., Guillon, F., Thibault, J.F. (2003). Pectins in The Fruits of Japanese Quince (*Chaenomeles japonica*), *Carbohydrate Polymers*, 53(4):361-372. Doi:10.1016/S0144-8617(03)00118-8

19. Turkiewicz, I.P., Wojdyło, A., Tkacz, K., Nowicka, P., Golis, T., Babelwski, P. (2020), ABTS On-Line Antioxidant, α -Amylase, α -Glucosidase, Pancreatic Lipase, Acetyl- and Butyrylcholinesterase Inhibition Activity of *Chaenomeles* Fruits Determined by Polyphenols and Other Chemical Compounds, *Antioxidants*, 9, 60, 2-3.
20. Urbanaviciute, I., Liaudanskas, M., Bobinas, C., Sarkinas, A., Rezgiene, A., Viskelis, P. (2020), Japanese Quince (*Chaenomeles japonica*) as a Potential Source of Phenols: Optimization of the Extraction Parameters and Assessment of Antiradical and Antimicrobial Activities, *Foods*, 9, 1132.
21. Urbanaviciute, I., Liaudanskas, M., Seglina, D., Viskelis, P. (2019), Japanese Quince *Chaenomeles Japonica* (Thunb.) Lindl. ex Spach Leaves a New Source of Antioxidants for Food, *International Journal of Food Properties*, 22:1: 795-803.
22. Turkiewicz, I.P., Wojdyło, A., Tkacz, K., Lech, K., Michalska-Ciechanowska, A., Nowicka, P. (2020), The Influence of Different Carrier Agents and Drying Techniques on Physical and Chemical Characterization of Japanese Quince (*Chaenomeles japonica*) Micro Encapsulation Powder, *Food Chemistry* 323, 126830.
23. Watychowicz, K., Janda, K., Jakubczyk, K., Wolska, J. (2017), *Chaenomeles*–Health Promoting Benefits, *Rocz Panstw Zakl Hig*, 68(3):217-227.
24. Zvikas, V., Urbanaviciute, I., Bernotiene, R., Kulakauskiene, D., Morkunaite, U., Balion, Z., Majiene, D., Liaudanskas, M., Viskelis, P., Jekabsone, A., Jakstas, V. (2021), Investigation of Phenolic Composition and Anticancer Properties of Ethanolic Extracts of Japanese Quince Leaves. *Foods*, 10(1):18.

**ANTIOXIDANT PROPERTIES AND PHENOLIC COMPONENTS IN THE LEAF OF
ISABELLA GRAPE (*Vitis labrusca* L.)**

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Isabella grape (*Vitis labrusca* L.) is one of the special grape species of the Black Sea region, and the leaves of this species, which are called fragrant grapes, are used for cooking, and wrapping. In this study, the antioxidant properties and phenolic composition of Isabella grape leaves, collected from Akçaabat of Trabzon, Turkey were investigated. The Total Phenolic Content (TPC), Total Flavonoid Content (TFC), total antioxidant capacity and phenolic profile of the 70% ethanolic extracts of dried fresh grape leaves were examined. As a result of the RP-HPLC-PDA analysis with 25 phenolic components including resveratrol, the resveratrol was not detected in the extract, but ellagic acid and rutin were determined as the major phenolic components. In addition, chromogenic acid, luteolin, quercetin, chrysin, pinocembrin, apigenin, and p-OH benzoic acid were determined in a lower concentration. The average TPC and TFC values of grape leaf extracts were measured as 23.327 ± 0.049 mg GAE/g and 2.598 ± 0.105 mg QUE/g respectively. The total antioxidant capacity of grape leaf extracts was measured in terms of Ferric Reducing Antioxidant Power (FRAP) and 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (IC_{50}) and was found to be 215.501 ± 1.326 μ mol $Fe_2SO_4 \cdot 7H_2O$ /g and $0,299 \pm 0,011$ mg/mL, respectively. As a result, Isabella grape leaf was determined as a food with high antioxidant capacity and high antioxidant properties.

Keywords: Isabella grape, leaf, *Vitis labrusca* L., antioxidant, ellagic acid, rutin

Introduction

Grape-vine leaves (*Vitis vinifera* L.) are traditionally used in cooking especially stuffed grape leaf (dolma/sarma) is a very famous dish in Turkish, Balkan and Middle East Nations cuisine (Banjanin et al., 2021). Grape-vine leaves are used in the food and pharmaceutical industry as a safe phenolic resource, and dietary supplement (Babalık & Baydar, 2019, Cantwell et al., 2022). Grape-vine leaves (*Vitis vinifera* L.) have been used in folk medicine because of their antibacterial, antifungal, antiviral, hepatoprotective, anti-inflammatory, antioxidant, hypoglycemic, spasmolytic, vasorelaxant properties and used treatment of disorder such as diarrhea, hemorrhage, eye infections and hypertension (Fernandes et al., 2013, Lima et al., 2016, Pintac et al., 2019). Additionally, *Vitis labrusca* var Bordo has antioxidant, neuroprotective, hepatoprotective, renal-protective, cardioprotective, anticarcinogenic and antithrombotic activity (Se-Uk et al., 2016, Oliboni et al., 2011). However, there is limited information in the literature on the biological activity of the Isabella grape (*Vitis labrusca* L.) which is one of the naturally grown grape species on trees or walls in the Black Sea Region without any pesticide or fertilizer (Kavgacı et al., 2023). Pacifico et al., (2011) showed antioxidant and antiproliferative activity of methanol extract of Isabella grape leaves in HepG2 human hepatoma cell lines and A549 human adenocarcinoma epithelial cell lines. Isabella grape and leaves are shown in Figure 1(Isabella grape and leaves).

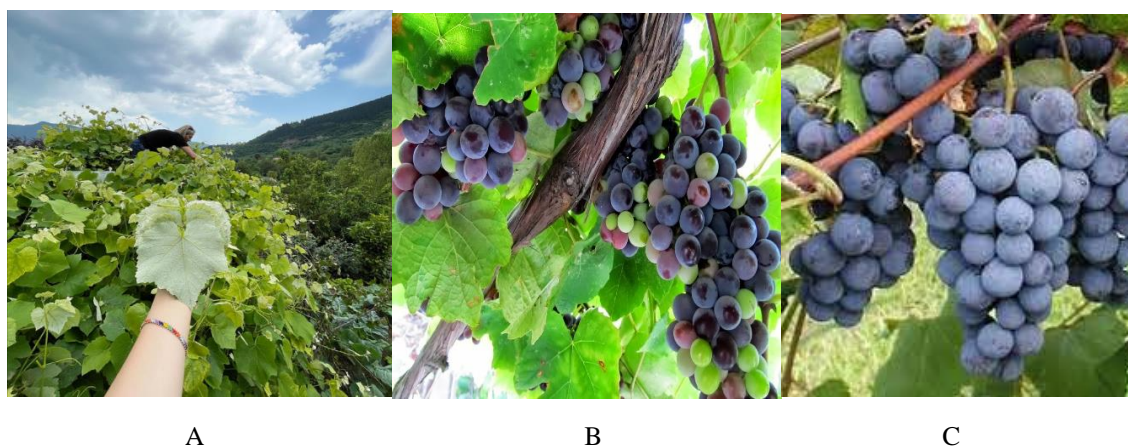


Figure 1: Isabella grape and leaves

The chemical compositions of grape leaves vary depending on grape species, soil type, and agro-climatic factors such as solar radiation, temperatures, rainfall, humidity, cold, wind, and insect activity (Pintac et al., 2019). For this purpose, antioxidant and phenolic compounds

analysis of Isabella grape leaves (*Vitis labrusca* L.) which were collected from Akçaabat-Trabzon, Turkey were investigated.

Material and Methods

Chemicals and Grape Leaf Samples

All chemicals are analytic grade from Sigma Aldrich (Chemie, Germany) and Merck (Chemie, Germany). Isabella grape leaves were collected from Akcaabat, Trabzon in August 2022, randomly. Akçaabat-Trabzon province was shown Figure 2 (Akçaabat-Trabzon and Turkey Map). All Isabella grape leaves were washed with water and dried at 40 °C. Dried Isabella grape leaves were grained and weighed 3 g and incubated in a shaker (Heidolph Promax 2020, Schwabach, Germany) with 30 mL 70 % ethanol for the 24 h at 200 rpm and filtered (Kara et al., 2022a). Leaf extracts were divided into two groups for antioxidant and phenolic composition analysis. Leaf extracts that saved phenolic analysis were evaporated by a rotary evaporator (IKA Werke Staufen, Germany) at 40 °C and prepared for RP-HPLC-PDA analysis by liquid-liquid extraction (Kara et al., 2022b). All extracts were saved at + 4 °C until they were used.

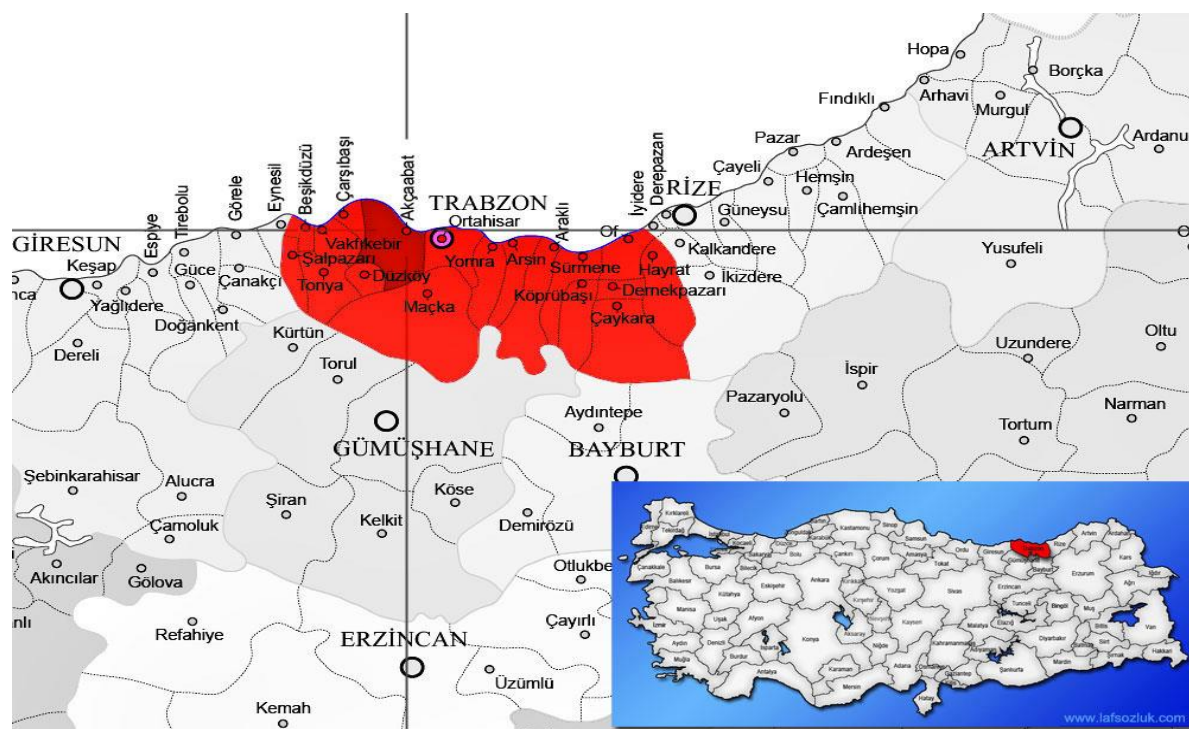


Figure 2: Akçaabat-Trabzon and Turkey Map.

Total Phenolic Content

The Total Phenolic Content values of Isabella leaf extracts were determined by Folin Ciocalteu's method (Singleton, Orthofer & Lamuela-Raventos, 1999) and Gallic acid was used as a standard. The absorbance of samples was measured at 760 nm by spectrophotometer. TPC values of Isabella leaf extracts were expressed as mg gallic acid equivalent (GAE)/g fresh leaf sample. All experiments were performed three times.

Total Flavonoid Content

The Total Flavonoid Content values of Isabella leaf extracts were determined by the spectrophotometric method of Fukumoto and Mazza (2000) and Quercetin was used as a standard. The absorbance of samples was measured at 415 nm by spectrophotometer. TFC values of Isabella leaf extracts were expressed as mg quercetin equivalent (QE)/g fresh leaf sample. All experiments were performed three times.

Ferric Reducing Antioxidant Power

The total antioxidant capacity values of Isabella leaf extracts were determined by the Ferric Reducing Antioxidant Power method of Benzie and Strain (1996) and Trolox was used as a standard. The absorbance of samples was measured at 595 nm by spectrophotometer. FRAP values of Isabella leaf extracts were expressed as $\mu\text{mol Fe}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}/\text{g}$ fresh leaf sample. All experiments were performed three times.

DPPH Radical Scavenging Activity

DPPH Radical Scavenging Activity values of Isabella leaf extracts were determined by the method of Molyneux (2004) and Trolox was used as a standard. Scavenging activity against DPPH radical expressed as IC_{50} (mg sample/mL). The absorbance of samples was measured at 517 nm by spectrophotometer. All experiments were performed three times.

Phenolic Composition

Phenolic composition analysis of Isabella leaf extracts was performed by RP-HPLC-PDA (Shimadzu Liquid Corporation LC 20AT HPLC equipped with a PDA detector) according to the method of Kara et al. (2022). For phenolic composition analysis of leaf extracts, C18 column (250 mm x 4.6 mm x 5 μm ; GL Sciences) was used as a reversed phase, 70-30 % for

acetonitrile-ultra pure water and 2 % acetic acid-ultra pure water were used as a mobile phase, and sample injection volume, flow rate and column oven temperature were set 20 μ L, 1 mL/min and 30 $^{\circ}$ C. Additionally, 25 phenolic standards such as apigenin, p-OH benzoic acid, m-OH benzoic acid, caffeic acid, caffeic acid phenethyl ester (CAPE), chlorogenic acid, chrysin, t-cinnamic acid, p-coumaric acid, curcumin, daidzein, ellagic acid, epicatechin, ferulic acid, gallic acid, hesperetin, luteolin, myricetin, pinocembrin, protocatechuic acid, quercetin, resveratrol, rhamnetin, rutin, syringic acid were used for analysis. Phenolic analysis results were expressed as μ g phenolic standard substance/g sample. All experiments were performed one time.

Statistic Analysis

Results of TPC, TFC, FRAP, and DPPH Radical Scavenging Activity of Isabella leaf extract are shown mean \pm standard derivation (n=3). Phenolic composition analysis of Isabella leaf extract was studied one time (n=1).

Results

TPC, TFC, FRAP, DPPH Scavenging Activity and phenolic composition analysis results of Isabella grape leaf extracts were shown in Table 1 and Table 2.

Table 1: Antioxidant properties of Isabella grape leaf extracts. (Mean \pm Standard Derivation, n=3)

Antioxidant Parameters	Isabella Grape Leaf
Total phenolic compounds (mg GAE/ g)	23.327 \pm 0.049
Total flavonoid compounds (mg QUE/ g)	2.598 \pm 0.105
Total antioxidant capacity (μmol Fe₂SO₄.7H₂O/g)	215.501 \pm 1.326
DPPH radical IC₅₀ (mg/mL)	0.299 \pm 0.011

Table 2: Phenolic composition of Isabella grape leaf extracts. (n=1)

Phenolic composition in RT-HPLC-DOT ($\mu\text{g/g}$)	Isabella Grape Leaf
Apigenin	21.675
p-OH benzoic acid	8.450
m-OH benzoic acid	-
Caffeic acid	-
CAPE	-
Chlorogenic acid	218.190
Chrysin	13.659
t-Cinnamic acid	-
p-Coumaric acid	-
Curcumin	-
Daidzein	-
Ellagic acid	3660.769
Epicatechin	-
Ferulic acid	-
Gallic acid	-
Hesperidin	-
Luteolin	20.459
Myricetin	-
Pinocembrin	10.562
Protocatechuic acid	-
Quercetin	87.682
Resveratrol	-
Rhamnetin	-
Rutin	436.906
Syringic acid	-

Discussion

Generally both of *Vitis vinifera* and *Vitis labrusca* L. (Isabella) grapes are used production of wine and fruit juice in the food industry. Additionally, the hybrid form of *Vitis vinifera* and *Vitis labrusca* L. also known as Strawberry grape, is used in red wine production in Italy. Pacifico et al., (2011) investigated methanolic extracts of the hybrid form of *Vitis vinifera* and *Vitis labrusca* L. grape leaves for antioxidant properties and antiproliferative activity in HepG2 and A549 cell lines. Caffeic acid and quercetin were determined at 5.2 mg/g extract and 11.4 mg/g extract by NMR analysis in methanolic extract of grape leaves and TPC values were measured higher than peel, seed, pulp and stalk extracts approximately 800 GAE/100 g fresh leaves. Trindade et al. (2016) investigated antigenotoxic, antimutagenic and antioxidant properties of the aqueous extract of organic and conventional *Vitis labrusca* L. Isabella grape leaves in V79 lung fibroblast cells. Quercetin 3-O-glucoside concentrations of water extracts of organic and conventional Isabella grape leaves were determined 54.66 ± 0.01 mg/g and 34.11 ± 0.05 mg/g and rutin concentrations were determined 5.41 ± 0.05 mg/g and 3.27 ± 0.04 mg/g, respectively by HPLC-DAD assays. Additionally, TPC values of water extracts of organic and conventional Isabella leaves were measured 56.05 ± 1.09 mg/g and 28.93 ± 0.88 mg/g and DPPH IC₅₀ values were measured 32.85 ± 0.01 mg/g and 83.8 ± 0.01 mg/g, respectively. Dani et al., (2010) investigated phenolic content and the neuroprotective effects of organic and conventional *Vitis labrusca* var. Bordo grape leaf extracts against hydrogen peroxide in rat brain tissues. TPC values of 70 % ethanolic extracts of organic and conventional grape leaves were determined 20.2 ± 1.80 mg gallic acid/mL and 19.0 ± 0.05 mg gallic acid/mL, respectively and quercetin concentrations were measured 5.86 ± 0.15 mg/g raw extract and 6.74 ± 0.08 mg/g raw extract, respectively by HPLC-UV. Additionally, rutin concentrations were measured 44.90 ± 0.22 mg/g raw extract and 55.75 ± 0.10 mg/g raw extract, catechin concentrations were determined 3.64 ± 0.01 mg/g raw extract and 4.30 ± 0.03 mg/g raw extract, resveratrol concentrations were determined 0.714 ± 0.01 mg/g raw extract and 0.062 ± 0.003 mg/g raw extract, kaempferol concentrations were determined 1.37 ± 0.10 mg/g raw extract and 1.43 ± 0.15 mg/g raw extract in organic and conventional leaves extracts, respectively and naringenin concentration was determined only conventional leaves extracts 0.77 ± 0.012 mg/g raw extract.

As stated above, since insufficient literature on Isabella grape leaves, the result comparison is difficult. Most researchers used different grape leaves or hybrid species, different extraction techniques and methods for antioxidant parameters and phenolic compound analysis. However, this study demonstrated the antioxidant properties and phenolic compounds of the Isabella grape leaves and contributed to the literature.

Conclusion

In conclusion, this investigation showed that *Vitis labrusca* L. grape leaves are good antioxidant resources and have phenolic compounds in different concentrations such as apigenin, chlorogenic acid, chrysin, ellagic acid, luteolin, pinocembrin, quercetin and rutin. With future studies, the components and biological activities of the grape species *Vitis labrusca* can be better clarified and Isabella leaves can be used an alternative antioxidant resource for the food and pharmaceutical industry.

References

- Akcaabat-Trabzon and Turkey map. [Cited 2023 April 25]. Available from:
<https://www.lafsozluk.com/2009/05/akcaabat-nerededir-nereye-baglidir.html>
- Babalık Z., Baydar N.G. (2019). Grape leaves as a natural antioxidant source: Determination of total phenolic compound changes. Turkish Journal of Agriculture-Food Science and Technology, 7(10): 1603-1606. <http://doi.org/10.24925/turjaf.v7i10.1603-1606.2646>
- Benzie I.F.F., Strain J.J. (1996). The ferric reducing ability of plasma (FRAP) as a measure of 'antioxidant power': The FRAP assay. Analytical Biochemistry, 239: 70-76. <http://doi.org/10.1006/abio.1996.0292>
- Cantwell M.I., Hong G., Albornoz K., Berlanga M. (2022). Fresh grapevine (*Vitis vinifera* L.) leaves: Postharvest biology and handling recommendations. Scientia Horticulturae, 292: 110627. <http://doi.org/10.1016/j.scienta.2021.110627>
- Dani C., Oliboni L.S., Agostini F., Funchal C., Serafini L., Henriques J.A., Salvador M. (2010). Phenolic content of grapevine leaves (*Vitis labrusca* var. Bordo) and its neuroprotective effect against peroxide damage. Toxicology in Vitro, 24(1): 148-153. <http://doi.org/10.1016/j.tiv.2009.08.006>
- Fernandes F., Ramalhosa E., Pires P., Verdial J., Valentao P., Andrade P., Bento A., Pereira J.A. (2013). *Vitis vinifera* leaves towards bioactivity. Industrial Crops and Products, 43: 434-440. <http://dx.doi.org/10.1016/j.indcrop.2012.07.031>
- Fukumoto L.R., Mazz G. (2000). Assessing antioxidant and prooxidant activities of phenolic compounds. Journal of Agricultural and Food Chemistry, 48: 3597-604. <https://doi.org/10.1021/jf000220w>
- Figure of Isabella Grape and Leaves A [Cited at 2023 April 26] Available from:
[https://kosgeb.gov.tr/site/tr/genel/haftaninkobisi/8530/karadenizin-gizli-hazinesi-uzum#prettyPhoto\[pp_gallery\]/5/](https://kosgeb.gov.tr/site/tr/genel/haftaninkobisi/8530/karadenizin-gizli-hazinesi-uzum#prettyPhoto[pp_gallery]/5/)
- Figure of Isabella Grape and Leaves B [Cited at 2023 April 26] Available from:
<https://kadirbekci53.blogspot.com/2010/09/isabella-uzumu-seferihisarda.html>
- Figure of Isabella Grape and Leaves C [Cited at 2023 April 26] Available from:
<https://biyologum.files.wordpress.com/2013/03/images.jpg>

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
Turkish Republic of Northern Cyprus, April 28-30, 2023

- Kara Y., Can Z., Kolaylı S. (2022a). Applicability of phenolic profile analysis method developed with RP-HPLC-PDA to some bee product. *Brazilian Archives of Biology and Technology*, 65. <https://doi.org/10.1590/1678-4324-2022210384>
- Kara Y., Can Z., Kolaylı S. (2022b). What should be the ideal solvent percentage and solvent-propolis ration in the preparation of ethanolic propolis extract?. *Food Analytical Methods*, 15(6), 1707-1719. <https://doi.org/10.1007/s12161-022-02244-z>
- Kavgacı M., Yukunc G.O., Keskin M., Can Z., Kolaylı S. (2023). Comparison of phenolic profile and antioxidant properties of pulp and seeds of two different grapes types (*Vitis vinifera* L. and *Vitis labrusca* L.) grown in Anatolia. *Chemistry Africa*, 2023. <https://doi.org/10.1007/s42250-023-00660-0>
- Lima A., Bento A., Baraldi I., Malheiro R. (2016). Selection of grapevine leaf varieties for culinary process based on phytochemical composition and antioxidant properties. *Food Chemistry*, 212: 291-295. <http://doi.org/10.1016/j.foodchem.2016.05.177>
- Molyneux P. (2004). The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity. *Songklanakarın Journal of Science and Technology*, 26, 211-219.
- Oliboni L.S., Dani C., Funchal C., Henriques J.A., Salvador M. (2011). Hepatoprotective, cardioprotective, and renal-protective effects of organic and conventional grapevine leaf extracts (*Vitis labrusca* var. Bordo) on Wistar rat tissues. *Anais da Academia Brasileira de Ciencias*, 83(4): 1403-1411.
- Pacifico S., D'Abrosca B., Scognamiglio M., Gallicchio M., Potenza N., Piccolella S., Russo A., Monaco P., Fiorentino A. (2011). Metabolic profiling of strawberry grape (*Vitis x labruscana* cv. 'Isabella') components by nuclear magnetic resonance (NMR) and evaluation of their antioxidant and antiproliferative properties. *Journal of Agricultural and Food Chemistry*, 59; 7679-7687. <https://doi.org/10.1021/jf200926t>
- Pintac D., Cetojevic-Simin D., Berezni S., Orcic D., Mimica-Dukic N., Lesjak M. (2019). Investigation of the chemical composition and biological activity of edible grapevine (*Vitis vinifera* L.) leaf varieties. *Food Chemistry*, 286, 686-695. <https://doi.org/10.1016/j.foodchem.2019.02.049>

Se-Uk K., Hoon-Yeon L., Mingjie X., Su-Jeong J., Hyoung-Kwon C., Dae-Sung K., Dae-Ki K., Young-Mi L. (2016). Antithrombotic activity of *Vitis labrusca* extract on rat platelet aggregation. *Blood Coagulation and Fibrinolysis*, 27(2): 141-146. <http://doi.org/10.1097/MBC.0000000000000394>

Singleton V.L., Orhofer R., Lamuela-Raventos, R.M. (1999). Methods in enzymology. In P. Lester (Ed) Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent. 299: 152-178. [http://doi.org/10.1016/S0076-6879\(99\)99017-1](http://doi.org/10.1016/S0076-6879(99)99017-1)

Trindade C., Bortolini G.V., Costa B.S., Anghinoni J.C., Guecheva T.N., Arias X., Cesio M.V., Heinzen H., Moura D.J., Saffi J., Salvador M., Henriques J.A.P. (2016). Antimutagenic and antioxidant properties of the aqueous extracts of organic and conventional grapevine *Vitis labrusca* cv. Isabella leaves in V79 cells. *Journal of Toxicology and Environmental Health Part A*, 79(18): 825-836. <https://doi.org/10.1080/15287394.2016.1190675>

DELIVERY TIME PREDICTION USING SUPERVISED MACHINE LEARNING

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Abstract

Fast and reliable delivery in the e-commerce sector is becoming increasingly important with the growth of digital sales channels. Customers value delivery reliability and whether or not orders arrive on the stipulated day. Accurate prediction of delivery times in the e-commerce sector plays an important role in optimizing supply chain operations and customer experience. The aim of this study is to develop delivery time prediction models based on supervised machine learning algorithms. Prediction models have been developed using Extreme Gradient Boosting (XGBoost), Random Forest (RF) and Multi-Layer Perceptron (MLP). The dataset, which has been obtained from Kaggle, has 5113 rows and includes historical shipment data over the 16-month period between February 14th 2019 and June 13th 2020. The performance of the developed models has been evaluated using Mean Absolute Error (MAE) by utilizing 10-fold cross-validation on the dataset. Results show that the average MAE's of RF-based, XGBoost-based and MLP-based models are 3.50, 3.68 and 3.83, respectively.

Keywords: Delivery Time Prediction, Supervised Learning, E-commerce

1. INTRODUCTION

For e-commerce companies, the most important factor influencing customers' purchase decisions is price perception, but staying competitive on price is not a sustainable strategy. In this context, e-commerce brands have started to focus on delivery times, which are one of the critical pillars in the supply chain, as Generation Z in particular expects fast delivery. Cargo companies determine the basic factors such as shortening delivery times, reducing costs and undamaged delivery of goods. This information is obtained from the cargo companies and agreements are made that include regional deadlines and the number of packages expressed in regional and non-regional terms. However, due to each brand's products and customer structure, there may be differences in delivery times. These differences lead to problems, such as the delivery time on the company's website, which is either quite long (e.g. between 4-7 days) and therefore not competitive, or does not convey any information at all. Since delivery time is an important purchase criterion for the end customer, the long delivery time causes them to abandon the purchase or develop an expectation based on an average time. While the company with which the brand has an agreement may be able to deliver within these deadlines in some regions (especially major cities), it may take quite a long time in others.

PwC's research shows that 39% of customers want delivery within 2 days and 50% find 3-5 days acceptable, but predictability of delivery time is more important than speed. Given the vagaries of the delivery process, accurately predicting the delivery date at the time of order is one of the biggest challenges in e-commerce, because a shipment delivered after the promised date impacts both the customer experience and the optimization of supply chain operations. For this reason, cargo delivery time prediction is of great importance for the e-commerce sector.

This study aims to develop delivery time prediction models based on supervised machine learning algorithms. For this purpose XGBoost, RF and MLP have been used. The performance of the developed models has been evaluated using MAE.

This paper is organized as follows: Section 2 presents related literature. Section 3 provides details on dataset generation. The methodology and details of the prediction models are given in Section 4. Result and discussions are presented in Section 5. Section 6 concludes the paper.

2. LITERATURE REVIEW

In the last few years, numerous methods have been used for delivery time prediction. (Antamis, et al., 2021) proposed predicting critical time frame states from warehouses to delivery points.

For this purpose RF, Gradient Boosting, WaveNet and Bagging were used. Monte Carlo simulations were performed for each technique to determine the method or methods with the best predictive performance. The simulation results showed that the Gradient Boosting and Bagging techniques predicted the best time intervals for most of the time periods studied. (Borst, 2019) used XGBoost to analyze and estimate service times for the delivery of customer goods. The performance of XGBoost was described in comparison to the current rule-based model for predicting service times and to a Simple Linear Regression model. (El Mekkaoui, et al., 2020) proposed a method for building prediction systems for ship arrival time prediction. Existing approaches for predicting expected time of arrival (ETA) were presented and the results showed that Neural Networks models predict the arrival time of a ship at its destination. (Mahajan, et al., 2022) described a machine learning based approach to deal with uncertainty in ETA of shipments. Multiple regression techniques were used to predict the ETA of a shipment at the destination port. The proposed approach predicted the ETA of the shipment with 89% accuracy. (Panchenko, et al., 2020) proposed a method for predicting the expected departure time for a cargo dispatch at the marshaling yard based on RF, and tested the prediction accuracy. (Prokhorchenko, et al., 2019) proposed method based on an MLP structure and a cross-validation method for predicting the ETA of a freight shipment. (Serova and Garlickii, 2022) introduced a delivery time prediction method based on determining the time that the stream occupied the facilities along the transportation routes based on their loads. The method was tested and proved its suitability in fulfilling the set tasks, as well as its effectiveness in calculating the prediction time of export coal cargo flows occupying the transportation routes. (Zhu, et al., 2020) used a Deep Neural Network based model to predict the fulfillment time, which refers to the amount of time that elapses between a customer placing an order and receiving the meal. Extensive offline and online experiments demonstrate the effectiveness of the approach. (Wahyudi and Arroufu, 2022) presented a method for predicting delivery time based on Linear Regression. The performance of the developed models was evaluated using Root Mean Square Error (RMSE). The result showed that LR achieved an RMSE value of 0.37%.

3. DATASET GENERATION

The dataset, which has been obtained from Kaggle (URL 1), has 5113 rows and includes historical shipment data over the 16-month period between February 14th 2019 and June 13th

2020. Categorical variables in the dataset were converted to numerical values using One-Hot Encoding. The attributes in the dataset and their explanations are given in Table 1.

4. METHODOLOGY

In this study, models were developed using XGBoost, RF and MLP to predict delivery times. 10 different models were created (i.e., for the creation of the 1st model, the first 500 rows of the dataset were used as the test set and the remaining data were used as the training set. For the 2nd model, rows 500 to 999 were used as the test set and the remaining data as the training set. This process was repeated 10 times and models were created). The summary of the methods used for developing the prediction models are given below.

Table 1. Attributes in the dataset

<i>Attribute Name</i>	<i>Definition</i>
Year	Year
Month	Month of the year
Day	Day of the month
Hour	Hour of the day
Minute	Minute of the hour
Second	Second of the minute
PuP	Pick up point
DoP	Drop off point
Source_country	Country from where the product needs to be delivered
Destination_country	Country to where the product needs to be delivered
Freight_cost	Cost of transportation / kg
Gross_weight	Gross weight in kg which needs to be delivered
Delivery_charges	Fixed cost per delivery
Delivery_mode	Method of delivery
Delivering_company	Candidate delivering company
Shipping_time	The time that it takes for a product to reach their destination

4.1. Random Forest

RF is a learning method used in random decision forest, classification, and regression, among others. In this method, a cluster of decision trees is first created. Then the data is classified based on the randomly generated decision trees. In this method, there is a directly proportional relationship between the number of trees in the forest and the accuracy rate (Noshad, et al., 2019).

4.2. Extreme Gradient Boosting

XGBoost is a machine-learning classification method. It features high information processing speed and improved performance characteristics. The method is created by increasing the size of tree models. In this process, existing models are developed by repeatedly adding new models. In this method, gradient descent algorithm is used for reduction when a new model is added (Prabha, et al., 2021).

4.3. Multi-Layer Perceptron

MLP is a feedforward artificial neural network model that is made up of multiple layers of nodes in a directed graph, with each layer fully connected to the next one. The elements of the hidden and output layers are called neurons. Each neuron is a processing unit (Sakar, et al., 2019).

5. RESULTS AND DISCUSSION

The performance of the models was evaluated using MAE. Table 2 shows the MAE's of the models using XGBoost, RF and MLP.

Table 2. MAE's of the models

Model No	XGBoost	RF	MLP
1	2.58	2.59	2.78
2	2.74	2.71	2.91
3	2.64	2.55	2.81
4	2.6	2.61	2.84
5	2.7	2.65	2.79
6	2.92	2.73	2.75
7	3.08	3.01	3.36
8	2.89	2.87	3.3
9	4.37	2.9	4.41
10	10.28	10.33	10.37

- The lowest MAE (2.55) has been observed in the 3rd model based on RF and the highest MAE (10.37) has been observed in the 10th model based on MLP.
- The average MAE's of RF-based, XGBoost-based and MLP-based models are 3.50, 3.68 and 3.83, respectively.
- In general, delivery time prediction models show consistent performance.

6. CONCLUSION

With cargo delivery time prediction, e-commerce companies can manage their delivery processes more effectively and explore different cargo company alternatives in regions where

they are no longer competitive in terms of delivery times. With effective delivery management, they can increase customer satisfaction, manage customer expectations with the information they can communicate on a regional basis, and gain a competitive advantage in delivery time, which is one of the critical purchasing decisions compared to their competitors. With highly accurate delivery time information, outcomes such as building customer trust in their brands, creating brand loyalty over time along with other critical factors, and increasing customer-based profitability in the medium term will be possible. This study proposes a delivery time prediction method using machine learning algorithms. Three different machine learning algorithms; RF, XGBoost and MLP have been used. It is found that the delivery time prediction models have consistent performance and can be used to predict delivery times with reasonable error rates.

REFERENCES

1. Antamis, T., Medentzidis, C. R., Skoumperdis, M., Vafeiadis, T., Nizamis, A., Ioannidis, D., and Tzovaras, D. (2021), "AI-supported forecasting of intermodal freight transportation delivery time", In 2021 62nd International Scientific Conference on Information Technology and Management Science of Riga Technical University (ITMS) (pp. 1-6). IEEE.
2. Borst, B. J. (2019), "Case study: Predicting service times in package delivery operations",
3. El Mekkaoui, S., Benabbou, L., and Berrado, A. (2020), "Predicting ships estimated time of arrival based on AIS data", In Proceedings of the 13th International Conference on Intelligent Systems: Theories and Applications (pp. 1-6).
4. Mahajan, P. C., Kiwelekar, A. W., Netak, L. D., and Ghodake, A. B. (2022), "Predicting Expected Time of Arrival of Shipments Through Multiple Linear Regression", In ICDSMLA 2020: Proceedings of the 2nd International Conference on Data Science, Machine Learning and Applications (pp. 343-350), Springer Singapore.
5. Noshad, Z., Javaid, N., Saba, T., Wadud, Z., Saleem, M. Q., Alzahrani, M. E., and Sheta, O. E., (2019), "Fault detection in wireless sensor networks through the random forest classifier", *Sensors*, 19 (7).
6. Panchenko, A., Prokhorchenko, A., Panchenko, S., Dekarchuk, O., Gurin, D., and Medvediev, I. (2020), "Predicting the estimated time of cargo dispatch from a marshaling yard", *Восточно-Европейский журнал передовых технологий*, 4(3-106), 6-15.
7. Prabha, A., Yadav, J., Rani, A., & Singh, V., (2021), "Design of intelligent diabetes mellitus detection system using hybrid feature selection based XGBoost classifier", *Computers in Biology and Medicine*, 136.
8. Prokhorchenko, A. V., Panchenko, A., Parkhomenko, L., Nesterenko, H. I., Muzykin, M. I., Prokhorchenko, H., and Kolisnyk, A. (2019), "Forecasting the estimated time of arrival for a cargo dispatch delivered by a freight train along a railway section".
9. Sakar, C. O., Polat, S. O., Katircioglu, M., and Kastro, Y. (2019), "Real-time prediction of online shoppers' purchasing intention using multilayer perceptron and LSTM recurrent neural networks", *Neural Computing and Applications*, 31(10), 6893-6908.
10. Serova, D. S., and E. I. Garlickii. (2022), "Method for Determining Forecast Time of Cargo Flow Occupying Transport Routes", *IOP Conference Series: Earth and Environmental Science*. Vol. 988. No. 2. IOP Publishing.

11. Zhu, L., Yu, W., Zhou, K., Wang, X., Feng, W., Wang, P., and Lee, P. (2020), "Order fulfillment cycle time estimation for on-demand food delivery", In Proceedings of the 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining (pp. 2571-2580).
12. Wahyudi, T., & Arroufu, D. S. (2022), "Implementation of Data Mining Prediction Delivery Time Using Linear Regression Algorithm", Journal of Applied Engineering and Technological Science (JAETS), 4(1), 84-92.
13. URL https://www.kaggle.com/datasets/salil007/1-shipping-optimization-challenge?select=train_2_pr.csv

**DEVELOPMENT OF A MACHINE LEARNING-BASED SELLER RANKING
ALGORITHM FOR E-COMMERCE MARKETPLACES**

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Abstract

On e-commerce marketplace websites and mobile applications, multiple sellers can sell the same product. When a seller wants to add a new product to the store, the system first checks if the product is available on the marketplace. If the product is available, it is added as a new seller under the existing product code without creating a new product code. This screen, where the same product is displayed with different seller options, is called "Buybox". The order in which sellers are listed on the "Buybox" screen is very important. This is because most product sales are made by the seller who is in the first place. At the same time, the higher a seller is in the ranking, the more likely he/she is to make a sale. In this study, a sorting algorithm based on Extreme Gradient Boosting (XGBoost) has been developed to rank sellers on the Buybox screen. A dataset of 57690 rows consisting of 7 attributes of products sold on Trendyol.com has been created. The sorting algorithm has been tested on 4 different product categories including electronics, fast-moving consumer goods (FMCG), textiles and default. The default category includes all electronics, FMCG and textile products. The performance of the developed algorithm has been evaluated using Mean Absolute Error (MAE). The MAE's obtained for the electronics, FMCG, textile and default categories are 2.49, 0.91, 0.31 and 1.54, respectively. In general, the performance of the ranking algorithm has been found to be high for all categories.

Keywords: Ranking Algorithm, Machine Learning, E-commerce Marketplace

INTRODUCTION

E-commerce marketplace is the term for online platforms set up by third parties on the Internet to bring sellers and buyers together, where sellers open stores and upload their products, and consumers evaluate and purchase corresponding products. In recent years, the number of e-commerce marketplaces has increased due to evolving technology and changing consumer shopping habits. It is well known that sellers who sell products and services through e-commerce marketplace platforms make their sales in a highly competitive environment. When a product is offered by too many sellers, it can increase e-commerce competition and negatively impact shop profitability. That's why the BuyBox system for e-commerce marketplace platforms was developed to help sellers sell more easily and quickly.

On e-commerce marketplace platforms, the BuyBox is the screen where sellers are ranked when more than one seller offers the same product. When customers click buttons like "Buy" or "Add to Cart" to purchase a product or service, they buy the product of the seller whose product is at the top of the BuyBox screen. Buybox brings many benefits to both buyers and sellers. On e-commerce marketplaces, Buybox increases the sales of related products and services, making them more advantageous than their competitors. This can increase the seller's visibility and help them reach more customers.

The importance of Buybox for customers is satisfaction oriented. Users who buy from the first seller on the Buybox screen have a more professional shopping experience and customers get both good products and good service because the seller in question meets some criteria to be higher on the Buybox screen.

This study aims to develop sorting algorithm based on XGBoost to rank sellers on the Buybox screen.

This paper is organized as follows: Section 2 presents related literature. Section 3 provides details on dataset generation. Methodology and details of the classification models are given in Section 4. Results and discussion are presented in Section 5. Section 6 concludes the paper.

LITERATURE REVIEW

(Hunold et al., 2022) analyzed seller and product recommendations of the hybrid e-commerce platform Amazon. They found that using web-scraped data made the visibility of offers of third-party suppliers in the "Buybox" dependent on prices on competing marketplaces like Walmart and eBay. (Cranenburgh et al., 2022) aimed to facilitate (further) the integration of machine

learning in the choice modelling field. To achieve this they made the case that (further) integration of machine learning in the choice modelling field was beneficial for the choice modelling field, and, shed light on where the benefits of further integration can be found. First, the similarities and differences between the two modelling paradigms were clarified. Second, a literature overview on the use of machine learning for choice modelling was provided and then the strengths of the current theory-driven modelling paradigm and compared with the machine learning modelling paradigm were reinforced. (Gomez et al., 2022) tried to estimate empirically the relevant seller characteristics that Amazon could consider featuring in the Buybox. To that end, 22 product categories from Italy's Amazon web page were studied over a ten-month period, and the sellers were analyzed through their products featured in the Buybox. Two different experiments were proposed and the results were analyzed using four classification algorithms (Neural Network, Random Forest, Support Vector Machine, and C5.0 Decision Trees) and rule-based classification. The first experiment aimed to characterize sellers unspecifically by predicting their change at the Buybox. The second one aimed to predict which seller would be featured in it. Both experiments revealed that the customer experience and the dynamics of the seller's prices were important features of Buybox. Additionally, they proposed a set of default features that Amazon could consider when no information about sellers was available. (Dash et al., 2021) was performed an end-to-end systematic audit of related item recommendations on Amazon and proposed a network-centric framework to quantify and compare the biases across organic and sponsored related item recommendations. (Lan et al., 2021) analyzed data collected from the Amazon website (specifically in the Handmade Category) to understand and analyze Vietnamese artisans' business context. Data analysis was also applied to determine the factors that bring success to Handmade products and compare products of the same industry among competitors to find out potential products. They also proposed solutions to help Vietnamese products become more appealing to international customers on the Amazon website. (Fletcher et al., 2021) outlined eleven key features of online markets that might necessitate standards additional to or different from those that were applicable offline, and provided a menu of possible policies in relation to each. Many of these were general to all online markets, but some were specific to the largest digital platforms. (Wieting and Sapi, 2021) analyzed algorithmic pricing on Bol.com, the largest online marketplace in the Netherlands and Belgium. Based on more than two months of pricing data

for around 2,800 popular products, they found that algorithmic sellers could both increase and reduce the price of the Buybox. (Abaluck and Compiani, 2020) stated a sufficient condition under which choice data alone sufficed to identify consumer preferences when choices are not fully informed. Firstly, the data-generating process was a search model in which the attribute hidden to consumers is observed by the econometrician; secondly, if a consumer searched good j , she/he also searched goods that were better than j in terms of the non-hidden component of utility; and thirdly consumers chose the good that maximized overall utility among searched goods were supposed. The approach intertwined several standard models, including full information. (Gómez-Losada and Duch-Brown, 2019) modeled the dynamics among sellers occupying the buy-box using a classification approach. Italy's Amazon webpage was crawled for ten months and features from products were analyzed to estimate the more relevant ones Amazon could consider for a seller occupying the Buybox. Predictive models showed that the more relevant features were the ratio between consecutive prices in products and the number of assessments received by customers. (Chen and Wilson, 2017) briefly summarized two recent works from a group that use observational data to study the mechanisms used by two large markets. First, Uber's surge price algorithm was examined and observed that its incentive model may not be effective at changing driver behavior. Second, the adoption of dynamic pricing strategies by sellers on Amazon Marketplace was studied and investigated how these strategies interact with Amazon's "Buybox" matching algorithm.

DATASET GENERATION

A dataset of 57690 rows consisting of 7 attributes of products sold on Trendyol.com has been created. The attributes in the dataset and their explanations are listed in Table 1.

Table 1. Attributes in the dataset

Attribute Name	Definition
product_price	Price of the product
product_price_difference_ratio	The ratio of the difference between the product price with the minimum price in the Buybox
seller_score_difference_ratio	The ratio of the difference between the product score with the maximum score in the Buybox
seller_score	Seller's score
has_seller_score	Whether or not seller has score
is_rush_delivery	Whether or not there is rush delivery
is_cargo_free	Whether or not cargo is free

METHODOLOGY

A sorting algorithm based on XGBoost has been developed to rank sellers on the Buybox screen. XGBoost is a machine-learning classification and regression method. It features high information processing speed and improved performance characteristics. The method is created by increasing the size of tree models and existing models are developed by repeatedly adding new models. (Prabha et al., 2021).

RESULTS AND DISCUSSION

The sorting algorithm has been tested on 4 different product categories including electronics, FMCG, textiles and default. The default category includes all electronics, FMCG and textile products. The performance of the developed algorithm has been evaluated using MAE. The MAE's obtained for the electronics, FMCG, textile and default categories are 2.49, 0.91, 0.31 and 1.54, respectively.

As a result of this study,

- In general, the performance of the ranking algorithm has been found to be high for all categories.
- The way in which the factors to be used for ranking are calculated has been better adapted to the operational processes of the providers.
- The factors that are important to customers' buying preferences have been identified.
- Activities such as promotions, campaigns, and coupon identification involving vendors have been incorporated into the ranking algorithm to have an impact in favor of the customer.
- Sudden changes in ranking scores caused by existing variable definitions have been prevented.
- Competition between vendors has been developed positively and in line with customer expectations.

CONCLUSION

In this study, a sorting algorithm based on XGBoost has been developed to rank sellers on the Buybox screen. The MAE's obtained for the electronics, FMCG, textile and default categories are 2.49, 0.91, 0.31 and 1.54, respectively. As a result of this study, the performance of the ranking algorithm has been found to be high for all categories and activities such as promotions, campaigns, and coupon identification involving vendors have been incorporated into the ranking algorithm to have an impact in favor of the customer.

REFERENCES

- Hunold, M., Laitenberger, U., & Thébaudin, G. (2022). Bye-box: An analysis of non-promotion on the amazon marketplace. Technical report, Mimeo.
- Van Cranenburgh, S., Wang, S., Vij, A., Pereira, F., & Walker, J. (2022). Choice modelling in the age of machine learning-Discussion paper. *Journal of Choice Modelling*, 42, 100340.
- Gómez-Losada, Á., Asencio-Cortés, G., & Duch-Brown, N. (2022). Automatic Eligibility of Sellers in an Online Marketplace: A Case Study of Amazon Algorithm. *Information*, 13(2), 44.
- Dash, A., Chakraborty, A., Ghosh, S., Mukherjee, A., & Gummadi, K. P. (2021, March). When the umpire is also a player: Bias in private label product recommendations on e-commerce marketplaces. In *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* (pp. 873-884).
- Lan, N. T. T., Phuong, N. P. A., Trang, N. T. M., Huong, P. T. M., An, N. T., & Le, H. S. (2021). Data Analytics Application: A Case Study of Online Business for Vietnamese Handicraft Products on Amazon. *Journal of Multimedia Information System*, 8(1), 61-68.
- Fletcher, A., Crawford, G. S., Crémer, J., Dinielli, D., Heidhues, P., Luca, M., ... & Sinkinson, M. (2021). Consumer protection for online markets and large digital platforms. Available at SSRN 3923588.
- Wieting, M., & Sapi, G. (2021). Algorithms in the marketplace: An empirical analysis of automated pricing in e-commerce. Available at SSRN 3945137.
- Prabha, A., Yadav, J., Rani, A., & Singh, V. (2021). Design of intelligent diabetes mellitus detection system using hybrid feature selection based XGBoost classifier. *Computers in Biology and Medicine*, 136, 104664.
- Abaluck, J., & Compiani, G. (2020). A method to estimate discrete choice models that is robust to consumer search (No. w26849). National Bureau of Economic Research.
- Gómez-Losada, Á., & Duch-Brown, N. (2019, June). Competing for Amazon's Buy Box: A Machine-Learning Approach. In *International Conference on Business Information Systems* (pp. 445-456). Springer, Cham.
- Chen, L., & Wilson, C. (2017). Observing algorithmic marketplaces in-the-wild. *ACM SIGecom Exchanges*, 15(2), 34-39.

**MIGRATION AND UNIMPLEMENTED HUMAN RIGHTS: CASE OF
EASTERN OF THE DEMOCRATIC REPUBLIC OF CONGO**

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ABSTRACT

Migration and human rights are usually connected each other due to the contexts of war conflicts in the Democratic Republic of Congo. Different analyses reveal a big number of Congolese who flee their homes because of gradual conflicts that exist from more than two decades. The reality is that Democratic Republic of the Congo is one of the most underlined country holding rebels and insurgents in East Africa. This situation gives result on violation of human right and uncontrollable trafficking due to human migration. This study analyzes the fundamental causes of migration in the Democratic Republic of Congo's eastern region, as well as the application of human right violation. In addition, it emphasizes the importance of regional and international actors in assisting in finding concrete solutions to problems. This research is conducted through qualitative research method which examines some documents related with migration and human rights as focus of data collection. The research results confirm that Congolese decide to leave from homeland due on the scarcity of peace and prevention of human right. From that perspective, war conflicts are increased under various reasons which have been analyzed. As there is lack of official judiciary instruments about human rights, migration is gradually increasing in Eastern of the Democratic Republic of Congo. Therefore, the existence of many rebels and army groups in the region contributes the violation of human right whose impacts are based on inciting migration to neighboring countries and other countries.

Keywords: Eastern Africa, Migration, Human Right, RDC, Impunity

INTRODUCTION

One of the key causes leading to the current deadlock in the violence in eastern DRC is poor mining governance. Hundreds of thousands of Congolese artisanal miners rely on minerals found in South Kivu and Ituri, but their trade and exploitation are plagued by largescale corruption and human rights atrocities done by armed groups, including undisciplined parts of the national army (Brier, 2021). Even if the level of the ferocity of the armed conflict that has plagued the Democratic Republic of Congo (DRC) for the past two decades has gradually decreased.

The situation of violence and instability in the east of the country, which began with Laurent Desiré Kabila's 1996 coup d'état against Mobutu Sese Seko and culminated in his surrender of power in 1997, persists. Following that, in 1998, the so-called 1st African World War began, in which Burundi, Rwanda, and Uganda, along with various armed groups, attempted to depose Kabila, who had received support from Angola, Chad, Namibia, Sudan, and Zimbabwe. This war was a result of deaths of nearly five million people, including at least 200.000 women, forced displacement of hundreds of thousands, and a long-term humanitarian disaster. The signing of a ceasefire in 1999, as well as various peace agreements between 2002 and 2003, resulted in the withdrawal of foreign troops and the formation of a transitional government led by Joseph Kabila, followed by an elected government in 2006, which was approved by referendum in 2011 elections amid allegations of fraud (Rufanges & Royo Aspa, 2016).

Nonetheless, due to Rwanda's role and the presence of non-demobilized militias like Les Forces Démocratiques pour la Libération du Rwanda (FDLR), which was responsible for the Rwandan genocide in 1994, this approach, did not end bloodshed in eastern DRC. Non-compliance with the peace agreements in 2009 prompted militants from the former CNDP to abandon the Congolese Army, which they had joined in 2012. According to Beswick, those who deserted formed the Mouvement du 23-Mars, which was sponsored by Rwanda (BESWICK, 2012). The insurrection was put down in 2013. At the same time, armed actors operating in the DRC, ranging from armed groups to the Armed Forces and other governmental agencies, have committed and continue to commit rapes and other acts of sexual violence as a war weapon. As a result, they contribute to the pervasive climate of insecurity and impunity that exists in the area. In the east of the country, there is ongoing instability and bloodshed, and the control and

exploitation of natural resources has led to the continuation of the DRC war and the deployment of foreign armed forces. As reported by the United Nations for the first time in April 2001, the Congolese Armed Forces (FARDC), local and international armed groups, local enterprises, several bordering countries, and Western and Asian multinationals have all been involved in this business. Even while considerable progress has been made in terms of the application of due diligence requirements to ensure that supply chains do not promote the mining of minerals from conflict-affected and high-risk areas, the mineral sector continues to ignore them, demonstrating the relevance of smuggling (Rufanges & Royo Aspa, 2016). According to the UN Group of Experts, Rwanda is where the majority of unlawfully exported resources are laundered and labeled (OCHA Services, 2001). However, there are a number of measures in place at the federal level.

In the end, the fact that the country experienced increased political instability, as Kabila's second presidential term draws to a close had to be emphasized. Political violence, suppression of the opposition, and the use of disproportionate force in mobilizations had all increased. Non-compliance with the electoral calendar had become a reality, which might lead to the postponement of elections and the extension of Joseph Kabila's presidential mandate, which was set to expire at the end of 2016, an issue that could spark a new cycle of instability (Rufanges & Royo Aspa, 2016). Finally, it is crucial to mention that the DRC has embarked on a new path of democratization following the arrival of new President Felix Tshisekedi. Soft-Power strategy has been seen as advocating for the construction of a new Eastern DRC devoid of war and turmoil. Felix Tshisekedi followed the same strategy with of the Burundian President Evariste Ndayishimiye as he presented his foreign policy to the international audience, inviting various leaders from other countries to discuss bilateral relations with the once-dubbed "enemy of the state" (Bigirimana, 2022). He made the decision to change DRC's fate in a different way than his fore fathers. He outlines the Congolese focus while dealing with other countries and ensures that Africa as a whole is liberalized in his foreign policy.

The main question of this study is how does Congolese government deal with regional actors and human right defenders in case of promoting security of people and decreasing the number of regional migration?. The design of this study of giving a brief presentation of region challenges on migration followed by the case of Eastern Congolese migration and rule of law in protecting people. After the brief introduction, the study will display the conceptual

framework and go around with analyzing the unimplemented human right in DRC and finally, searching and devotement of the solution to mixed migration challenges.

Brief Overview of Congolese refugees

Congolese Refugees: A Portrait

Congolese refugees in Burundi are mostly from Katanga and South Kivu Provinces, but Congolese refugees in Rwanda are virtually entirely from North Kivu. The majority of people in Tanzania come from South Kivu, while the majority of people in Uganda come from North Kivu. The majority of the refugees in Rwanda and Tanzania today left in 1996, with a second peak in 1999 in Tanzania (UNHCR, 2022). Between 2002 and 2005, there was a steady but significant increase in immigration in all four countries, with Uganda seeing the most growth. Banyarwanda people make up the majority of Congolese refugees. The remaining Congolese refugee populations come from a wide range of ethnic groups. The bulk of the refugees in the DRC are under the age of 18. For the prolonged population, the average household size is expected to be five people. A large majority of Congolese refugees do not have access to formal schooling. They speak a variety of languages, the most common of which are Kinyarwanda and Kiswahili (UNHCR, 2022). Although French is more widely spoken than English, French skills are vanishing in English-speaking host nations. Moreover, agriculture is where the bulk of Congolese refugees labor.

The majority of Congolese refugees from eastern DRC live in camps or settlements in the Great Lakes and Southern Africa region, most of who have been there for many years. The 45,124 Congolese refugees registered in Burundi as of January 1, 2014 reside in the city of Bujumbura. The 72,988 Congolese refugees registered in Rwanda dwell in different camps of the country (Ibid). In addition, the 64,569 Congolese refugees in Tanzania are housed in Nyarugusu camp; eighty-eight percent of Uganda's 155,742 Congolese refugees live in settlements, while twelve percent live in Kampala. The goal of this research is to better understand the fundamental causes of migration in the Democratic Republic of Congo's eastern region, as well as the application and violation of human rights against Congolese residing there. This research will also reveal how these infractions affect the country's sociopolitical and economic circumstances, as well as what may be done to improve things. To do this, the focus of this research will be on other researchers and articles on the subject. The following are the research objectives, which have been designed to achieve the above-mentioned goal: Understanding the causes and

consequences of migration and human rights violations in the Eastern region of the DRC, to address the underlying cause of relocation in this socially polarized region of the DRC. Demonstrating how education and democratic values may be utilized to combat all forms of evil in the global environment and finally, to emphasize the importance of regional and international actors in assisting in the development of concrete solutions to problems.

CONCEPTUAL FRAMEWORK

The humanitarian, human rights, and security situation in the DRC have been deteriorating, its effects have been disastrous for the Congolese people, with 4.5 million people uprooted from their homes, the highest number in Africa, and 2 million children facing famine. In recent months, tens of thousands of refugees have fled to Uganda, Angola, Tanzania, and Zambia (Sewenet, 2019). The 2006 general elections, which saw incumbent president Joseph Kabila win re-election, signaled the end of the transition phase and solidified the control of the national institutions by a democratically elected president and his patronage network (ibid). As the affirmation of Kabila's power hampered the chances of significant changes in the national power balance, numerous factions that had already expressed dissatisfaction with the transitional process refused to integrate their men into the national army (Verweijen & Vlassensroot, 2017). Since 2015, security forces have killed nearly 300 individuals amid mostly peaceful rallies. As a result, since August 2016, an outbreak of violence between Congolese security forces, government-backed militias, and local armed groups has killed up to 5,000 people in the country's central Kasi area.

Furthermore, government officials and security forces perpetrated widespread repression and grave human rights crimes against political opposition leaders and sympathizers, pro-democracy and human rights activists, journalists, and peaceful protestors throughout 2018. Widespread irregularities, voter suppression, and violence marred the December 30 elections. When voting in three pro-opposition districts was postponed until March 2019, more than a million Congolese were unable to vote (World Report, 2019). Several armed groups, as well as government security personnel, attacked residents in central and eastern Congo, murdering and injuring many innocent people. With 4.5 million people uprooted from their homes and over 130,000 refugees fleeing to neighboring nations, the humanitarian situation remained dire (World Report).

Driver of Displacement in Eastern DRC

Large numbers of people have been displaced from their homes in the DRC for nearly two decades, frequently repeatedly, because of ongoing war. Over the years, the waves of violence have become so common that they have developed a culture of displacement that has affected practically every resident of the eastern provinces. In September 2014, the DRC had an estimated 2.7 million internally displaced persons (OCHA Services, 2014). The number of internally displaced persons (IDPs) has generally remained around two million for over a decade, despite fluctuations. The highest number of internally displaced persons (IDPs) ever reported in Congo was 3.4 million at the end of 2003 (IDMC, 2022), the number of internally displaced persons (IDPs) increased again at the end of 2013 (to 2.9 million), but has since decreased to 2.6 million. To put the enormity of the crisis in context, the DRC has the world's fifth biggest IDP population, behind Syria (7.6 million), Colombia (5.7 million), Sudan (3.4 million), and Nigeria (3.4 million) (Médecins Sans Frontières, 2014).

Inter-ethnic tensions, power battles over natural resources and territory, the development of armed organizations, many of which are foreign, and the meddling of DRC's neighbors in the situation in the east have all contributed to the ongoing war in eastern Congo. Multiple armed groups and militias operating in the eastern provinces, including FARDC, have never made a clear difference between civilians and combatants during the DRC conflict. Furthermore, they have preyed on civilian communities on a regular basis, carrying out arbitrary killings, rapping and kidnapping women, pillaging villages, and forcibly recruiting youngsters into their army. Abuse and harassment of civilians is a common occurrence. People are forced to carry supplies for armed groups and are billed for protection and transportation (Médecins Sans Frontières, 2014).

UNIMPLEMENTED HUMAN RIGHTS

Human Rights Violation Patterns

In eastern DRC, human rights violations can be classified into three categories:

A. Abuse of human rights by state and non-state actors in the pursuit of physical control over resource-rich areas, as well as trade routes, border checkpoints, and economic hubs. These atrocities were most serious in places touched by the armed conflict in eastern DRC, although they also happened elsewhere;

B. These groups perpetrated human rights violations after conquering these areas in order to maintain control. Most of these were done by fighting sides in the midst of an armed conflict;

C. Systematic violations of economic rights resulting from large-scale looting, theft, and corruption, both in conflict and non-conflict areas, were a motivation for these parties to keep fighting; a major source of finance that sustained their activities and enabled them to continue perpetrating acts of violence against civilians; and a factor that prolonged the conflict (Global Witness, 2009).

Perpetrators and Protection from Discrimination

The Congolese government and security forces, as well as a variety of Congolese non-state armed groups, including the Rassemblement congolais pour la démocratie (RCD) and its three factions RCD-Goma, RCD-Mouvement de libération (RCD-ML), and RCD National, and the Mouvement de la libération du Congo (MLC), have all been perpetrators of all three categories of abuses (MLC) according to many sources. The Union des patriotes congolais (UPC), the Front des nationalistes et intégrationnistes (FNI), the Forces armées du peuple congolais (FAPC), the Forces de résistance patriotique d'Ituri (FRPI), and a host of mai-mai and other groups have all brought chaos to this part of DR Congo (Global Witness, 2009). In addition, companies and individual traders who were willing to trade in natural resources produced under these conditions, or with communities with a history of poor human rights, can be deemed to have contributed to these unfortunate circumstances.

The DRC continues to be plagued by conflict-related sexual and gender-based violence (UN Team of Experts, 2017). Ongoing insecurity, internal displacement, and political tensions pose a threat to progress in combating sexual violence as a weapon of conflict (UN Security Council, 2018). Sexual assault is on the rise in conflict-affected provinces, perpetrated by both armed groups and security officials (UN Security Council, 2018). Moreover, violence against women and girls is on the rise in both social and domestic settings (United States Department of State, 2017). Women and girls have experienced an increase in sexual and gender-based violence in conflict-affected areas as a result of this climate.

The United Nations Population Fund (UNFPA) reported 5,783 occurrences of sexual violence in conflict-affected provinces in 2017, more than double the number in 2016 (UN Team of

Experts, 2017). In 2017, conflict-related sexual violence spread to the three Kasai provinces in the center of the DRC, but the eastern provinces of Tanganyika and Ituri accounted for 72 percent of the instances (Stearns & Vogel, 2015). Armed groups have also been responsible for conflict-related sexual violence in North and South Kivu, with the number of armed organizations increasing from around 70 in 2015 to 118 in 2017 (Stearns & Vogel, 2017). This surge in Sexual and Gender based violence (SGBV) incidents in conflict-affected areas is not just due to armed groups, but also to Congolese security forces. In 2017, the number of sexual violence occurrences ascribed to the Congolese army (FARDC) and the Congolese National Police (PNC) increased by 28% and 109%, respectively, when compared to 2016 (UN Peace Keeping, 2018). The victim was in police custody for more than a third of the events (Ibid).

According to the Demographic Health Survey conducted in 2013-2014, 27 percent of women in the DRC had experienced sexual violence at some time in their life, up from 22 percent in 2007 (United States Department of State, 2017); (Promundo, 2014). According to a survey done in North Kivu region in 2013, roughly 65 percent of male participants thought, "Women should accept partner violence to keep the family together." Around 27% of men agreed with the statement "a male can force a woman to have sex, and she may love it" in the same study, indicating a significant level of discriminating views among men (Ibid).

Legal Framework

According to the article 8, 12 and 13 of the 2015 Democratic Republic of the Congo Constitution: *The human person is sacred and has the right to life.* The State has the obligation to respect it and to protect it. Each citizen has the right to the full development of his person within respect for the rights of others, of the public order, of ethics and of morals.

The penalty of death is abolished (Article 8)

War crimes, crimes against humanity, the crime of genocide, are punished within the conditions determined by the law, as they are imprescriptible (Article 12). Any propaganda or any incitement to ethnic hatred, to insurrection, to violence or to civil war constitutes a crime punished by the law (Article 13).

Regional and International Actors

Eastern Neighbors of the DRC

Uganda, Rwanda, and Burundi's rivalries, as well as their internal difficulties, pose a threat to the DRC. These countries have used militias in the DRC to fight proxy wars between themselves. The FDLR, for example, is tied to Uganda and Burundi in their fight against Rwanda. 64 In exchange, Rwanda is linked to assisting rebel organizations fighting Burundi in South Kivu and rebels like the ADF fighting Ugandan President Yoweri Museveni (French, 2009). President Tshisekedi intends to settle this dynamic diplomatically, hence the quadrature framework for rapprochement between Rwanda, Uganda, and Burundi.

The UN Mission in the Democratic Republic of the Congo (MONUSCO)

Since the creation of MONUC in 1999, the United Nations (UN) has been the dominant Inter Governmental Institution (IGI) in the DRC war. The United Nations Security Council (UNSC) established MONUSCO in 2010 as an upgrade to MONUC, with two strategic priorities: civilian protection and support for the stabilization and strengthening of state institutions in the DRC, as well as key governance and security reforms. The United Nations contributes 57 personnel from various member states (UN). Because of MONUSCO's poor response to reported attacks against civilians, the inhabitants of Beni demanded its departure in February 2020. The lack of success was attributed to a lack of financial, people, and logistical capabilities, as well as engagement rules that do not allow for quick involvement when needed (Minani, 2020). Despite these setbacks, MONUSCO's collaboration with the FARDC and the Congolese National Police (PNC) allowed for the safe return of displaced people. The situation of late October 2020 in Pinga, Walikale territory of North Kivu, is a recent example (MAGURU & BA, 2022).

Civil Society

The Catholic Church in the DRC is the most powerful civil society organization with a membership that exceeds 50% of the population. It participates in the DRC's peace process as a neutral party (mediator), facilitating political involvement (mobiliser) (Berkley Center for Religion, 2020). The postponed election and repression sparked actions that went beyond mediation (The Africa Center for Strategic Studies, 2027). Under Kabila's administration,

human rights breaches and democratic inadequacies shaped his mobilizer's role, while Tshisekedi's administration takes a different approach. Furthermore, Actions et Initiatives de Développement Pour la Protection de la Femme et de l'Enfant (AIDPROFEN), which focuses on women and children and receives support from INGOs and the US Embassy, among others, focuses on women and children. In Goma, North Kivu, an equal education initiative for abandoned girls and boys has managed to prevent many from joining armed organizations (AIDPROFEN, 2022).

SOLUTION TO MIXED MIGRATION CHALLENGES

The Government of the DRC has difficulties in central, and the national government that pushed on the lacks of dynamism to fill the void. As a result, the government should lead a structural shift away from overburdening the central government and toward empowering provinces to manage their own affairs. In terms of the economy and security, this entails decentralization. As a result, legitimate authorities at the local level will lead to conflict prevention and resolution. This will inspire grassroots ownership of governance, peace, and security infrastructures. The load on the central government will be decreased as a result of this decentralization process. This will help to strengthen institutions, which is one of the African Charter on Democracy, Elections, and Governance's top priorities (ACDEG) (African Union, 2007). In this vein, more initiatives with political will to work, such as the Inter-provincial Commission to Support the Awareness, Disarmament, Demobilization, and Community Reintegration Process (CIAP-DDRC), which was launched in South Kivu in 2019, are needed in eastern DRC, and the context specificity of the CIAP-DDRC should be emphasized.

This would facilitate the following: the transition of armed groups with ties to local communities into provincial security forces capable of receiving adequate professional training; political participation by focusing citizens' and civil society's attention on appointing suitable leaders to manage the affairs of the provinces. Furthermore, the formulation, implementation, monitoring, and evaluation of policies tailored to the realities of each province rather than the national average. It would also create a climate in which inter-provincial competitiveness might be shifted away from violent confrontation and toward development.

To Interstate Organization

The timely restructuring of FIB requires the support and facilitation of UN member states (ISS, 2020). Following its triumph over the M-23 movement, it has shown to be the only effective

force against armed groups, necessitating SADC's call for FIB reorganization. However, the focus should be on improving its ability to defend civilians. There is also a need to concentrate on local grievances and ties with local communities, which are exploited by armed organizations. These criticisms might readily be construed to MONUSCO's harm, jeopardizing the much-needed public trust and support in local communities. As a result, managing and avoiding further attacks would include UN MONUSCO finding a mechanism to avert retaliation and increasing public diplomacy operations. To the ICGLR, the AU, and the RECs to begin, technical and capacity-building assistance for institutions at the grassroots level is needed to help them develop a sense of ownership of governance, peace, and security infrastructures. This is important for peacebuilding because broken institutions are one of the reasons why the conflict in eastern DRC has lasted so long. In addition, the African Union needs to strengthen its presence in the DRC in order to comply with UNSCR 2250, the African Youth Charter, the African Union Continental Framework on Youth Peace and Security, and other similar normative frameworks (s). This is important for conflict prevention and peacebuilding because it will help to occupy and distract the attention of the young population, allowing them to see beyond the use of violence as a means of survival.

The AU PSC may also be required to intervene in international terrorism and violent extremism, establish measures to prevent genocide and other crimes, and become more involved in human rights concerns, particularly to rein in the FARDC's excesses (African Union, 1993). On the youth agenda in the DRC, RECs and the International Conference of the Great Lakes Region (ICGLR) should collaborate with the AU. RECs and member states must also expand their support for President Tshisekedi and his diplomatic strategy in order to boost regional security cooperation. Finally, the AU and RECs should prioritize maintaining peace and facilitating constructive conversation between Pro-Kabila and Pro-Tshisekedi. This would result in a healthy opposition, as is required in a democracy that does not fuel conflict or undermine governmental institutions.

CONCLUSION

Despite significant progress in the DRC's, fight against impunity for human rights violators must be reviewed and making in action new policies to deal with it. Such as the President of the Republic's promulgation of legislation on the implementation of the Rome Statute of the International Criminal Court on December 31, 2015, or the law n°15/013 of August 1, 2015 on

rules for implementing women's rights and gender parity, several malfunctions negatively impact the Congolese justice system and impede progress in the effect. During the time under review, the President and Congolese authorities, with the backing of the international community, spearheaded initiatives and public campaigning that resulted in the conviction of at least 231 State agents for conflict-related sexual violence.

Furthermore, according to UNJHRO data, at least 447 FARDC soldiers and PNC operatives were convicted of human rights breaches during the same time. In comparison to the large number of reported human rights breaches, this remains a low figure. The low number of security agents successfully convicted, particularly high-ranking officers, and the difficulty in prosecuting armed group combatants as they physically evade justice. In other word or are rather targeted by military operations, are concerning considerations, especially given that United Nations bodies frequently emphasize the importance of bringing perpetrators of serious human rights and international humanitarian law to justice in order to effectively combat impunity. The percentage of human rights breaches committed by government agents (54, 5%) is alarming. It exposes major institutional flaws as well as a lack of criminal prosecution of human rights violations, particularly by high-ranking officers. This situation must be rectified immediately, especially given the country's current electoral setting, in which security forces are viewed as a tool of the state used to achieve political ends, namely to suppress political opponents, civil society, and the media. Prosecution of armed group combatants for crimes including human rights violations is extremely rare, with only 28 convictions recorded over the time period under consideration.

Amnesty or absorption into the FARDC ranks are frequently offered to armed group combatants. Indirectly, this de facto impunity encourages the commission of violations, which has a negative impact on the victims. The National State of Justice held in Kinshasa from April 27 to May 2, 2015, and coordinated by the Ministry of Justice and Human Rights and the *Conseil supérieur de la magistrature* conveyed a strong message about the government's intention to strengthen the Congolese legal system. The Ministry of Justice and Human Rights' efforts to institutionalize judicial changes are admirable; nevertheless, aggressive prosecutions of human rights violators, legislative reforms, and enough resources supplied by the government and its foreign partners must back them. The East African migration is underlined with a big number of Congolese who abandoned their mother in search of freedom and care of

human rights values. The region of eastern RDC is the main in the case of national migration index influenced by several repletion of war and human right violation. Non-respect of principal human right value in the rule of power and well-being of people sourced from government staffs and non-government groups has negative impacts on forming national peace and stability aimed to develop the country.

REFERENCES

- African Union. (1993, 6 28). *Protocol relating to the establishment of the Peace and Security Council of the African Union*. Retrieved from <https://www.peaceau.org/uploads/psc-protocol-en.pdf>
- African Union. (2007, 1 30). *AFRICAN CHARTER ON DEMOCRACY, ELECTIONS AND GOVERNANCE*. Retrieved from http://archive.ipu.org/idd-E/afr_charter.pdf
- AIDPROFEN. (2022, 4 20). *AIDPROFEN RD Congo Protection et promotion des droits de la femme et de l'enfant*. Retrieved from <https://aidprofenasbl.wordpress.com/about-us/>
- Berkley Center for Religion. (2020, 7 24). *Catholic Peacebuilding in the Democratic Republic of Congo During the COVID-19 Emergency*. Retrieved from <https://berkeleycenter.georgetown.edu/posts/catholic-peacebuilding-in-the-democratic-republic-of-congo-during-the-covid-19-emergency>
- BESWICK, D. (2012, 12 19). *Unpacking Rwanda's Involvement in DR Congo and the International Response*. Retrieved from <https://www.e-ir.info/2012/12/19/unpacking-rwandas-involvement-in-dr-congo-and-the-international-response/>
- Bigirimana, M. (2022, 4 10). *Evariste Ndayishimiye's Foreign Policy: Case of Burundi-China Successful and Lasting Relation*. Retrieved from https://www.researchgate.net/publication/356998318_Evariste_Ndayishimiye%27s_Foreign_Policy_Case_of_Burundi-China_Successful_and_Lasting_Relation
- Brier, G. (2021). *Analyse de conflit et cartographie des acteurs dans le Sud Kivu et l'Ituri*. *International Peace Information Service*, 2-50.
- French, H. W. (2009, 9 24). *Kagame's Hidden War in the Congo*. Retrieved from <https://www.nybooks.com/articles/2009/09/24/kagames-hidden-war-in-the-congo/>
- Global Witness. (2009). *NATURAL RESOURCE EXPLOITATION AND HUMAN RIGHTS IN THE DEMOCRATIC REPUBLIC OF CONGO 1993 to 2003*. *Global Witness*, http://cdn-globalwitness-production.s3-website-eu-west-1.amazonaws.com/archive/files/pdfs/drc_exploitation_and_human_rights_abuses_93_03_en.pdf.
- IDMC. (2022, 4 25). *Global Report on Internal Displacement 2021*. Retrieved from <https://www.internal-displacement.org/global-report/grid2021/>

- ISS. (2020). *Africa: Why Is SADC Slow to Intervene in Political Crises?* Gaborone: issafrica.org.
- Langevin, L., Lamarche, N., Down, R., & Cimetta, S. (2018). Democratic Republic of Congo 2018 Conflict Risk Diagnostic . *NPSIA*, 2-10.
- MAGURU, S., & BA, A. (2022, 11 4). *PINGA: REASSURED BY THE PRESENCE OF PEACEKEEPERS AND THE ARMY, FAMILIES HAVE RETURNED HOME*. Retrieved from <https://monusco.unmissions.org/en/pinga-reassured-presence-peacekeepers-and-army-families-have-returned-home>
- Médecins Sans Frontières. (2014). *Everyday Emergency: Silent Suffering in Democratic Republic of Congo*. Amsterdam: Médecins Sans Frontières.
- Minani, R. (2020, 4 18). *Exasperated, the People of Beni Demand the Departure of the United Nations Troops (MONUSCO) from the Democratic Republic of the Congo*. Retrieved from <https://africaupclose.wilsoncenter.org/exasperated-the-people-of-beni-demand-the-departure-of-the-united-nations-troops-monusco-from-the-democratic-republic-of-the-congo/>
- Mvondo, S. A. (2015). National-Level Corruption Risks and Mitigation Strategies in the Implementation of REDD+ in the Democratic Republic of the Congo: an Overview of the Current Situation. *U4 ISSUE*, 1-31.
- OCHA Services. (2001, 4 12). *Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of DR Congo*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/report-panel-experts-illegal-exploitation-natural-resources-and>
- OCHA Services. (2014, 4 28). *Democratic Republic of Congo: Internally Displaced People and returnees (March 2014)*. Retrieved from <https://reliefweb.int/report/democratic-republic-congo/democratic-republic-congo-internally-displaced-people-and-returnee-2>
- Promundo. (2014). *Gender Relations, Sexual Violence and the Effects of Conflict on Women and Men in North Kivu, Eastern Democratic Republic of Congo: Preliminary Results from the International Men and Gender Equality Survey (IMAGES)*. Washington D.C: Promundo.
- Rufanges, J. C., & Royo Aspa, M. J. (2016). DEMOCRATIC REPUBLIC OF CONGO: A REVIEW OF 20 YEARS OF WAR. *Centre Delàs d'Estudis per la Pau*, 1-44.

- Sewenet, G. (2019). CHALLENGES OF DEMOCRATIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO (DRC). *Jurnal Studi Pemerintahan*, 84-108.
- Stearns, J. K., & Vogel, C. (2015). The Landscape of Armed Groups in the Eastern Congo. *Congo Research Group*, 4-10.
- Stearns, J., & Vogel, C. (2017). The Landscape of Armed Groups in Eastern Congo Fragmented, politicized networks. *KIVU SECURITY TRACKER*–, 2-9.
- The Africa Center for Strategic Studies. (2027, 2 17). *Interview: Prospects for Peace in the DRC*. Retrieved from <https://africacenter.org/spotlight/interview-prospects-peace-drc-katunga/>
- UN Peace Keeping. (2018). *report of the secretary-general on CONFLICT-RELATED SEXUAL VIOLENCE*. Wahington DC: UN.
- UN Security Council. (2018). *Report of the Secretary-General on conflict-related*. New York: UN.
- UN Team of Experts. (2017). *Rule of Law/Sexual Violence in Conflict, Annual Report 2017*,. New York,: UN.
- UNHCR. (2022, 4 10). *Congolese refugees A protracted situation*. Retrieved from <https://www.unhcr.org/558c0e039.pdf>
- United States Department of State. (2017). *2017 Country Reports on Human Rights Practices: Democratic Republic of the Congo*. Washington, D.C.: United States Department of State.
- World Report. (2019). *Democratic Republic of Congo Events of 2018*. Retrieved from <https://www.hrw.org/world-report/2019/country-chapters/democratic-republic-congo>

ROMANIA-EU RELATIONS FROM FULL MEMBERSHIP TO THE PRESENT

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ABSTRACT

The political and economic interdependency pushes several states to come under cooperation and establishes strong partnership in many aspects of life. The development and foundation of European Union promoted economic and welfare of European countries and decreases political instability in the region. This study focus on the Romanian EU relation from full membership to the present, analyses the regional relation under economic and political dimension. This study displayed the Romanian interest on EU, the process and political dimension applied by Romania and it advantages of full integration. The research demonstrated that Romania gained much more advantages than consequences in his membership in the EU member states. In its conclusion, this paper confirmed that the integration of Romania in European Union contributed in setting policies of ameliorating social, economic, and political structures. The relationship between Romania and the EU from its full membership to the present is examined in this article using the content analysis method of qualitative research.

Keywords: Romania, EU, Full Membership, Social Mobility, Integration, Diplomatic Relation.

1. Introduction

The foundation of European Union as an intergovernmental organization in 1993 promoted much more European countries to be collective and work under a policy of partnerships in several issues. Since its foundation, many countries of Europe gate chance to move from a bad style of life to a precious one. Due on this policy of welfare of European countries, many states established several policy toward the EU integration and worked with dignity in order to gain membership.

The foundation based on promoting economy in the region, did not limit his affection on trade cooperation but it outmoded the main point and development many other branches to push over stability and economy in the region. EU seems to be one of the most successful intergovernmental organization in the globe, it power of application still pushing other states to take example from it. The economy interdependency pushes some states to follow the line of integration in the EU, staring from forming strong partnership to a membership status, are timeline exerted by countries in dealing with the incorporation in EU. Romania is one of country who tried and succeed in taking party in EU since 20007. As it was before and after it, Romania is taking place of one of the most important country doing business with EU member states from long.

This study took a while on displaying the demographic structure of Romania followed by its socio-politic structure, give a brief understand of the time line of Romanian policy toward European Union and its diplomatic aspect of progression. Moreover, the study will present advantages and consequence of the integration of Romania in the EU. After the official integration of Romania in the EU many aspect seem to change in the country and the new policy have been established toward the standard of EU member countries. From 2007 to the ongoing time, Romania developed his intern politic and economic. The influence of being member of EU help on state reconstruction and resized the political situation that was facing the country from long. National industry and trade capacity upsized and pushed the stability of development in several aspect of life in the region.

1.1. PRESENTATION OF ROMANIA

1.1.1. Demographic Presentation of Romania

Romania is a state situated in the Southeastern Europe with a total of 238 391 km², it has border with Bulgaria in South, Ukraine in North, the West part there is Hungary and Serbia in the Southwest followed by Moldova in the East and the Black Sea in the Southeast (Britannica, 2021). The county is very popular and know depend on its forest region of Transylvanian. The country's official language is Romanian and its currency is Romanian Leu, the population of the state is 19.29 million (Macrotrends LLC, 12), (The World Bank, 2021). The report of World Bank demonstrated that in Romania population range is decreasing instead of increasing.

1.1.2. Socio Politic and Economic Structure of Romania

The socio politic situation of Romania changed several times due on politic played in the region and the change rule in the country. In this party starting from social reform to political changes, brief analyze will be done in order to compare the polity of Romania before the membership and how it changes after his integration in the European Union in 2007. According to the historical background of the country, the change of socio political views took place while it started to pursue the participation in NATO. Romania started the movement of taking way to democracy in 20003 with the target of entering NATO and European Union (Constitutional Court of Romania, 2003). The policy toward EU integration pushed the proclamation of Social republic where people derived sovereignty. From the full membership in the European Union, Romania established several policies and developed many factors of promoting social life style followed by economy and political structures.

1.1.2.1. Social

In the past of Romania, the republic was well known as a Social Republic of Romania; during the era of 1947 until 1989 Marxist-Leninist and one party communist dominated the country. The long of 1989 to 1965 the country was recognized as the Romanian People's Republic (Bachman, 1991).

After the reform of social class in the country, social mobility took place in the region and pushed several changes to be in application. The social mobility was founded by maintaining the evolution of family law, changes of family structure and family life. In other side Break out of women organization, education system was promoted. People of Romania

even the political influence of religion in the region is punched principally on Orthodox and Catholics; other religions are not taking important place as the two on top. Finally, the social mobility seems to increase amelioration of social condition, case of Housing, public health and state welfare assistance (Bachman, 1989). The transformation of social class in Romania built a schema of social class under 10 classified groups (Pop, 2013). Starting from *Employers, Managers, Professionals, Supervisors, Self-employed, Technicians and officer workers, skilled manual workers, service and trade workers, unskilled manual works and farmers (peasants)*. This classification was designed by the report done by Pop while analyzing the new class schema in the Republic of Romania.

After a brief passage dating from the past of Romania in social mobility, Romania established policies to act in accordance with the EU integration and helped on developing several sectors of social life. The Romanian policy toward EU integration was characterized by changing its social status and put in place some amelioration of citizen's life. Creating occupation, establishing a policy to face social income and welfare of householders seem to be in priority of change in social structure in the last decades (China-cee.eu, 2021). The social life of Romanian changed its views after its full integration in the European Union, benefiting from EU social policy and social development toward welfare of people gives change to Romanian to develop its skills and promote much more social security.

1.1.2.2. Economic

As it was in the social structure of Romania before its integration in the EU, the economic average was at the same time under a shot. The country was full of people living in rural economic power, people of the region was much influenced by law economy depended on agriculture. It was underlined by several study that the economic situation of Romania took reform after 2007; its integration to EU promoted the reconstruction of economy and helped on developing his industrial sectors. The world economical rank demonstrated that, in 2020 Romania occupied 45th place of Gross Domestic product globally (World Bank, 2021), the index of economic freedom in 2021 demonstrated that Romania is occupying 43th place with a score of 69.5 in the globe. At the sometime Romania, appear at the 26th class of 45 European countries (Heritage.Org, 2021).

Out of economic change of Romania, one of the most important factor of production that promote education in the region is rentable land. Romania is rich of naturel resources, local

industry utilize the prosperity of and contribute in national economic and development (123Helpme, 2021). I should argue that Romania is one of the European states that has adequate suppliers of nature gas and petroleum; it has iron, ore, timbre, coal and salt. By analyzing the result of commercial evolution of Romania, it has high income that is mixing economy and high Human development index and organized labor force. It concluded the 12th place of Europe in total nominal DDP and occupied the seventh largest by sup up power equivalence (International Trade Administration, 2021).

1.1.3. Political Structure

Romania is a democratic republic with has a semi presidential rule, in the state the Prime Minister is at top of government and the president is taking representation of the country at international level. The president has authority of signing some decree and ratify laws announced by the parliament (Europa.eu, 2021). The republic of Romania is an independent sovereign and unitary, the president of Romania is coming to power from a direct election with a term of five years and renewable only two times. The body is government is compose by 329 deputies the government under control of Parliament and 136 senator directly elected (Europa.eu, 2021). Executive, judicial and legislative, forms the Romanian main power (Global Edge, 2021)

2. HISTORICAL BACKGROUND OF THE EU

European Union is an intergovernmental organization established on 1993, it took existence from the European Coal and Steel Community (ECSC) founded in July 23 1952 in Paris (Europa, 2022) followed by the European Economic Community founded under the treaty of Paris in 1951 and the Treaty of Rome in 1957. The movement was influenced by the cooperation of six countries that come together to establish an economic organization with aims to facilitate trade and market between then, the up listed members of the organization at the beginning were: *Belgium, France, West Germany, Italy, the Netherlands, and finally Luxembourg* (EUR-LEX, 2022). By analyzing, the main reasons of creating the European Union seem to stop war among neighbors, establishment of supranational organization to deal with enforcement of democracy and making war unthinkable (European Union, 2022).

2.1. Development of EU Over Decades and Important Events

The periodical analyses of European Union starts with the era of 1945 just after the end of the second WW. Taking point from this time to 1993 is period-characterized changes and

development of EU from beginning of cooperation between European countries to the foundation of the intergovernmental and supranational organization.

- Period between 1945 and 1959

This period defined as the post war era, is characterized by the break out of cooperation in Europe, which gives result of foundation of several organization and treaties. The break out of the period are as bellow: 1945, end of WW II in Europe followed by the establishment of the ECSC in 1951. The first treaty in Europe after the WW II took place in 1957 well known as Treaty of Rome that played an important role in bringing together European states (Netaffair.org, 2022). Many European bodies were established just after the WW II as determined in the EU country history: On 4 April 1949 the establishment of NATO, 5 May 1949 the Council of Europe, 9 May 1950 New political Cooperation in Europe and on 18 April 1951 the European Coal and Steel Community (EU, 2022).

- Period between 1960 and 1969

An important remark point named “Period of Economic growth” characterized the era between 1960 and 1969. Some of major activities and events realized in this period was 1960 creation of European Free Trade Association, 1961 construction of Berlin Wall, 1962 Common Agriculture policy, 1963 first international Agreement signed by EEC, 1965 Merger Treaty, 1968 Student riot in Paris, 1968 Break out of Customs Union and finally in 1968 the crush of Prague spring (EU, 2022).

- Period between 1970 and 1979

The fill out of European Community characterized this period, some of predominant events of the era are: the Environmental protection in 1970, up size the member of EU from six to nine in 1973, oil crisis in Europe 1973. During 1974, there was a reduction of disparities among region, new democracy in three country in 1975 and the direct election in the European Parliament in 1979 (EU, 2022).

- Period between 1980 and 1989

During this period in Europe, there has been a change of the views of Europe and the give way from communist. Some events of this term are, rights of worker established in 1980, set up of the initial European research program in 1981, maintaining the policy on the

road of single market in 1986, in 1987 the starts of Erasmus program and finally in 1989 the drop down of Berlin wall (EU, 2022).

- Period between 1990 and 1999

This era is the promoted first decade just after the foundation of European Union, during this period in Europe various changes have been remarked, the main aspect of the period is that Europe passed to "*no border system*". All countries member of the organization gained a privilege of free travel. The remarked changes and events of this decade are the first event took place in 1991 that was the break-up of Yugoslavia, 1992 the Maastricht Treaty. the put in place of single market in 1993, creation of European Economic area in 1994, establishment of free border in 7 countries, the treaty of Amsterdam in 1997, and finally the nascent of the Euro in 1998 (EU, 2022).

- Period between 2000 and 2009

This period recognized as the period of "*Further expansion*", during this period extend of Europe influenced by new members occupied the reality of Europe. Some of event and important activities of the decade are the Treaty of Nice in 2001, break out of Euro notes and coins in twelve states in 2002, the first peacekeeping operation of Balkans in 2003. In 2005 the establishment of EU constitution followed by Lisbon treaty in 2007 and finally the global crisis based on economy in 2008 (European Union, 2022).

- Period between 2010 and 2019

This decade was announced as the *challenging* era of EU, in this term the European Union played mayor role in setting policies toward welfare of people and the respect of human right. Underlined that this decade gives conclusion on the decrease of member stated resulted from the referendum of 2016. Displayed events and activities of the decades were listed as bellow; in 2010 the Europe windless the financial crisis, in 2012 Nobel peace prize, 2015 terrorism in Europe followed by the Paris agreement of climate change. After 2015 Europe faced a problem of asylum seeker, in 2016 the United Kingdom elected to be away from the EU and in 2019 the establishment of process to face climate change (EU, 2022).

- The ongoing period from 2020 until present

The most important issues influencing the ongoing era of Europe is the global crises pushed by the Pandemic Covid-19. In the history of EU, this era is called the period of "*Covid-19 and the road to recovery*". The main event of the ongoing situation is the Covid-19 pandemic and the fight of human health (European Union, 2022).

2.2. Timeline of European Union Member States

The EU founded in 1993, was promoted by the starting of ECSC under membership of six countries. From this promotion in 1952, the line of change seem to take progression over time and gives the result of founding the EU in 1993. Since its creation to 2020, the organization has 28 member states. At the end of January 2020, the UK abdicated the organization and given the result of member states of EU to become 27 (European Union, 2022). The timeline of member states of EU is; at the first time, the organization commenced with six countries that established the ECSC in 1951, in 1957 the EEC and the EAEC. The six countries are Belgium, Germany, France, Italy, Luxembourg and the Netherlands (European Commission, 2022).

Timeline of countries that joined the union after the six (Schengen Visa Info, 2022):

1973: Denmark and Ireland

1981: Greece

1986: Portugal and Spain

1995: Austria, Finland, Sweden

2004: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

2007: Bulgaria and Romania.

2013: Croatia

The study displayed that many European states joined the Union after the demolition of Yugoslavia. Romania is one of the recent states to join the European Union comparing with other countries in the timeline of the EU member states (De Munter, 2021).

2.3. Romania's Journey towards Integration into the European Union

2.3.1. Process

The process of Romania to join the EU started long time even before the official idea of founding the European Union, after the Romanian revolution in 1989; the countries started by participate in the EC. After this era, the government of Romania and all political parties

manifested the important of it integration in the European Union. In other sources, the regional interest pushed the government of Romania to follow the line of integration, as the Republic of Bulgaria seem to follow the line in the same time (European Commission D G C, 2022). The first process of Romania to integrate in the European Union started with its first application of membership in 1995, this application take place of decision of the Council of Ministers on 17 July 1995 and provided its consultation under the commission (European Commission, 2022). During his process to join the EU, the government of Romania demonstrated with high competence his capability of dealing with all realizations and norms, obligations of EU member states, at his stage the government promised to upgrade and realizes the obligation under cited.

Some of principal criteria expressed by the Romanian government toward EU are:

- Development of the implementation law and Consolidation,
- Access of pluralism in politic
- To separate power
- Freedom in election
- Priority and respect of human rights
 - Establish the market and capability of economy in accord with EU. All this criteria, are taking reference from the EU enlargement criteria well defined as "*the Copenhagen Criteria*" (European Commission, 2022).

The change of government of Romania in 1966 promoted much more the way to reach the integration in the EU, the president of the term starting by saying that the policy of the country must work hard to make reform in the economic structure of the country (Popescu, 1997).

By analyzing the timeline and process of Romania integration to EU, even there was no any problem remarked during it wait for accordance there have been a hold up of years before it official recognition. The research released that scarcity of reform in administration and slow-moving economy seem to be the main reason of the delay in passing on full agreement (CVCE, 2022). It was remarked that Romania applied its EU membership with too many other countries that have been accepted as countries member of EU in 2004, but the accord of Romania and Bulgaria joined in 2007. According to the register of EU the two states integration is recognized as the *fifth enlargement of the European Union* (Rem & Gasper, 2008). On the road to EU, the government of Romania updated it intern policy in order to arrive at the accomplishment of

Copenhagen criteria, several changes were realized by the government include the change of government. Romania participated in many cooperation with other European states. In 1990s, Romania and EU countries signed an agreement on trade cooperation (Phinnemore, 2008).

2.3.2. Diplomatic Relationship

After the deterioration of Romania and Russia in 2000, Romania started to push it foreign policy in the west power (IMEMO, 2022). The accession of the country in NATO promoted its relation with the United State. After 2007 Romania played a major role of increasing it relation with European states due on it full membership in the European Union (Pridham, 2007). The summary of diplomatic relation of Romania and European Union was not founded by the full membership in the organization but since the regional cooperation between European counties, the government of Romania was influenced by western cooperation more than the other side of Soviet priority. The vies of Romanian foreign policy changed just after it got the occasion of joining NATO in 2004 and the EU in 2007 (OLTEANU, 2020).

3. ADVANTAGES AND CHALLENGES OF ROMANIA IN THE EUROPEAN UNION

3.1. ADVANTAGES

3.1.1. Social-economic

In this passage we will try to take away to analyze the socio economic changes in Romania before its membership to EU and compare with its situation after the integration in the European Union. Comment on the reality of change and the influence of EU on the socio economic changes of Romania.

3.1.1.1. Social

During the process of Romania to access the EU, several development took place and influenced extraordinary changes in all aspect of life and social evolution. As the government played important role in promoting and achieving the request of membership of EU, at the sometime welfare of people and upsizing social criteria were at the first place.

The timeline of social change of Romanian started with the end of communist regime in 1989 (Friedlmeier & Gavreliuc, 2013), that promoted his way regarding democracy and capitalist system. The long of communist era, Romanian people's life was set with successful policy from the communist rule; all right and need of people were fulfilled. The situation of Romania seem to change and passed in mediocre situation just after its social structure changes

from Communist to road of democracy (Friedlmeier & Gavreliuc, 2013). It was argued with Friedlmier and his colleagues that, after the social change in 1989 in social life the role of women changed its views and women were taking role in the care of family and jobs. Young and adolescent were the most challenged by the changes due on the non-adaptation on work (Friedlmeier & Gavreliuc, 2013).

With the success of Romania to integrate in the European Union, countless social changes break out, with the power of democracy the social class of Romania changed and women participation in much aspect of life took place. Democratic liberation pushes political parties to act with guaranty of existence and freedom. With the contribution of the EU, established policies to maintain welfare of Romanian and durability of social structure are mentioned as bellow (VASILESCU, 2019):

- *Employment*: it is policy established in order to decrease the economic situation in the region and promote the increase of social income in the society. In additional this policy promoted active labour and market policies, facing the take forward of working mass and skill inadequacy.

- *Poverty and income inequity*: this policy was established in 2015 with the aim of resizing the average of poverty in the country and make stability on income issues. This policy pushed the integration of social income, education, labour market, health, housing and social participation policies for people of countryside.

- *Social inclusion of downsides category*: this policy faces women places in society and the principle right of children.

- *Migration policy*: this policy was established to deal with "*Diaspora start-up*" influenced by people who emigrant back to Romania.

Out of those policies putted in place by the EU, many other programs have been organized by the organization in order to promote the development of social structures of Romania. From it full membership in the EU Romania benefited from the EU more package of setting is socio economic progress (European Commission, 2022). The republic of Romania has 15 representative in the European Economic and social committee (EESC) working in the advisory of the countries and deal with changes and social situation (EU, 2022).

3.1.1.2. Economic

Statistical result of several research's done in 2007 demonstrated that Romania upsized its socio-economic style just after its integration in EU. Economically, the country developed much more all sectors of production. Starting from industry, foreign trade, tourism, trade and services, Earning, labour force and marketing, unemployment (Voineagu , 2022). According to the many found of realized studies, the full membership of Romania promoted the sectoral development followed by increasing welfare of people and guaranty of work.

The sectorial index of development realized after the full membership of Romania in the EU are briefly demonstrated as bellow (Voineagu , 2022): This average are given by comparing February 2006 and February 2007, economy of Romania changes followed this line.

Source *Sectoral evolution of Romania*.

- Industry 5.6%
- Resource of primary energy 80.3%
- Construction 27.9%
- Trade and services 71.3% (wholesaler)
- Foreign trade 73.3% Export and 71% Import
- Tourism 16.6%
- Earning 2.5 %
- Unemployment (decreased women 1.3% and men 4.5%)

Out of the brief statistical result of Romania just after a sort moment of its integration in the EU, depends on the economic development of European Union and the implementation of its policy over member states, Romania get chance to upsize its economy and occupied a good rank among European counties even globally.

Global ranking of Romania during time changes;

In 2006, Romania was 48th ranking in GDP of 195 countries published globally; it figured \$122.024 million in 2006 (Country Economy, 2022). In 2020, the World Bank denounced the GDP of Romania with a number of 248.75 billion \$. The World Bank argue that in 2020 Romanian GDP was 0.22 % of global economy (Trading Economic, 2022).

3.1.2. Politics and Security

The political structure of Romania seem to move to from another aspect just after its route to democracy, its separation from the communist movement promoted much more political

change in Romania. The political construction of Romania before 1989 was founded under one political party that was the *Communist party of Romania*, it was the only one party officially recognized and acting as the main force in Romanian society (Britannica, 2022). Political change in Romania stated in 1991 under push of constitution of that year, the adopted constitution of 1991 delated the single party in politics and adopted the rule of democracy and plurality in political parties. It was underlined by the Britannica that, after the adoption of new law in the 1991 constitution political parties revived from WW II come back in activity after this new adoption of law (Britannica, 2022). Security and peace process was not that easy in Romania before it joined NATO in 2004, even before its acceptance as member of NATO Romania seem to be the first Eastern Europe state to join the North Atlantic Treaty Organization (Britannica, 2022). It was argue that the *military force of Romania played an important role in Afghanistan in 2002 where they was representing international security assistance*, confirmed by the Britannica. The body of Romania security is under control of the Ministry of Administration and Interior (MAI). Three divided groups NPF, NG, and BPF form police force.²⁰

3.1.2.1. Record of event in Romania outline

The time line of Romania profile from its path to EU until now was collected from the BBC news channels in comparison with the Romanian official web and EU reports (BBC, 2022), (Romania-Insider, 2022).

Right way to EU membership

On his way to EU membership in 2004 Romania joined NATO, the presidency of Trian Basescu voted in 2004, Ally Calin Tariceanu took power of prime ministry with plan of stimulating EU oriented changes. In 2005, Romania adopted EU joining treaty (European Union law, 2021).

Full member ship

Romania joined the EU in 2007; this period was characterized by several changes in Romania politic along with the EC notification over Romania prominent corruption in 2008 (CSIS, 2021). The financial crisis in Romania pushed the IMF to fund a package of 20 billion euros to redeem Romania's situation (The New York Times, 2022).

²⁰ **NPF:** National Police Force

NG: National Gendarmerie (Military branch of the National police)

BPF: Border Police Force

Other political events over time

Here are some political events that took place between 2012 and 2020. In 2012, the government started confrontation over self-denial and corruption and the push of Victor Ponta on the rule of prime ministry (Leaders Mag, 2022). The out pointed event of 2015 was the resign of Victor Ponta in his previous position after the misconduct that resulted in died of citizens in fire (Chandler, 2015). In 2016, NATO installed a system of defense in the views of Russian opposition (NATO, 2022). The first political event of 2017 was the formation of government by social democrats after the win of December 2016 election and the posttest over government due on corruption process. It was remarked that since the change of political structure in Romania from the communist regime in 1989 the huge demonstration was manifested in 2017 (DW, 2022). 2019 was remarked by the misplace of social democracy that given priority to Centrist Ludovic Orban on the place of prime minister, one year later the defense minister become prime minister in action at the place of Orban (Balkan Insight, 2022).

3.2. CHALLENGES

3.2.1. Copenhagen Criteria

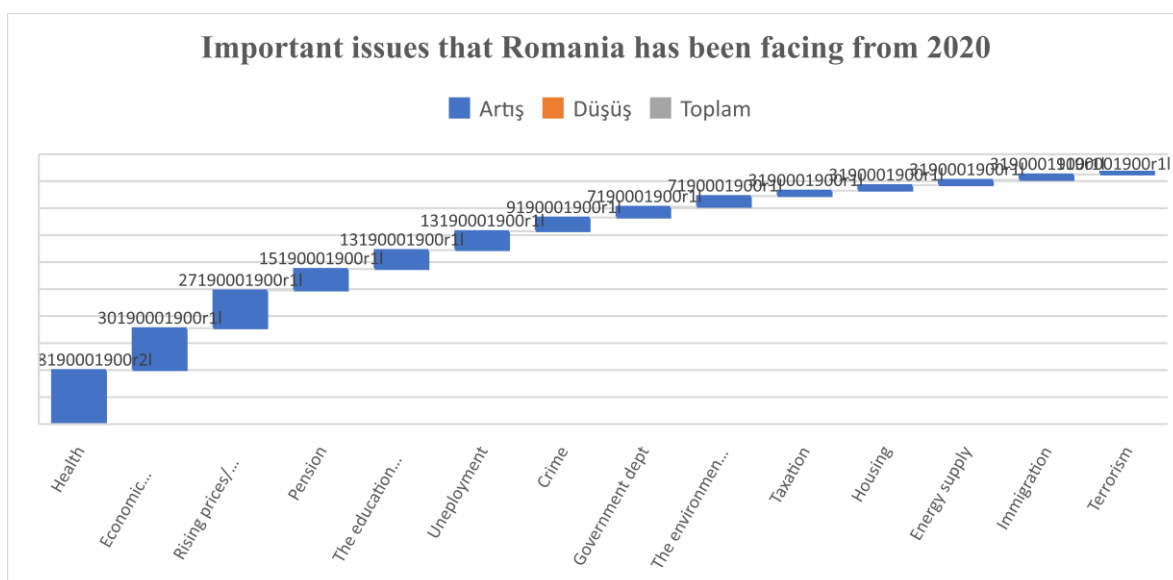
As required to all country that apply membership to the EU, Romania faced the challenge of completing the Copenhagen criteria while starting it road to the EU. At this act, Romania played important role of dealing with the EU requirement. Romania was challenged by establishing an institution of dealing with democracy, implementation of law, promoting human rights and protecting minorities (OECD, 2022). With the work toward integration to EU Romania's incapability on facing integration, criteria seem to result on the delay of Roman to being accepted in the European Union member states.

3.2.2. Socio-economic

After the full membership of Romania there, have been a break out of migration in Romania changes the social status of the country and promoted the fair of EU member states to do not react directly on the issues of Romania. These issues contributed in border instability between EU countries (MPI, 2022). It was underlined that a big number of immigrant who moved from a region to region were under search of labour, in social case one of the most remarked challenge of Romania was of dealing with the decreasing of number of unemployment. Rebuilt economy of Romania was observed as main challenge of the country

in completing the criteria of integration, even the government tried why high stage in pushing national economy the reality of corruption seem to increase and pushed the late of country's opportunity to integrate (Statista, 2022). Challenges faced by Romania toward EU membership were characterized by the scarcity of economy and social structure, from its way to EU integration the country worked hard in promoting the power of stability and complete all needs from the EU. Away from challenges faced by Romania toward EU, the ongoing situation of Romania demonstrate that as all country in globe are suffering from global crisis resulted from the Pandemic Covid-19, at the same level Romania is surviving that challenges (ITA, 2021).

3.2.3. Current important issues that Romania is facing



Source: Statista 2022. <https://www.statista.com/statistics/1109873/challenges-romania/>

CONCLUSION

Starting from the full membership of Romania in EU, the relation of the two actors seem fruitful due on the policies of EU toward member states and the contribution of Romania in the EU. A back analyses of the collected data demonstrated that the EU did not give that much priority on Romania integration due on several challenges faced the country as determined in the timeline. Even Roman applied to join the organization since long time, being out of those states that joined the organization in 2004 displayed how Romania was not that much attractive in the join of the organization at same case of Bulgaria. The join of Romania was not easy

depend on that the country was not eligible to complete all the required criteria case of Copenhagen.

The relation of EU and Romania was founded under the EU member states policies toward development and welfare of EU people. Out relation based in organization, Romania has a strong relation with other EU member states due on its power of energy supply. The development of industry in Romanian promoted the increase of bilateral relation between the EU and Romania. With its strong cooperation and integration to EU Romania upsized it economy globally and pushed the change of social structure of the region. The relation between EU and Romania seem to resize the case in racism in the countries and promoted much social development in the region, at the sometime Romania faced several problem before even after its full membership in the region. Even the relation of Romania and EU appeared in several aspect of development still Romania is facing much many challenges. The most important challenges that is facing Romania are at the top al all there are Heath problems, economic instability followed by the rise of price influenced by inflation. At other side education, system, housing, and environment are underlined in the list of the post important issues of that are facing the country.

In conclusion, the two actor's relation is built under the EU's membership relation followed by the regional influence that are resulted from geopolitical aspect of Romania and the European Union. Even Romania faced more challenges toward EU integration his participation in the intergovernmental organotin displayed this good will in the road of development and cooperation.

REFERENCES

- 123Helpme. (2021, 12 30). *Romania 's Factor Of Production*.
<https://www.123helpme.com/essay/Romania-s-Factor-Of-Production-654953>
adresinden alındı
- Bachman, R. D. (1989). SOCIAL STRUCTURE. In R. D. Bachman, *Romania: A Country Study* (pp. 93-130). Washington: Library of Congress.
- Bachman, R. D. (1991). *Romania: A Country Study*. Washington, D.C: Library of Congress.
- Balkan Insight. (2022, 01 04). *Romanian Defence Minister Named Interim Premier after PM Resigns*. Retrieved from <https://balkaninsight.com/2020/12/08/romanian-defence-minister-named-interim-premier-after-pm-resigns/>
- BBC. (2022, 01 03). *Romania profile - Timeline*. <https://www.bbc.com/news/world-europe-17776876> adresinden alındı
- Britannica. (2021, 12 24). *Romania*. <https://www.britannica.com/place/Romania> adresinden alındı
- Britannica. (2022, 01 03). *Security*. Retrieved from
<https://www.britannica.com/place/Romania/Political-process>
- Chandler, A. (2015, 11 4). *How a Nightclub Fire Brought Down a Prime Minister*.
<https://www.theatlantic.com/international/archive/2015/11/romania-prime-minister-victor-ponta-resigns/414145/> adresinden alındı
- China-cee.eu. (2021, 12 29). *Romania social briefing: The changes in Romania' social strata in the past 30 years*. <https://china-cee.eu/2021/02/26/romania-social-briefing-the-changes-in-romania-social-strata-in-the-past-30-years/> adresinden alındı
- Constitutional Court of Romania. (2003, 11 31). *Romania 1991 (rev. 2003)*.
https://www.constituteproject.org/constitution/Romania_2003?lang=en adresinden alındı
- Country Economy. (2022, 01 03). *Romania GDP - Gross Domestic Product*.
<https://countryeconomy.com/gdp/romania?year=2006#:~:text=The%20GDP%20figure%20in%202006,in%202005%2C%20it%20was%20%244%2C604.> adresinden alındı

- CSIS. (2021, 01 04). *European Commission Warns Romania and Bulgaria*. Retrieved from <https://www.csis.org/analysis/european-commission-warns-romania-and-bulgaria>
- De Munter, A. (2021, 10 -). *THE ENLARGEMENT OF THE UNION*. Retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_5.5.1.pdf
- DW. (2022, 01 04). *Biggest anti-corruption protests held in Romania since fall of communist rule*. <https://www.dw.com/en/biggest-anti-corruption-protests-held-in-romania-since-fall-of-communist-rule/a-37376153> adresinden alındı
- EU. (2022, 1 2). *History of the European Union 1960-69*. https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en adresinden alındı
- EU. (2022, 1 02). *History of the European Union 2000-19*. https://european-union.europa.eu/principles-countries-history/history-eu/2010-19_en adresinden alındı
- EU. (2022, 01 03). *Romania*. https://european-union.europa.eu/principles-countries-history/country-profiles/romania_en adresinden alındı
- EUR-LEX. (2022, 01 01). *Treaty establishing the European Coal and Steel Community, ECSC Treaty*. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Axy0022> adresinden alındı
- Europa. (2022, 01 01). *Expiry of ECSC treaty*. https://europa.eu/ecsc/index_en.htm adresinden alındı
- Europa.eu. (2021, 12 30). *Romania*. <https://portal.cor.europa.eu/divisionpowers/Pages/Romania.aspx> adresinden alındı
- European Commission . (2022, 1 2). *From 6 to 27 members*. https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/6-27-members_en adresinden alındı
- European Commission. (2022, 01 02). *Accession criteria*. https://ec.europa.eu/neighbourhood-enlargement/enlargement-policy/glossary/accession-criteria_en adresinden alındı
- European Commission. (2022, 01 02). *Commission Opinion on Romania's application for membership of the European Union: Introduction and Conclusion (15 July 1997)*. Brussels: CVCE. https://www.cvce.eu/content/publication/2007/11/13/0a1a7322-5eb0-410a-8c48-cd71d2bacf8b/publishable_en.pdf adresinden alındı

- European Commission D G C. (2022, 01 02). *Bulgaria*. https://european-union.europa.eu/principles-countries-history/country-profiles/bulgaria_en adresinden alındı
- European Union. (2022, 1 2). *Country profiles*. https://european-union.europa.eu/principles-countries-history/country-profiles_en adresinden alındı
- European Union. (2022, 01 01). *History of the European Union 1945-59*. https://european-union.europa.eu/principles-countries-history/history-eu/1945-59_en adresinden alındı
- European Union. (2022, 1 3). *The history of the European Union 2020 to today*. https://european-union.europa.eu/principles-countries-history/history-eu/2020-today_en adresinden alındı
- European Union law. (2021, 01 04). *Accession Treaties*. <https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-accession.html> adresinden alındı
- Global Edge. (2021, 12 30). *Romania: Government*. <https://globaledge.msu.edu/countries/romania/government> adresinden alındı
- Heritage.Org. (2021, 12 29). *2021 Index of Economic Freedom* . <https://www.heritage.org/index/country/romania> adresinden alındı
- IMEMO. (2022, 01 02). *Romania's Foreign Policy after NATO and EU Accession*. Retrieved from <https://www.imemo.ru/en/publications/periodical/meimo/archive/2019/11-t-63/europe-new-realities/romaniyas-foreign-policy-after-nato-and-eu-accession>
- International Trade Administration. (2021, 12 30). *Romania - Country Commercial Guide*. <https://www.trade.gov/country-commercial-guides/romania-market-overview> adresinden alındı
- ITA. (2021, 01 04). *Romania - Country Commercial Guide*. <https://www.trade.gov/country-commercial-guides/romania-market-challenges> adresinden alındı
- Leaders Mag. (2022, 01 04). *Romania's Recovery*. http://www.leadersmag.com/issues/2012.4_oct/ROB/LEADERS-Victor-Ponta-Prime-Minister-Romania.html adresinden alındı
- Macrotrends LLC. (12, 12 2021). *Romania Population 1950-2022*. <https://www.macrotrends.net/countries/ROU/romania/population> adresinden alındı

- MPI. (2022, 1 04). *EU Enlargement in 2007: No Warm Welcome for Labor Migrants*.
<https://www.migrationpolicy.org/article/eu-enlargement-2007-no-warm-welcome-labor-migrants> adresinden alındı
- NATO. (2022, 01 04). *NATO-Russia relations: the facts*.
https://www.nato.int/cps/en/natohq/topics_111767.htm adresinden alındı
- Netaffair.org. (2022, 1 2). *THE TREATY OF ROME* . <https://netaffair.org/documents/1957-rome-treaty.pdf> adresinden alındı
- OECD. (2022, 01 05). *COPENHAGEN CRITERIA*. Retrieved from
<https://stats.oecd.org/glossary/detail.asp?ID=3048>
- OLTEANU, A. R. (2020). ROMANIA – NATO RELATIONS: THREE DECADES OF DIALOGUE AND TRANSFORMATION CONCERNING SECURITY. *STRATEGIC IMPACT*, 7-24.
- Phinnemore, D. (2008). And We'd Like to Thank ... Romania's Integration into the European Union, 1989–2007. *Journal of European Integration*, 291-308.
- Pop, C.-I. (2013, 1). Social classes in Romania. A New Class Schema. *researchgate.net*, 75-102.
https://www.researchgate.net/publication/341400020_Social_classes_in_Romania_A_New_Class_Schema adresinden alındı
- Popescu, L. (1997). A Change of Power in Romania: The Results and Significance of the November 1996. *Cambridge University Press*, 172-186.
- Pridham, G. (2007). Romania and EU membership in comparative perspective: A post-accession compliance problem? – The case of political conditionality. *Perspectives on European Politics and Society*, 168-188.
- Romania-Insider. (2022, 01 03). *Romania's Great Union Centennial: 10 major historical events of the last 100 years*. <https://www.romania-insider.com/1918-great-union-historical-events-romania> adresinden alındı
- Schengen Visa Info. (2022, 1 2). *The European Union and Countries in the EU*.
<https://www.schengenvisainfo.com/countries-in-europe/eu-countries/> adresinden alındı

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Statista. (2022, 01 04). *What are the most important issues that Romania is facing at the moment?* <https://www.statista.com/statistics/1109873/challenges-romania/> adresinden alındı

The New York Times. (2022, 01 04). *Romania seeks bailout from EU and IMF.* <https://www.nytimes.com/2009/03/10/business/worldbusiness/10iht-bailout.4.20738820.html> adresinden alındı

The World Bank. (2021, 12 25). *The World Bank in Romania.* <https://www.worldbank.org/en/country/romania/overview#1> adresinden alındı

Trading Economic. (2022, 01 03). *Romania GDP.* <https://tradingeconomics.com/romania/gdp> adresinden alındı

Voineagu , V. (2022, 01 02). *ECONOMIC AND SOCIAL EVOLUTION OF ROMANIA DURING 1.I-28.II.2007 PERIOD. IDEAS, 48-72.* Retrieved from <https://plagiarism.repec.org/socol-socol/socol-socol2.pdf>

World Bank. (2021, 12 29). *Gross domestic product 2020.* <https://databank.worldbank.org/data/download/GDP.pdf> adresinden alındı

**FRANSIZCA ÖĞRETİM YÖNTEMLERİNDE DERS KİTABI ETKİNLİKLERİNİN
EVRİMİ**

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ÖZET

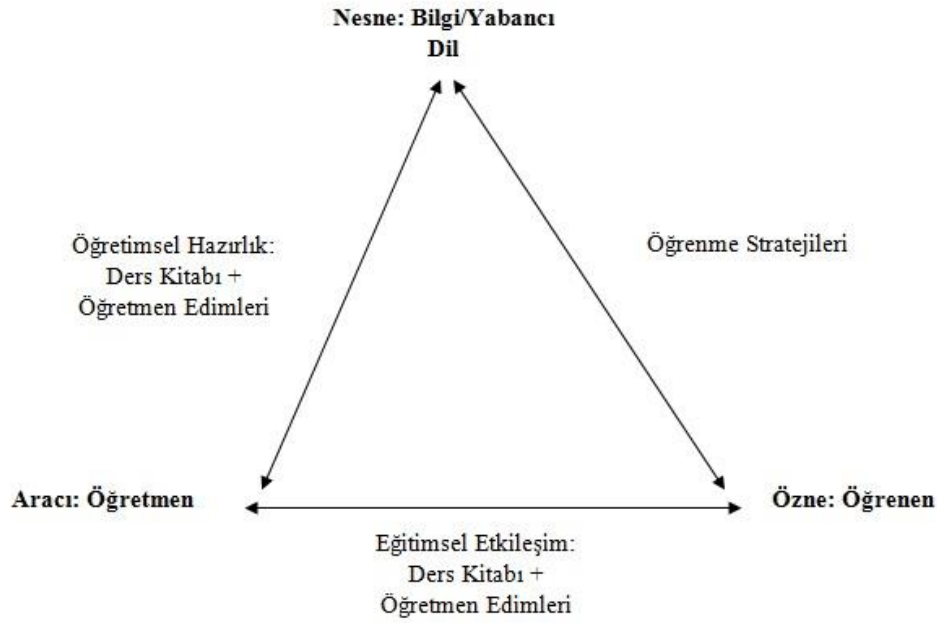
Bu çalışmanın amacı, çok ögeli bir dizge arz eden Fransızca öğretiminde ders kitabı etkinliklerinin, yani kuramsal içerik ile alıştırmaların geçirdiği evrimi irdelemektir. Bahsi geçen evrimi irdelerken ilk olarak yabancı dil öğretiminin, özellikle dilbilim ve ruhbilim gibi rehber teşkil eden alanlardan etkilenerek geçirdiği tarihsel dönüşüm dikkate alınmıştır; bu bağlamda dil odaklı, bildirişim yetisi odaklı ve güncel olarak da daha seçmeci bir özellik gösteren eylem odaklı aşamalar gözlemlenmektedir. Daha sonrasında ise Fransızca öğretimi bağlamında önemli yer tuttuğu düşünülen ders kitapları, belge çözümleme yöntemiyle nitel olarak irdelenmiştir. Fransızca öğretiminin değerler dizisinde kuram ile uygulama arasında köprü görevi gören ders kitaplarındaki etkinliklerin evrimine bakıldığında şu bulgulara rastlanmıştır: Dil yetisinin giderek yerini bildirişim yetisine bıraktığı süreçte, çeviri tamamen bir kenara bırakılmış; dilbilgisinin önemi önce azalmış, sonra artmıştır. İkinci olarak ise sözlü dil kullanımı daha çok vurgulanmaya başlanmıştır. Daha güncel yöntemlerde bildirişime ve dil kullanımı yoluyla gerçekleştirilen gerçek eylemlere yönelik etkinlikler artmıştır. Kültür aktarımında güncel öğeler ön plana çıkartılmıştır. Kitaplardaki görsellik zenginleşmiş ve eğitsel içeriğin özgün belgelerle aktarımı yaygınlaşmıştır. Sonuçta, günümüzde Fransızca ders kitabı etkinliklerinin yöntemli ve ilkeli bir seçmecilikle oluşturulduğu bulgulanmıştır.

Anahtar Sözcükler: Fransız dili, yöntem, ders kitabı, bildirişimsel yaklaşım, eylem-etkinlik yaklaşımı

GİRİŞ

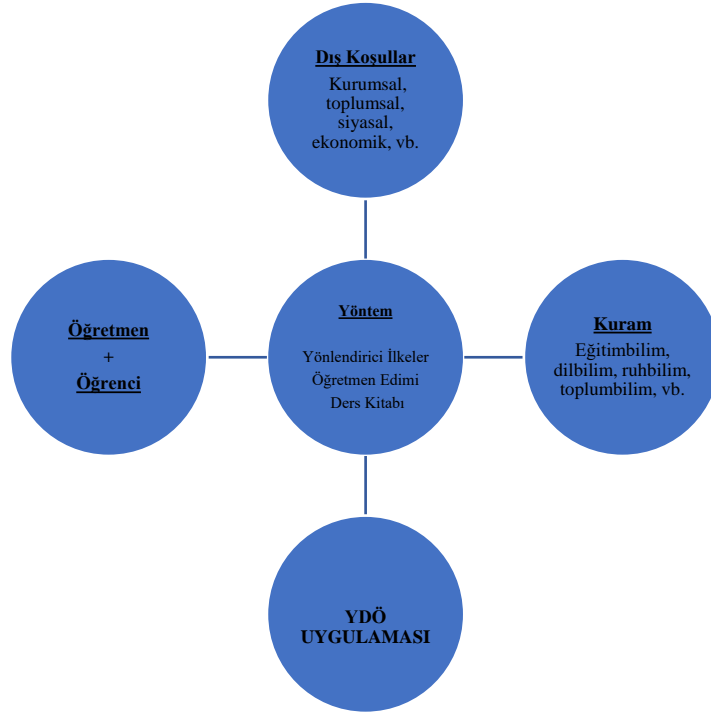
Bu çalışmada, Fransızca öğretimi ders kitaplarında bulunan dilsel ve/ya da bildirişimsel alıştırmalar/etkinliklerin değişimi, yabancı dil öğretimi (YDÖ) yöntemlerinin evrimi ışığında ele alınacaktır. YDÖ'nün disiplinlerarası bir alan olduğu; özellikle, eğitimbilim (ki kendi de karma bir alan arz etmektedir), dilbilim, toplumbilim ve de ruhbilim gibi rehber teşkil eden alanların kesişim noktasında konuşulduğu öne sürülebilir. Ancak, nesnesi olan yabancı dilleri belli bir yöntemle aktarması ve kendine has terimler ortaya koyması hesaba katıldığında, YDÖ'nün bilgi kuramı açısından (bknz. Piaget, 1970) bir bilim olduğu da belirtilebilir. YDÖ'nün değerler dizisi düşünüldüğünde ise alanın siyasal/ekonomik/toplumsal dış etmenlerle yukarıda bahsi geçen rehber alanlardan etkilendiği, sonrasında ise kendi kuramını ve uygulamasını oluşturduğu anlaşılmalıdır. Bunun en belirgin örneklerinden biri şudur: 2. Dünya Savaşı'nın ortamında müttefik güçlerinin askerlerinin hızlıca Almanca öğrenme gereksinimi doğduğundan, ABD'de davranışçılığın savunucularından Burrhus Frederic Skinner'ın ruhbilimsel uygulamaları ve Leonard Bloomfield'in dağılımcı yapısalcılığı bir potada eritilerek *Ordu Yöntemi* adı da verilen *İşitsel-Sözel Yöntem (méthode audio-orale)* ortaya çıkmıştır; yani, dilbilim ve ruhbilim harmanlanarak YDÖ bağlamında tutarlı bir yöntem ortaya konulmuştur (Germain, 1993).

YDÖ'yü ister disiplinlerarası ortak bir alan, ister salt bir bilim olarak düşünelim, öncelikle Hameline'in (1985) *eğitimbilimsel üçgenini* ele almalıyız; burada üç temel bileşen olan *nesne*, *özne* ve *aracı*, YDÖ'de sırasıyla *yabancı dil*, *öğrenen/öğrenci/dil kullanıcısı* ve *öğretmen/eğitmen* tarafından temsil edilmektedir (aktaran Pastiaux & Pastiaux, 2011, s. 7). Üçgende (bknz. Şekil 1) her bir bileşenin arasındaki bağıntılar irdelendiğinde, ilkin öğretmenin ders öncesi hazırlığı, yani öğretimsel hazırlık (*élaboration didactique*) söz konusudur; öğretmen ders öncesinde anlatım, tekrar, açıklama, tanımlama, beden dili, ders kitabı, diğer ders materyalleri vb. (bknz. Cicurel, 2011) sözlü/sözlü dil dışı stratejilerini ve/ya da edimlerini planlamakta, belirlemekte ve çalışmaktadır. Öğretmen, öğrenciyle arasındaki eğitimsel etkileşim (*relation pédagogique*) bağlamında bu stratejileri ve edimleri sınıfta uygulamaktadır; öğrenci ise bilişsel, duyuşsal ve toplumsal-etkileşimsel-kültürel öğrenme stratejilerini (bknz. Oxford, 2011) kullanarak yabancı dili öğrenmeye çalışmaktadır.



Şekil 1. Eğitimsel Üçgenin YDÖ'deki Belirginliği

Dolayısıyla, YDÖ'nün değerler dizisi, temelde, rehber alanlardaki kuramların şekillendirdiği yöntem ve yöntemin sınıfta uygulanması etrafında oluşmaktadır; bu dizideki değişkenler ise *öğrenci*, *öğretmen*, *kuram*, *yöntem* ve *dış koşullar* olarak görülebilir (bkz. Şekil 2). Bu çalışmanın temel amacı da, kuramsal alanın tetiklediği yöntem ve uygulama değişkenlerinin bir parçası olan Fransızca ders kitaplarındaki etkinliklerin evriminin incelenmesidir. Burada, *yöntem* kavramının kapsamına, rehber teşkil eden kuramsal alanlardaki ilkesel yönelimler (yani, dil anlayışı ve öğrenme anlayışı bağlamında örneğin, dilbilimde işlevselcilik ya da ruhbilimde bilişsellik), öğretmenin sınıfta Fransızca öğretmek için seçtiği ve/ya da izlediği yol-yordam (yani, öğretim anlayışı bağlamında gerçekleştirilen edimler ve dersin aşamaları) ve de bir ürün olarak ders kitapları girmektedir (bkz. Germain, 1993). Kaldı ki, Fransızca ders kitapları bir dönem (özellikle 1970'li ve 1980'li yıllarda) *Fransızca Öğretim Yöntemi* alt başlığıyla basılmışlardır. Yani, Fransız alanyazınında yöntem kavramı çok anlamlıdır. Bu çalışmada ise yöntem ve ders kitabı Anglosakson alanyazından esinlenilerek ayrı terimler olarak kabul edilecektir.



Şekil 2. YDÖ'deki Değerler Dizisi

YDÖ'nün evrimi göz önünde bulundurulduğunda, üç temel aşama saptanmaktadır: *dil yetisi odaklı dönem*, *bildirişim yetisi odaklı dönem* ve *eylem odaklı dönem*; kullanım sıklığı ve belirginlik/önem etmenlerini hesaba katarak (bu çalışmada ders kitapları etkinlikleri ekseninde) *Dilbilgisi-Çeviri Yöntemi*, *Doğal Yöntem*, *İşitsel-Sözel Yöntem*, *İşitsel-Görsel Yöntem*, *Bildirişimsel Yaklaşım* ve *Eylem-Etkinlik Yaklaşımı* gibi YDÖ yöntemlerini/yaklaşımlarını alanyazından derleyerek kısaca irdelleyelim (Puren, 1988/2012; Germain, 1993; Martinez, 1996; Seara Rodriguez, 2001; Cuq, 2003; Tagliante, 2006; Bertocchini & Costanzo, 2008; Cuq & Gruca, 2017):

- *Dilbilgisi-Çeviri Yöntemi* (*méthode grammaire-traduction*, DÇ ya da *méthode traditionnelle/classique*, *Geleneksel/Klasik Yöntem*) salt dil yetisine odaklı bir yöntemdir. Rönesans sırasında din adamlarına Latincenin ve Yunancanın yabancı dil olarak öğretilmesini örnekçe olarak alan ve 20. yüzyıla kadar geçerli olan bu yöntemin temel belirginlikleri arasında okuma-yazma becerileri, dilbilgisi ve çeviri bulunmaktadır. Yabancı dil öğrenme, DÇ'de entelektüellik ve kültür göstergesi olarak (zihinsel bir etkinlik olarak) görülmektedir; sınıf etkinliklerinde dilbilgisi konularına bağlı olarak bildirişimsel bir durum arz etmeyen, bağlamdan soyutlanmış tümceler (ya da ilerleyen aşamalarda yazınsal/dinsel/felsefî metinler) anadilden yabancı dile, sonra da yabancı dilden anadile çevrilmektedir. Dilbilgisi kuralları tümdengelimle ve açık olarak kurdan örneğe doğru ilerlenerek aktarılmaktadır. Sözlü bildirişime önem verilmemekte ve anadil sınıf etkinliklerinde kullanılabilir. Sözlü bildirişime önem verilmemekte ve anadil sınıf etkinliklerinde kullanılabilir.

- Bildirişim yetisi odaklı aşamanın, sözlü dilin kullanımına önem veren *Doğal Yöntem* (*méthode directe*, DY) ile başladığı ileri sürülebilir. Kökleri 16. yüzyıla dayanan (Örneğin, ünlü Fransız felsefeci Montaigne, Almancayı ve Latinceyi bu yöntemle öğrenmiştir.) ve 19. yüzyılın sonları ile 20. yüzyılın ilk yarısında özellikle Almanya ve Fransa’da geçerli olan DY’de, anadilin çocuk tarafından doğal bir biçimde öğrenilmesi örnekçe olarak alınmış ve bu örnekçe, YDÖ’ye uyarlanmıştır; öğrenci, doğrudan yabancı dilde düşünmesi için teşvik edilmektedir. DY’deki dil anlayışına göre amaç yabancı dilde sözlü bildirişimdir. Sınıf etkinliklerinde anadil kullanımı yasaktır ve dilbilgisi, tümevarımla örtük bir biçimde (yani örnekten kuralı sezdirecek biçimde) aktarılmaktadır. Öğrenim-öğretim anlayışı bakımından ise dildışı içerik ile dilsel biçim, çağrışımçılık (*associationnisme*) ilkelerine göre eşleştirilmektedir. Öğretimde izlenen yol ise ilkin ders içeriklerinin çeşitli bildirişimsel temalar etrafında oluşturulmasıdır; ikinci olarak ise dildışı içerik resimler, nesnelere, el-kol devinimleri ve yüz ifadeleri aracılığıyla sözcüklerle eşleştirilmekte ve öğrencinin, sözcükleri tümce içinde kullanması sağlanmaktadır. Sınıf alıştırmaları arasında soru-yanıt, serbest söyleşi, boşluk doldurma, yazdırma (*dictée*) ve yazılı çalışmalar (*composition/rédaction*) bulunmaktadır.
- 1940’lı yıllarda ABD’de ortaya çıkan *İşitsel-Sözel Yöntem*’de (*méthode audio-orale*, İSY) amaç, yabancı dili o dilin konuşucusu kadar iyi bir söyleyişle (*accent*) konuşabilecek kişiler yetiştirmektir; dolayısıyla sözlü bildirişim ve özellikle de konuşma birincil öncelik arz etmektedir. Öğrenme anlayışı davranışçı ruhbilimden, dil anlayışı ise dağılımcı yapısalcılıktan esinlenmektedir. YDÖ’de belirlenen yol, sınıf etkinlikleri bağlamında şudur: Davranışçılığa özgü uyaran-tepki ikili karşıtlığından yola çıkarak dildeki biçimsel-sözdizimsel kalıplar (*cadres morphosyntaxiques*) ya da dilbilgisel kurallar, dağılımcılık (*distributionnalisme*) ilkesine göre öğretilmektedir. Ferdinand de Saussure yapısalcılığının Amerikan sürümü olan dağılımcılıkta, sözcük türleri, sözcük dizilimleri (yani, sözcüklerin tümcede hangi konumda bulunduğu) ve sözcüklerin tümcede uğradığı biçimsel değişimler (ekler vb.) önem kazanmaktadır; *dağılım* kavramı bir sözcüğün tümcede yer alabileceği dilsel konumlara (hangi sözcük türüyle yan yana gelebileceği, hangi ekleri alabileceği, hangi anlamsal işlevlere sahip olduğu, hangi sözcüklerle karşıtlık içinde olduğu vb.) göndermede bulunur (bknz. Schott-Bourget, 1994). İSY, dil laboratuvarlarında dilsel kalıpların uyaran (soru)-tepki (yanıt)-pekiştirme (tekrar) yöntemiyle, yani aşırı tekrar yoluyla öğrenilmesini ve otomatikleştirilmesini salık vermektedir. Laboratuvarda yapılan alıştırmaya ya da etkinliklere *yapısal alıştırma* (*exercice structural*) adı verilmiştir. Yapıya/biçime aşırı önem vererek anlamı geri plana atan ve karşı anlıkçı (*anti-mentaliste*) bir yaklaşım sergileyen İSY daha sonraları Noam Chomsky gibi, dildeki anlam boyutuna ve dil

kullanımındaki bilişsel özelliğe dikkat çeken dilbilimciler tarafından eleştirilmiştir. Yapısal alıştırma türlerine ise *Araştırma ve Bulgular* bölümünde değinilecektir.

- İSY'nin bir türevi olarak görülebilecek *İşitsel-Görsel Yöntem*'in (*méthode audiovisuelle*, İGY) kuramsal temelleri 1950'li yıllarda Petar Guberina (Zagreb) ve Paul Rivenc (Fransa) tarafından ortaya atılmıştır. Gündelik konuşmalardan yola çıkılarak Fransızca öğreniminin başlangıç seviyesine yönelik 1475 sözcükten oluşan ve *Temel Fransızca (français fondamental)* adı verilen bir bütüncü oluşturularak eğitsel içerik hazırlanmıştır. İGY, öğrenme ve dil kuramları bağlamında yapıscılık, çağrışımıcılık ve *gestalt* gibi (herhangi bir biçimin bütünsel olarak algılanıp bileşenlerinin beyin tarafından daha sonra süzgeçten geçirildiğini savunan anlayış) akımlardan etkilenmiştir. *Gestalt* (biçim) bağlamında, dilsel yapılar bir bütün olarak öğretilmelidir; örneğin, bir metinde sözcüklerin tek tek önemi yoktur, önemli olan, metnin bütünündeki genel anlamdır. Diğer bir deyişle, dilsel öğeler kapsamlı olarak aktarılmalıdır; yani dilbilgisi, söz varlığı ve söyleyiş bilgisinin yanında titreleme (*intonation*) ya da vurgulama gibi bürünsel (*prosodique*) olgular ile el-kol devinimi ya da yüz ifadesi gibi sözlü dil dışı öğeler de öğrenim-öğretim sürecine katılmalıdır. Öte yandan, öğrenci yalnızca dilsel öğrenme stratejilerini değil, aynı zamanda duyuşsal (*affectif*), etkileşimsel ve ruhsal temeldeki becerilerini de devreye sokmalıdır. Bu nedenle, İSY'nin YDÖ'deki yaklaşımı yapısal-bütünsel (*structuro-global*) olarak nitelendirilmektedir. Son olarak ise eğitsel içerikle ilgili etkinlikler (ders konusunun diyaloglar aracılığıyla tanıtımı ve soru-yanıttan oluşan alıştırma) ses ile görselliğin harmanlandığı bir süreç arz eder; öğrenci yabancı dili anlayabilmek için ses ile imge arasında eşleştirme yapmalıdır. Ancak, bu yöntemde sözlü dile çok fazla önem verilmesi (özellikle, diyaloglardaki kalıpların ezberletilmesi ve söyleyiş üzerinde fazlaca durulması), örneğin dilbilgisi gibi örtük olarak aktarılan alanlara ilişkin becerilerin gelişimini geciktirmektedir; aslında, İSY'ye getirilen eleştirilerden biri de budur.
- 1980'li yıllarda YDÖ'nün değerler dizisinde daha köklü bir değişim yaşanarak ortaya *Bildirişimsel Yaklaşım (approche communicative, BY)* çıkmıştır. 1990'lı yıllara da damgasını vuran bu yöntem yaklaşım adının verilmesi boşuna değildir; öncelikle, teknolojik gelişmelerin ışığında ders kitabı setlerine kasetlerin ve daha sonra CD'lerin eklendiğini; sınıf ortamına kişisel bilgisayarların yavaş yavaş girmeye başladığını görmekteyiz. Öte yandan, öğrenme-dil anlayışı bağlamında ruhbilim, toplumdilbilim, edimbilim ile dil felsefesinin kavşağında bulunan ve seçmeci bir özellik arz eden BY'nin en büyük belirginliği, YDÖ ortamında tamamen bildirişim odaklı ders kitaplarının ve öğretmen edimlerinin tasarlanması ve uygulanmasıdır. Yöntemin çıkış noktasında Amerikalı toplumdilbilimci Dell Hymes'in 1972 yılında *dilsel kalıpları toplumsal bağlama göre kullanabilme* olarak tanımladığı *bildirişimsel yeti* kavramı bulunmaktadır. Bu bağlamda, Hymes, Noam Chomsky tarafından düşüncenin anlatımı

olarak kavramsallaştırılan dil olgusuna karşı çıkar; çünkü dil öncelikle bir sözlü bildirişim aracıdır. Öte yandan, dil felsefesinde İngiliz dilbilimci John Langshaw Austin'in (1962/1970) ortaya attığı *dil/söz edimi* kavramının, yani dil yoluyla gerçekleştirilen örtük/açık edimler/eylemlerin de BY üzerinde etkisi olmuştur; öyle ki ders kitaplarındaki ünite ve dersler dil edimlerinin, yani kolaydan zora doğru dilsel işlevlerin (örneğin, kendini tanıtmak, biriyle tanışma, rica etme, bilgi verme/alma, yakın çevresini betimleme, gerekçelendirme yapma, tavsiye verme, uyarıda bulunma, emir verme vb.) etrafında oluşturulmaya başlanmıştır. Günümüzde de ders kazanımları/işlevleri, ders kitaplarındaki ünitelerin ya da konuların başında tanımlanmaktadır. Sonuçta, BY'nin anlayışına göre, dil konuşucusu herhangi bir dili belli bir bildirişimsel niyetle (ki bunu dil edimi ya da işlevi olarak okuyabiliriz) ve belli bir bildirişimsel bağlamda kullanmaktadır; dolayısıyla, dil kullanımında dilsel biçimler ile içeriği toplumsal bağlama ya da bildirişimsel duruma uyarlamalıdır. Buradaki öğrenme anlayışı Rus ruhbilimci Lev Vigostki'nin toplumbilişsellğine (*socio-cognitivism*) dayanmaktadır; yani, dil öğrenen birey bilişsel işlemler yapmakta; öte yandan da, hem fiziksel hem de toplumsal çevreyle etkileşmektedir. BY Fransızca öğretimi bağlamında günümüzde yaygın kullanılan bir yöntemdir. BY'nin diğer belirginlikleri şunlardır:

- i. Öğrenene odaklılık ve öğrenenin gereksinimleri temeldir; bu nedenle, farklı gruplara farklı ders içerikleri sunulmalıdır (örneğin, genel Fransızca, turizm Fransızcası, özel Fransızca vb.).
- ii. Bildirişimsel yeti kapsamlıdır; bu yeti, dil yetisinin dışında dilin kullanımına ve genel kültüre yönelik bilgi-becerileri de kapsamaktadır.
- iii. Dilbilgisi öğretimi temelde örtük (kimi zaman açık) ve işlevseldir; belli bir metinden ya da ses diyalogdan yola çıkılarak dil kuralları toplumsal bağlam içerisinde öğrenciye sezdirilir. Bununla birlikte, BY sergileyen Fransızca ders kitaplarının özellikle ünite sonlarında dilbilgisi kurallarının tündengelimli ve açık olarak aktarıldığı özetleyici kısımlar da (*bilan*) mevcuttur. Diğer bir seçenek olarak da Fransızca öğretmeni, yardımcı ders notlarıyla ya da ders anlatımlarıyla dilbilgisel noktaları öğrencide sağlamlaştırabilir.
- iv. Ders kitaplarında yazınsal metinler, kurgusal diyaloglar, elle yapılan çizimler ya da bağlamdan kopuk fotoğraflar yerine, gerçek bir bildirişim durumu arz eden ve daha çok gündelik yaşama ilişkin *özgün belgeler* (gerçek gazete haberleri, kaza tutanakları, mektuplar, dilekçeler vb.) kullanılmaya başlanmıştır. Daha önceki yöntemlerde de özgün belgelere kimi zaman yer verilmiştir; oysa BY özgün belgeleri daha düzenli ve hedefli olarak kullanmıştır. Özgün belgeler sonuçta gerçek bildirişimsel durumları yansıtmaktadır ve aslen eğitsel

nedenlerle üretilmemiştir. Ancak, kimi BY ders kitaplarında gerçek fotoğraflarla aktarılan kurgusal diyaloglar da (fotoroman benzeri) bulunmaktadır.

- v. Sınıfta konuşma-yazma becerileri bağlamında gerçekleştirilen bildirişimsel etkinlikler ise kurgusal karakterlidir; BY’de öğrencilerin bildirişim yetilerini geliştirmek için *benzetime (simulation)* ve kurgusal rollere dayalı *canlandırmalara (jeu de rôle)* başvurulmuştur. Örneğin, alışverişe dayalı bir ders içeriğinin açıklanması ve çalışılmasından sonra iki öğrencinin tahtaya çıkartılarak birine satıcı diğerine alıcı rolleri atanıp öğrencilerin birbiriyle diyalog kurmaları BY’nin tipik canlandırma etkinliklerinden biridir.
- 2000’li yıllara doğru Avrupa Konseyi *Avrupa Dilleri İçin Ortak Başvuru Metni*’ni (Conseil de l’Europe, 1998/2001/2005) yayımlayarak YDÖ’nün siyasasına ve eğitsel içeriğine yönelik bir rehber yapıtı oluşturmuştur. Bahsi geçen yapıtta önerilen YDÖ yöntemi *Eylem-Etkinlik Yaklaşımı*’dır (*Perspective Actionnelle*, EEY). Puren’in (2019) de belirttiği üzere, BY’nin bir devamı ya da türevi olarak görülebilecek olan EEY’nin YDÖ’deki en büyük belirginliği, gerçek bildirişim durumları arz eden dilsel-bildirişimsel-kültürel çalışmaların, yani eylem-etkinliklerin (*tâche*) sınıf ortamında ve ders kitaplarında yer almasıdır. Adından da anlaşılacağı üzere, eylem-etkinlik dâhilinde yabancı dil öğrenenler, birer toplumsal aktör olarak birtakım gerçek eylemlere girişirler (BY’deki kurgusal etkinliklerin tersine); bu eylemlerde dilsel, bildirişimsel ve/ya da kültürel bilgi-beceriler harekete geçirilir (Conseil de l’Europe, 1998/2001/2005). Fransızca olarak gerçekleştirilecek eylem-etkinliklere örnek olarak okul gazetesi çıkartma, okul radyosunda yayın yapma, yabancı turistleri gezdirme, sınıfta öğrencinin doğum gününü kutlama, şiir yarışmasına katılma, güncel bir konu hakkında araştırma yapıp sınıfta sunum yapma, internet sitesi kurma, video çekip bir kanaldan yayımlama vb. gösterilebilir. Bu türden, kurgusal olmayıp gerçek olan etkinlikler birçok beceriyi aynı anda harekete geçirerek öğrencinin dili ve diğer becerilerini gerçek toplumsal bağlamda kullanmasını sağlamaktadır. EEY’de ayrıca çok dillilik, çok kültürlülük, öğrenme özerkliği ve özdeğerlendirme gibi kavramlar da ön plana çıkartılmaktadır.

Temel YDÖ yöntem ve yaklaşımlarını tartıştıktan sonra özellikle Anglosakson alanyazında büyük tartışma yaratan *yöntem sonrası dönem* kavramına değinmek gerekmektedir. Dick Alwright 1991 yılında *Death of the Method (Yöntem Kavramının Ölümü)* başlıklı bir seminer vermiş; öğrenci gereksinimi, öğrenci bilişselliği (örneğin farklı öğrenme biçimleri, stratejileri vb.) ve bağlam gibi değişkenleri dikkate almayarak yabancı dil sınıfının her bir bireyine aynı yöntemle yabancı dil öğretmeye çabalayan yöntem odaklı dönemi eleştirmiştir (aktaran Thornbury, 2020). Buna bağlı olarak alternatif bir yöntemden ziyade, yöntem kavramının kendine bir alternatif aranmakta olsa da, yöntemsizlik değil, daha çok ilkeli ve tutarlı bir seçmecilik ya da uygulama ortaya konulması amaçlanmıştır; öğrenci gereksinimi ve özerkliği

gözetilerek uygulamadan hareketle yöntemin oluşturulması, yöntemin baştan dayatılmaması gerektiği görüşü ağır basmıştır (Kumaravadivelu, 2003, 2006).

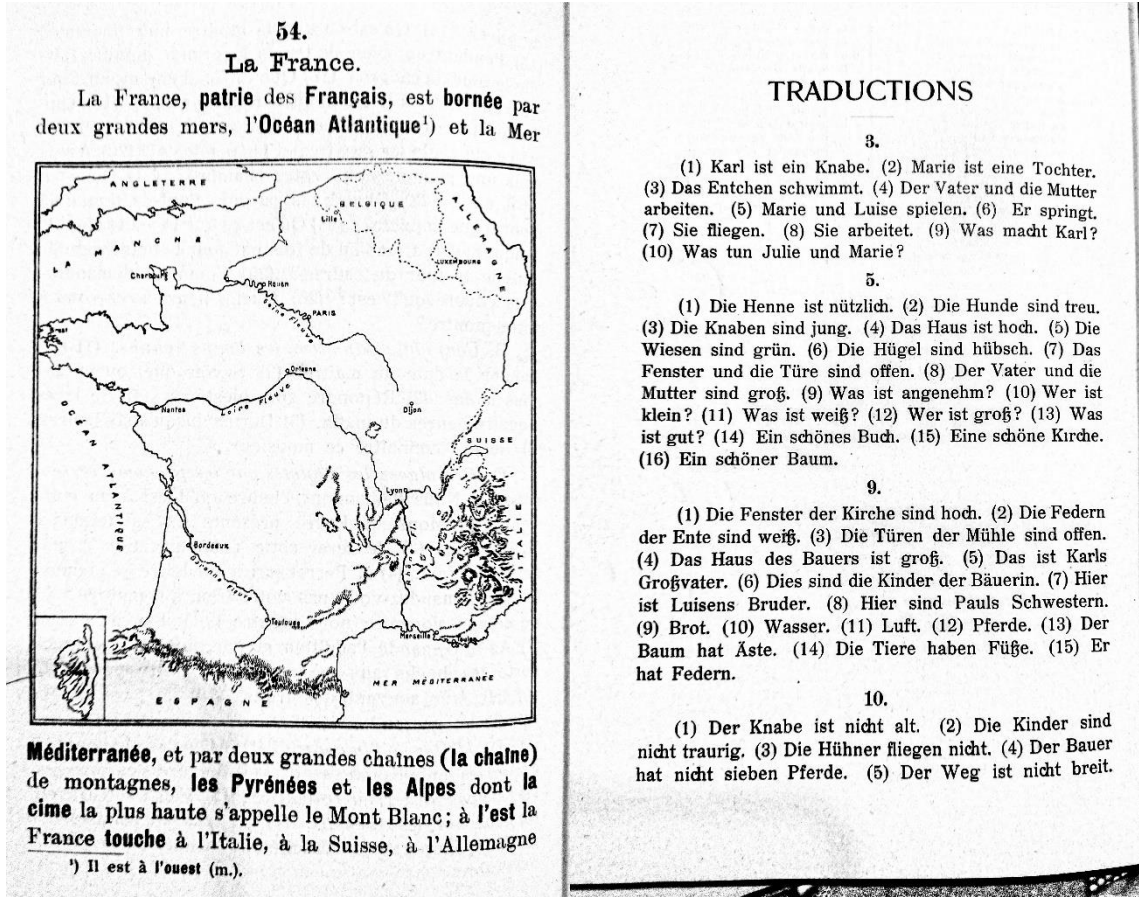
Hiç kuşkusuz, aynı yöntemle yabancı dil öğrenen bireyler, birçok değişken hesaba katıldığında, farklı sonuçlar alacaklardır; öte yandan, öğrenci odaklılık ve gereksinimleri YDÖ’de asıl amaç olmalıdır. YDÖ’de tutarlı ve ilkeli bir biçimde farklı yöntemlerin en etkili öğeleri seçmeci bir yaklaşımla harmanlanabilir; öğrenci çeşitliliği de gözetilerek öğretmenler farklı kaynaklardan, yöntemlerden ve alanlardan yararlanarak kendi yöntemlerini, öğrenci gereksinimlerini de hesaba katarak oluşturabilirler. Ancak, unutulmamalıdır ki YDÖ yöntemlerinin evrimine bakıldığında, toplumsal/teknolojik gereksinimler/değişimler ışığında her bir yöntem, bir önceki yöntemin getirilerinin üzerine fazladan katkı sunmayı amaçlamıştır. Bu bağlamda belli bir tutarlılık ve süreklilikten bahsedilebilir. Aynı şekilde, hiçbir yöntem mükemmel olmadığından, kuram-yöntem-uygulama üçlüsünün her bir bileşeni birbiriyle sürekli etkileşimde olmalı ve birbirini beslemelidir. Kuramsal temelin ya da belli bir yöntemin olmadığı, keyfi ya da rastlantısal uygulamalar başarısız olacaktır; öte yandan, uygulamanın elde ettiği sonuçları önemsemeyen kuram ya da yöntemler de güdük, soyut ve gereksiz olacaktır.

ARAŞTIRMA VE BULGULAR

Çalışmanın sorunsalı olan Fransızca ders kitaplarında etkinliklerin evrimini irdelemek için kullanılan yöntem, nitel belge çözümlemesidir (Merriam, 2009). Burada etkinlikten kastedilen, hem kuramsal içerik hem de içerik etrafında oluşturulmuş dilsel-bildirişimsel alıştırmalardır. Öte yandan, Fransızca ders kitaplarını seçerken erişilebilirlik temel alınmış, herhangi bir yöntemi en çok temsil ettiği düşünülen kitaplar seçilmeye çalışılmış ve belli bir dil düzeyi gözetilmemiştir.

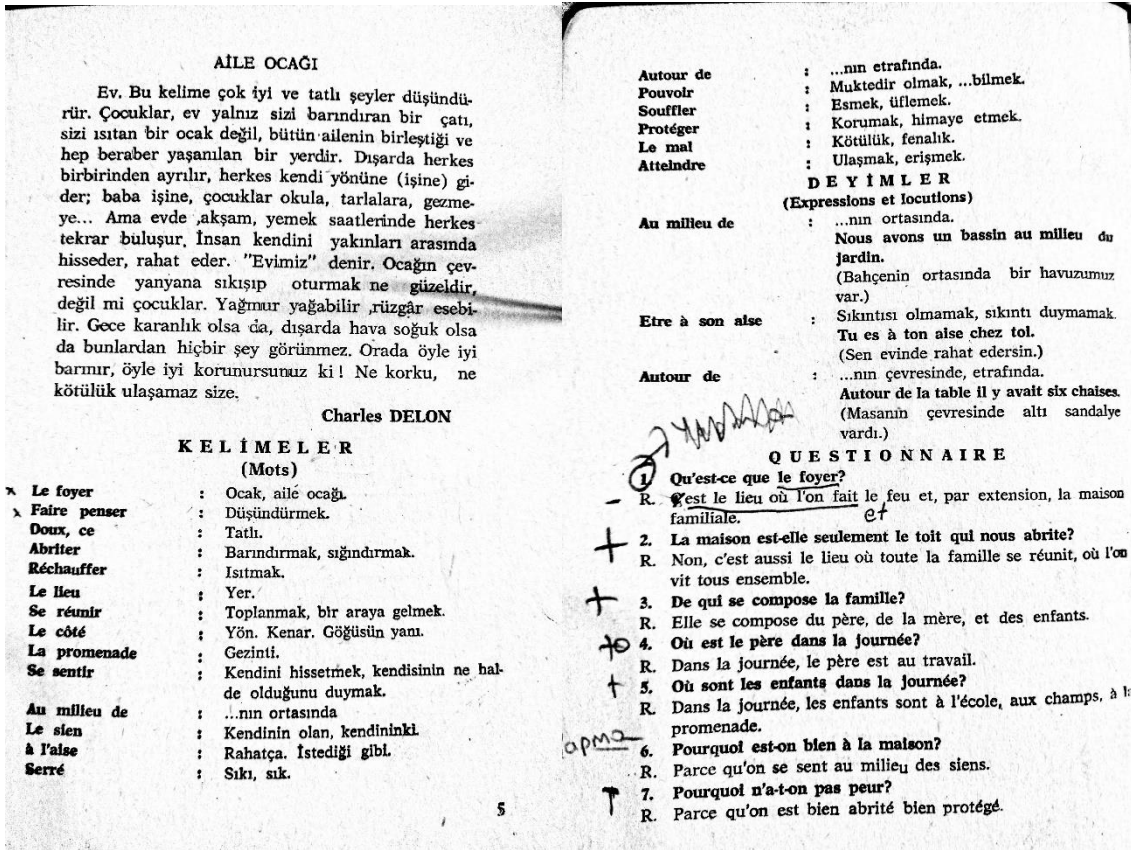
DÇ yöntemi özellikle 20. yüzyılın ilk yarısında Fransızca öğretiminde yer bulmuştur. DÇ çerçevesinde en önemli kitaplardan biri *Méthode Alge: Nouvelles Leçons de Français*’dir (Alge & Ripman, 1927). İsviçre’de Almanca bilen topluluğun Fransızca öğrenmesine yönelik olarak hazırlanmış kitapta (ilk 2 yıllık Fransızca öğretimi bağlamında), Şekil 3’te de görüldüğü üzere, dilbilgisi tümdengelimle ve açık bir biçimde verilmektedir; söz varlığı (*vocabulaire*) aktarımı, kitap sonunda Fransızcadan Almancaya çeviri yöntemiyle desteklenmektedir. Alıştırma türleri tamamen dil odaklı olup dilbilgisi ve söyleyiş bilgisini ön plana çıkartmaktadır; amaç sözcüklerin dilbilgisi dâhilinde öğretilmesidir. Alıştırmalarda basit soru-yanıtlar, değiştirim (örneğin, adın yerine adıl koyma) çalışmaları ve okuma-sesletme çalışmaları yer almaktadır. Başlangıçta daha kısa, ilerleyen aşamalarda daha uzun metinlerle ders içerikleri öğretilmektedir. Görsellik bağlamında ise kitapta yalnızca Fransa haritası bulunmaktadır; bu bağlamda, Galisson’un (2000) *gündelik kültür/yüksek kültür* (uygarlık) ayrımına göndermede bulunursak, kültür aktarımı denilince, DÇ’ye has bir biçimde, yalnızca tarihte yer etmiş kültür öğeleri; yani uygarlık öğeleri anlaşılmalıdır. Bu seçkinci kültür aktarımı anlayışı ilerleyen yöntemlerle birlikte yerini daha çok, gündelik kültürün aktarımına bırakmıştır.

<p style="text-align: center;">2</p> <p style="text-align: center;">2. Numéro deux.</p> <p>Travailler: Le père travaille, il travaille. La mère travaille aussi, elle travaille aussi.</p> <p>Jouer: Charles joue et Marie joue aussi; il joue et elle joue aussi.</p> <p>Nager: Le canard nage, il nage. Qui est-ce qui nage aussi? Le caneton nage aussi.</p> <p>Qu'est-ce que Charles fait? Il joue. Que fait Charles? </p> <hr/> <p>Grammaire.</p> <p><u>travailler</u> est un verbe. <u>il</u> est un pronom personnel. <u>aussi</u> est un adverbe.</p> <p style="text-align: center;">Exercices.</p> <p>A. Qui est-ce qui (1) travaille? (2) joue? (3) nage? (4) Qu'est-ce que Marie fait? (5) Que fait le canard? (6) Qu'est-ce que Louise? (7) Qui est-ce qui est un garçon? (8) Qu'est-ce que le père fait? (9) Qu'est-ce que Julie fait?</p> <p>B. Remplacez le substantif par le pronom personnel. (1) La mère travaille. (2) Le canard nage. (3) Julie joue. (4) Cécile travaille. (5) René joue. (6) Le père travaille. (7) Le caneton nage. (8) Charles joue. (9) Marie joue aussi.</p> <p style="text-align: center;">3. Numéro trois.</p> <p>Marcher: Le père marche. La poule marche. Sauter: Charles saute. Le chien saute. Voler: Une hirondelle vole. L'abeille (une abeille) vole.</p>	<p style="text-align: center;">3</p> <p>Le chien est un animal. L'hirondelle est un oiseau. La poule aussi est un oiseau. L'abeille est un insecte.</p> <p>une fille deux filles trois filles un garçon deux garçons trois garçons</p> <hr/> <p>le garçon: Charles les garçons: Charles, René et Paul la fille: Marie les filles: Marie, Julie, Louise et Cécile</p> <p>l'hirondelle les hirondelles l'abeille les abeilles l'insecte les insectes</p> <p>Les canards nagent, Les hirondelles volent, ils nagent. elles volent.</p> <p>Qu'est-ce que Marie et Louise font? Elles jouent. Que font Marie et Louise? </p> <hr/> <p>Grammaire.</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;"><i>singulier:</i></td> <td style="text-align: center;"><i>pluriel.</i></td> </tr> <tr> <td>Le père travaill-e</td> <td>Les pères travaill-ent</td> </tr> <tr> <td>La poule march-e</td> <td>Les poules march-ent</td> </tr> <tr> <td>L'abeille vol-e</td> <td>Les abeilles vol-ent</td> </tr> </table> <hr/> <p>Prononciation.</p> <p>Un père, un animal, un garçon, un oiseau. Les hirondelles, deux hirondelles, trois hirondelles; les abeilles, deux abeilles, trois abeilles.</p> <p>[Ouvrez le livre à la page 3. Répétez tous (toutes) ensemble.]</p>	<i>singulier:</i>	<i>pluriel.</i>	Le père travaill- e	Les pères travaill- ent	La poule march- e	Les poules march- ent	L'abeille vol- e	Les abeilles vol- ent
<i>singulier:</i>	<i>pluriel.</i>								
Le père travaill- e	Les pères travaill- ent								
La poule march- e	Les poules march- ent								
L'abeille vol- e	Les abeilles vol- ent								



Şekil 3. *Méthode Alge* (Alge & Ripman, 1927, ss. 2-3, s. 154. & s. 294)

DÇ yöntemine bağlı olarak ülkemizde de Fransızca ders kitapları kullanılmıştır. En tipik örneklerden biri *Fransızca Yardımcı Ders Kitabı 1* (Öztaş, 1968) ve ilgili seridir. Şekil 4'te de görüldüğü üzere, Türkçe olan bir metinden yola çıkarak etkinlikler tasarlanmıştır. Bahsi geçen metindeki kimi önemli sözcüklerin ve kalıpların Fransızca karşılıkları verilmiştir. Büyük olasılıkla, sınıf etkinliklerinde ilk önce Türkçe metin öğretmen gözetiminde Fransızcaya çevrilmiştir. Soru-yanıt alıştırmalarından sonra ise eylem çekimleri üzerinde durulmuştur. (Burada gösterilmemiştir.) Yardımcı ders kitabı olsa da, izlenen yol bağlamında bu yapıt DÇ'nin eğitimsel anlayışıyla uyumludur.



Şekil 4. Fransızca Yardımcı Ders Kitabı: Lise 1 (Öztaş, 1968, ss. 5-6)

Blanchet'nin de (2000) bahsettiği üzere, dilbilgisinin açık ve tümdengelimli anlatımı ile kültür aktarımı bağlamında DÇ yöntemine bağlı kalan bir diğer önemli Fransızca kitabı *Cours de Langue et de Civilisation Françaises I* dir (Mauger, 1953/1967). Ancak, sayfa düzeni ve eğitsel içerik açısından bakıldığında, bahsi geçen kitap DY'nin ilkelerini de yansıtmaktadır. Öncelikle, kitabın herhangi bir yerinde Fransızca dışında başka bir dile başvurulmasını öneren ya da ima eden bir kısım bulunmamaktadır. Dolayısıyla, kitabın kullanıcısı etkinliklerde kendi anadiline başvurmayacaktır. Şekil 5'te de görüldüğü üzere, dikdörtgen kutular içinde ders içeriği verilirken temel çıkış noktası açık ve tümdengelimli dilbilgisidir; ancak çeviriye başvurulmamaktadır. Öte yandan, söz varlığı aktarılırken resimlere başvurulmaktadır. Söyleyiş bilgisi için köşeli ayraç içerisinde sözcüklerin sesletimleri verilmektedir; böylece, bu ders kitabı, o dönem popülerleşen *Uluslararası Sesbilgisi Abecesi*'ni öğrenciye tanıtmış olmaktadır. Öte yandan, çoğu çizime dayalı resimlerin oluşturduğu görsel imgeler dışında, kültür aktarımı bağlamında gerçek bir sınıfın fotoğrafı da yer almaktadır (ve kitabın ilerleyen bölümlerinde başka bildirim durumlarını yansıtan fotoğraflar). Etkinlikler ve alıştırmalar açısından bakıldığında ise ucu açık sorular, boşluk doldurma soruları, yazdırım çalışmaları ve diyaloglar yoluyla çeşitlilik sağlanmıştır. Sonuç olarak bu Fransızca ders kitabı ilkeleri ve uygulanması kapsamında, DÇ yöntemi ile DY arasında konuşlanmıştır.

8 LEÇON 4

le livre vert		la robe vert[e]	
Masculin	Féminin	Masculin	Féminin
Le livre est vert [ve:r]	La robe est vert[e] [vert]		
gris [gri]	gris[e] [gri:z]		
brun [brœ]	brun[e] [bryn]		
noir [nwa:r]	noir[e] [nwa:r]		
bleu [blø]	bleu[e] [blø]		

Pluriel
 Les livres sont vert[s] [ve:r]
 Les robes sont verte[s] [vert]

ATTENTION !
 Le livre est rouge [ru:ʒ] La robe est rouge [ru:ʒ]
 Le livre est jaune [ʒo:n] La robe est jaune [ʒo:n]
 Le livre est rose [ro:z] La robe est rose [ro:z]
 Le livre est blanc [blɑ̃] La robe est blanche [blɑ̃:ʃ]

De quelle couleur est la craie ? — La craie est blanche.
 Est-ce que la craie est verte ? — Non, la craie n'est pas verte; elle est blanche.

9 QUATRIÈME LEÇON

GRAMMAIRE

1) FÉMININ de l'adjectif vert = MASCULIN + e
 verbe
 ATTENTION! jaune, rouge, rose : MASCULIN = FÉMININ

2) PLURIEL de l'adjectif vert = SINGULIER + s
 verbe
 ATTENTION! gris : SINGULIER = PLURIEL

Un livre bleu { un est un article indéfini
 livre est un nom
 bleu est un adjectif qualificatif

EXERCICES

I) De quelle couleur est le tableau? De quelle couleur sont les bancs? De quelle couleur sont les murs? De quelle couleur est la porte? De quelle couleur sont les cahiers? De quelle couleur sont les robes? Est-ce que la craie est blanche? Est-ce que le tableau est blanc?

II) Écrivez les adjectifs féminins : Le banc est brun, la table est... Le cahier est vert, la gomme est... Le stylo est noir, la serviette est... Le gant est gris, la clé est... Le mouchoir est blanc, la craie est... Le crayon est rouge, la robe est... Le livre est bleu, la règle est...

III) Écrivez les adjectifs pluriels : Les crayons sont [gris]. Ce sont des livres [rouge]. Les robes sont [noire]. Les gants sont [brun]. Les murs sont [blanc]. Ce sont des sacs [noir]. Ce sont des cravates [verte]. Ce sont des mouchoirs [bleu].

IV) Écrivez les adjectifs masculins : La robe est verte, le gant est... La cravate est jaune, le sac est... La clé est grise, le mur est... La gomme est blanche, le mouchoir est... La serviette est rouge, le livre est... La règle est noire, le stylo est...

V) Écrivez des adjectifs de couleur : La gomme est... La table est... Le calendrier est... La règle est... Les cahiers sont... Les cravates sont... La craie est... Les livres sont... ou... ou... Les robes sont... ou... ou...

VI) Où est le cahier? Où est la gomme? Où est le sac? Où est le tableau? Où sont les livres? Où sont les lampes? Où sont les chaises? Où est l'horloge? Où sont les clés?

VII) Écrivez et lisez : Vert-verte, gris-grise, brun-brune, blanc-blanche, noir-noire, bleu-bleue.

PRONONCEZ : ver(t), verte, — gri(s), grise (comme z), — mais : noir, noir(e), — bleu, bleu(e).
 ATTENTION ! Où est le livre? — mais : les robes sont blanches ou rouges, ou bleues, etc.

10 Revision et variétés. Leçons 1 à 4

VOCABULAIRE, PRONONCIATION

LEÇON 1

NOMS	EXPRESSIONS
le garçon	la chaise
le crayon	la femme
le banc	la fille
le cahier	la gomme
l'homme	la règle
le livre	la serviette
le stylo	la table

pour les exercices de prononciation
 ordre alphabétique

EXPRESSIONS
 Qu'est-ce que c'est?
 Est-ce un...?
 Oui, c'est un...
 Non, ce n'est pas un...
 Ce sont des...
 Ce ne sont pas des...

LEÇON 2

NOMS	EXPRESSIONS
le calendrier	la lampe
le gant	la montre
le plancher	la clé
le plafond	la cravate
le mouchoir	la fenêtre
le mur	l'horloge
le sac	la porte

EXPRESSIONS
 Est-ce que c'est un...?
 Ce sont des...
 Ce ne sont pas des...

LEÇON 3

NOMS	MOTS INVARIABLES
l'étudiant	l'étudiante
l'oiseau	la classe
le tableau	
le professeur	

où?
 dans
 devant
 derrière
 sous
 sur
 maintenant
 voici

LEÇON 4

NOMS	ADJECTIFS	EXPRESSION
la craie	blanc	De quelle couleur est le...?
la robe	brun	
	jaune	
	rouge	
	bleu	
	noir	
	gris	
	rose	
	vert	

11

UNE CLASSE dans une école de français pour étrangers.

DICTÉES (à préparer)

1) Voici une classe (ou une salle de classe). Qu'est-ce que c'est? — C'est la porte. — Est-ce que ce sont les fenêtres? — Non, ce ne sont pas les fenêtres, ce sont les murs. — Le professeur est devant le tableau noir. Les étudiants sont devant le professeur, derrière les tables, sur les bancs.

2) Le livre vert, le cahier rose, la gomme grise, la règle noire, les crayons bleus sont dans la serviette jaune. La serviette est sous le banc, devant le tableau noir. Le mouchoir est dans le sac. Le sac est rouge. Et le mouchoir? — Le mouchoir est blanc.

DIALOGUE

La classe

— Toc! Toc! — Entrez! — Bonjour, Monsieur. — Bonjour, Hélène. Fermez la porte, s'il vous plaît. Savez-vous votre leçon? — Oui, Monsieur. — Répondez : qu'est-ce que c'est? — C'est un livre. — De quelle couleur est le livre? — Le livre est vert. — Qu'est-ce que c'est? — Ce sont des crayons. — De quelle couleur sont les crayons? — Les crayons sont bleus. — Où sont les crayons? — Les crayons sont dans la serviette. — De quelle couleur est la craie? — La craie est blanche. — Est-ce que le tableau est blanc? — Non, le tableau n'est pas blanc; il est noir. — Est-ce que la robe de Marie est verte? — Oui, la robe de Marie est verte. — Où sont les lampes? — Les lampes sont sous le plafond. — Où sont les tables? — Elles sont sur le plancher. — Merci, Hélène; c'est bien.

Şekil 5. Cours de Langue et de Civilisation Françaises I (Mauger, 1953/1967, ss. 8-11)

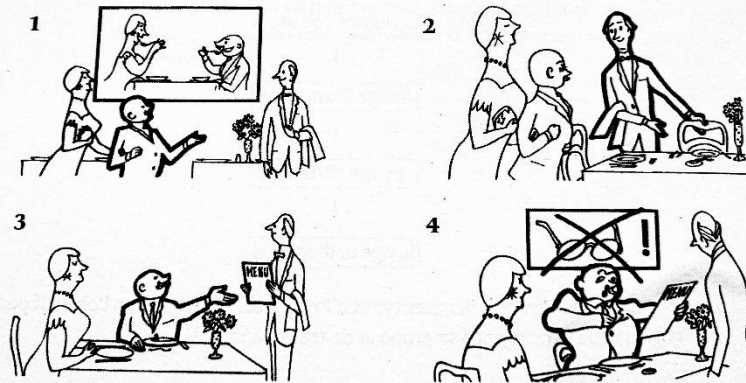
Sınıf etkinlikleri bağlamında, İSY'de ve İGY'de 1950'li yıllardan başlayarak 1980'li yıllara kadar kullanılan yapısal alıştırmalar belirginlik kazanmaktadır; hatta, yapısal alıştırmalar

kısmen 1990'lı yıllarda BY kapsamında kimi ders kitaplarında yer almıştır. Amaç, öğrencinin Fransızcanın biçim-sözdizimini, yani dilbilgisi kurallarını aşırı tekrarla pekiştirerek otomatikleştirmesidir; buna bağlı olarak örnekçe teşkil eden bir soru-yanıt sonrasında ilgili kural, *değiştirim* (*substitution*) ve *dönüştürüm* (*transformation*) alıştırmaları üzerinden çalıştırılır (Girard, 1972; Tagliante, 2006). Değiştirim alıştırmalarında bir sözcük, sözcük grubu ya da tümce bir başkasıyla değiştirilir; örneğin ad dilbilgisel ulamı yerine adıl kullanılabilir. Dönüştürümde ise bir tümce herhangi bir kurala göre yeniden yazılır; örneğin, etken çatılı bir tümcenin çatısı edilgene dönüştürülerek gerekli biçimsel-sözdizimsel değişiklikler yapılır. Girard (1972) dönüştürüme örnek olarak eylemleri şimdiki zamanda yazılmış bir paragrafın başına *dün* sözcüğünün eklenerek zamanların değiştirilmesi ve paragrafın yeniden yazılmasını vermektedir (s. 125). Germain'in (1993) ise değiştirim için verdiği örnek şudur (s. 146):

- *Vous partez le treize ? (Aydın on üçünde mi yola çıkıyorsunuz?)*
- *Nous... → Değiştirim → Nous partons le treize. (Aydın on üçünde yola çıkıyoruz.)*

Yapısal alıştırmalar sonuçta 1990'lı yıllarda yazılmış kimi BY Fransızca ders kitaplarında bile farklı adlandırmalarla devam ettirilmiştir; örneğin, *Le Nouveau Sans Frontières 2*'de (Dominique ve diğerleri, 1989) bu türden alıştırmalara *düzenek* (*mécanisme*) denilmiştir.

İGY bağlamında bir diğer belirginlik de şudur: *Voix et Images de France* (1958) adlı ders kitabıyla beraber, yabancı dil öğrenenler aynı anda işitsel ve görsel uyarana tabi tutulmuşlardır; yani amaç, duvara ya da tahtaya yansıtılan yansılar (karikatürümsü çizimler/görüntüler) ve teypteki kasetten dinletilen diyalogların eşzamanlı olarak öğrenciye aktarılmasıdır; projektör ve teyp aracılığıyla görüntü ve ses aynı anda öğrenciye ulaştırılarak öğrencinin birçok beceriyi harekete geçirmesi (dili dinleme ve el-kol devinimlerini/yüz ifadelerini izleme) amaçlanmıştır; örneğin, *Le Français et La Vie* (1971) adlı ders kitabında, ders içeriği olarak restoranda sipariş verme teması, çizim ve teypten dinletilen kaset yoluyla şu şekilde verilmiştir (Mauger, 1971, s. 210, aktaran Tagliante, 2006, ss. 184-185):

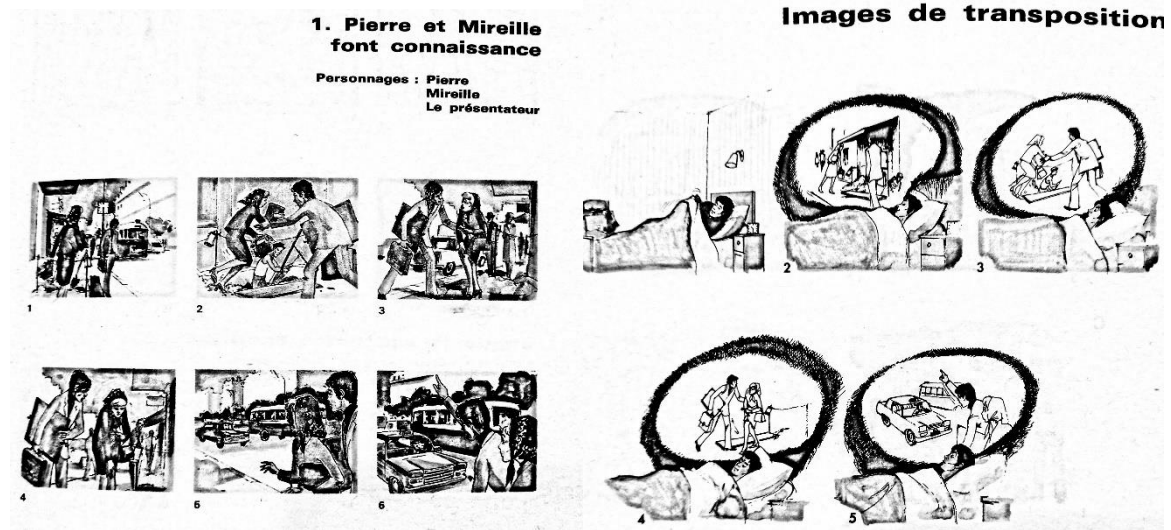


- 1 - *Garçon, nous voulons déjeuner. (Garson! Öğle yemeği yemek istiyoruz.)*
- 2 - *Bien monsieur. Asseyez-vous à cette table. (Hay hay bayım. Bu masaya oturunuz.)*
- 3 - *Donnez-moi le menu, s'il vous plaît. (Bana mönüyü veriniz lütfen.)*
- 4 - *Oh! Je n'ai pas mes lunettes! (Ah! Gözlüklerim yok!)*

Şekil 6. İGY'de Çizim-Diyalog İlişkisi

Burada ses ile eşzamanlı olarak verilen yansılar sayesinde öğrenci adeta bir çeşit çizgi film izlemektedir. Öte yandan, görsellikle seslerin göndermede bulunduğu sözcükleri eşleştirmek, öğrenci açısından kimi zaman zor olabilmektedir. Unutulmamalıdır ki İGY’de anadile başvurmak sınıfta yasaktır.

Ders içeriği dışındaki etkinliklere bakıldığında İGY’de *aktarım (transposition)* adı verilen (bkz. Germain, 1993) ve ana diyalogla benzer bildirişim durumları içeren başka diyaloglar da öğrenciye çalıştırılmaktadır; ayrıca diyaloglar üzerine sözlü soru-yanıt alıştırmaları ile dinleme-yazma becerilerini geliştirmeye yönelik yazdırım alıştırmaları da mevcuttur; İGY’nin en önemli ders kitaplarından biri olan *De Vive Voix*’da (Moget & Neveu, 1975) görüntülü olarak dinletilen diyaloglar (asıl diyalog ve aktarımın yapıldığı diyalog) sonrasındaki tüm alıştırmalar temelde sözlü dili geliştirmeye yöneliktir (bkz. Şekil 7).



Şekil 7. *De Vive Voix*’da Ana Diyalog ve Aktarım Diyaloğu (Moget & Neveu, 1975, s. 3 & s. 7)

İGY’nin dilbilgisi anlayışı örtük ve tümevarımsal olduğundan, genelde dil yetisi ve özelden ise yazma yetisi YDÖ sürecinin özellikle başlangıcında öğrencilerde pek gelişmemektedir. Dolayısıyla, İGY’nin dilbilgisi dersleriyle desteklenmesi gerekli görülmüştür.

Çizimlerden oluşan ve kurgusal olan diyaloglar, BY ile beraber yerini temelde özgün; yani, asıl olarak eğitsel amaçlarla oluşturulmamış metinlere (gazete haberleri, makaleler, raporlar, görüşmeler vb.) bırakmıştır. BY’nin diyaloga dayanan ders içeriklerinde ise fotoromana benzeyen, altyazılı fotoğraflara rastlanmaktadır. Bu diyaloglar ise temelde kurgusaldır. Şekil 8’de de görüldüğü üzere, örneğin *Le Nouveau Sans Frontières 2*’de (Dominique ve diğerleri, 1989) hem kurgusal diyaloglar (gerçeğe yakın bildirişim durumları arz eden) hem de özgün belgeler kullanılmıştır.

International Conference on Global Practice of Multidisciplinary Scientific Studies-IV
 Turkish Republic of Northern Cyprus, April 28-30, 2023

UNITÉ 1 - LA GUERRE DES STARS - PAGES 8-9

LEÇON 1 UNE VEDETTE DE LA TÉLÉVISION

1. Dans la salle à manger d'une famille française. Il est vingt heures.

A table! C'est bientôt l'heure du journal télévisé! Laure, tu peux mettre la Quatre, s'il te plaît?

Moi, je trouve cette Claire Martin plutôt ennuyeuse. J'aime mieux le présentateur de TV5. Il a de l'humour, lui!

On ne peut pas regarder les informations sur une autre chaîne?

Il fait des plaisanteries stupides.

Et elle est agréable à regarder!

Et il n'est pas très objectif.

Claire Martin, elle, est sympathique, pas bête.

Bon, d'accord, j'ai aussi seule contre tous, j'abandonne. Regardons votre star!

TÉLÉ- SEMAINE

CLAIRE MARTIN, PRÉSENTATRICE DE L'ANNÉE

Soixante pour cent des téléspectateurs choisissent de regarder le journal télévisé sur Antenne 4 et Claire Martin s'impose comme la présentatrice tendre de l'année. Mais notre star du petit écran n'a pas une vie familiale. Tout simplement, je suis très organisée. Le matin, je me lève à 7 h et je m'occupe des enfants... petit déjeuner... école... Puis je passe une heure dans la salle de bains. C'est bon pour moi.

8. VOICI DES ACTEURS FRANÇAIS. Quel type de rôles leur donneriez-vous? Expliquez pourquoi

Michel CONSTANTIN

Emmanuelle BÉART

ANÉMONE

7. QU'EST-CE QUI FAIT l'originalité de ce chauffeur de taxi?

DES GENS, DES FAITS, D

Robert le taxi, le Zorro du voyageur

Tout va mal, certains jours: migraine, boutons, discussions... Il a posé en urgence et manque de timbre... Pour couronner le tout, vous allez être en retard à votre rendez-vous à l'autre bout de Paris? Le bonheur c'est ce jour-là de rencontrer le taxi de Robert Izord.

clients. Puis s'habituant à la surprise, le regard saute du Pariscapote de la semaine à des jeux de patience destinés au prochain embouteillage. En cas de besoin, Robert Izord dévoile sa boîte secrète: sa « malloite des petits services rendus ». Parmi les tricornes, l'agrafeuse, l'aiguille, l'essen-

Ancien photographe, organisateur de sa vie, Robert vous conduira à destination. Jusqu'à, rien d'extraordinaire pour un taxi. La première chose qui étonne dans sa voiture, c'est le dos des sièges-avant placardés de coupures de presse. Des photocopies des articles sont même à la disposition des

ce de térébenthine ou l'aspirine submergée. Tous les petits objets dont l'absence est cause de mille tracés quotidiens, sont disponibles sur simple sourire. On irait jusqu'à soupçonner Robert de détenir aussi du papier cadeau dans son coffre. Pour le savoir, rendez-vous dans son taxi... aux prochaines fêtes. ■

Quel que soit votre souci du moment, du bouton décousu à la lettre à timbrer, sans oublier les migraines; Robert a vraiment réponse à tout!

Imaginez ce que pourrait être ...

- un train original,
- chez le médecin ou chez le dentiste, une salle d'attente originale,
- un café ou un restaurant original.

FEMME ACTUELLE, n° 195.

Şekil 8. Le Nouveau Sans Frontières 2' de Kurgusal Diyaloglar ve Özgün Metinlere Dayalı Alıştırılmalar (Dominique ve diğerleri, 1989, s. 8, s. 13 & s. 46)

Sonuçta, burada amaç, gerçek ya da gerçeğe yakın bildirişim durumlarıyla öğrenciyi yüzleştirmektir. Bu nedenle, belli bir role bürünmeye (canlandırma) ve benzetime dayalı alıştırmalar BY'nin ön plana koyduğu sınıf etkinliklerindedir (bkz. Şekil 9).

4. RÉPONDEZ-LEUR en imaginant de fausses excuses

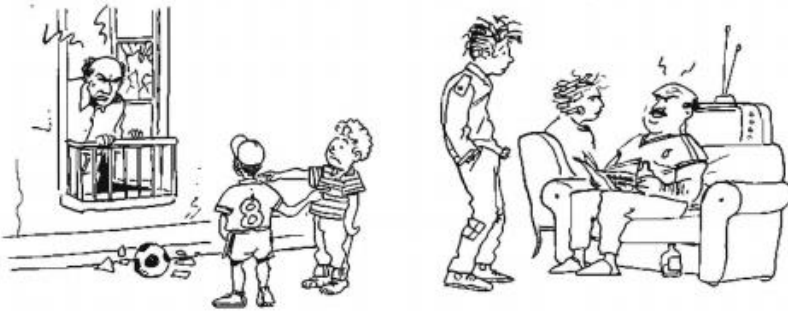
a. Vous n'avez pas envie d'aller à ce dîner. Vous pensez que vous allez vous y ennuyer. b. Vous n'avez pas envie de le/la revoir.

M. et Mme Jean Baudin
vous prient de leur faire l'honneur
de venir dîner
le 25 novembre à 20 h.
R.S.V.P.

Je voudrais bien qu'on se revvoie.
Voudrais-tu dîner avec moi
un de ces jours ou aller voir
un film ?

10. JOUEZ LES SCÈNES. A. accuse – B. s'explique et s'excuse

a/ Ils ont cassé un carreau. b/ On l'a renvoyé.



8. ÉCOUTEZ! Faites le compte rendu de cette séance du Conseil municipal

Précisez quel est l'objet de la réunion.
Résumez en une phrase les interventions de chaque participant au débat.

Şekil 9. *Le Nouveau Sans Frontières* 2'de Rol Oynama ve Benzetim Etkinlikleri (Dominique ve diğerleri, 1989, s. 45, s. 47 & s. 71)

Şekil 9'daki 4 numaralı alıştırmada, gerekçe göstererek bir davete katılmaması konusunda öğrenciye mektup yazdırılmaktadır. 10 numaralı alıştırmada ise ilkin öğrencilerden rol yapmaları istenmektedir; soldaki bildirişim durumunda cam kıran iki çocuk ve onlara kızan ev sahibi, sağdaki ise okuldan ya da işinden kovulan bir genç ile babası arasındaki diyalogun gerçekleştirilmesi istenmektedir. 8 numaralı etkinlik ise asıl olarak bir benzetimdir. Öğrenciler belediye meclisi toplantısını dinleyip bir tutanak yazarak toplantının konusunu ve katılımcıların sözlerini aktaracaklardır. Ancak, daha sonrasında, öğretmen öğrencilerden başka bir konuyla ilgili olarak sınıfta grupça gerçekleştirilecek bir toplantı yapmalarını ve toplantıdaki kişileri canlandırmalarını isteyebilir. Benzetimler, skeç benzeri olan rol oynama etkinliklerine göre daha planlı ve daha kapsamlıdır; ön hazırlık gerektirebilecektir (bkz. Bertocchini & Costanzo, 2008).

Son olarak sınıf etkinlikleri bağlamında EEY'nin belirginliğinden bahsetmek gerekmektedir. Rol yapmaya ve benzetime dayalı sınıf etkinlikleri, yerini gerçek bildirişim durumları arz eden ve dilsel, bildirişimsel ve/ya da kültürel bilgi-becerilerin eşzamanlı olarak harekete geçirildiği

etkinliklere bırakmıştır. Bahsi geçen eylem-etkinlikler aşamalara bölünerek genelde grupça (maksimum 4 öğrenci örneğin) ve sınıfta ya da sınıf dışında gerçekleştirilir. Amaç, grup etkileşimini, öğrenme özerkliğini ve özdeğerlendirmeyi teşvik etmektir (bkz. Conseil de l'Europe, 1998/2001/2005). Şekil 10'daki eylem-etkinlik, B2 dil düzeyi için tasarlanmış ve EEY'yi düzenli olarak uygulayan ilk Fransızca ders kitaplarından *Rond-Point 3*'te (Capucho ve diğerleri, 2003) yer almıştır.

8. LE NAMING, C'EST IN

A. Écoutez cette interview du directeur d'une agence de *naming*. Prenez des notes à l'aide de cette fiche.

B. Feriez-vous appel à ce type d'entreprise si vous aviez un produit à commercialiser ? Discutez-en avec deux camarades, puis exposez le point de vue de votre groupe au reste de la classe.

9. INÉDIT !

A. Par groupes de trois, créez un nom de marque et un slogan pour un objet quelconque, soit un objet du quotidien (un balai, un tabouret, un tournevis...) soit un produit très exclusif (un parfum, une marque de vêtements, une voiture...) soit un objet original de votre création. Dans la mesure du possible, suivez les procédures et les critères indiqués par le directeur de l'agence de *naming*.

B. Créez ensuite une page de pub pour un magazine afin de faire connaître votre produit et sa marque.

FICHE DE PRISE DE NOTES

DÉFINITION DU NAMING	
IMPORTANCE DE L'ACTIVITÉ	
ÉTAPES DE CRÉATION D'UNE APPELLATION	1. 2. 3. 4. 5. 6. 7.
CRITÈRES À SUIVRE POUR LA CRÉATION DU NOM	1. 2. 3. 4.
AVENIR DU MÉTIER	

Unité 2 dix-sept

Şekil 10. *Rond-Point 3*'te Eylem-Etkinlik Örneği (Capucho ve diğerleri, 2003, s. 17)

8 numaralı eylem-etkinlikte ilkin bir reklam ajansının yöneticisinin konuşması dinletilmektedir. Konuşma sırasında öğrencilerden not tutmaları istenmektedir. Ardından, 3'lü gruplar hâlinde, konuşmadaki pazarlama stratejisinin uygun olup olmadığının sınıfta sunum-tartışma şeklinde görüşülmesi önerilmektedir. 9 numaralı eylem-etkinlikte ise yine 3'lü öğrenci grupları dâhilinde, günlük kullanım değeri olan ya da ender bir ürün (veyahut öğrencilerin kendilerinin tasarlayacağı bir ürün) için öğrencilerden marka adı ve slogan üretmeleri istenmektedir. Sonrasında ise öğrencilerden ürünü ve marka adını tanıtımları için bir dergiye reklam sayfası tasarımları beklenmektedir. Bu türden eylem-etkinlikler özellikle dil düzeyi arttıkça çeşitlendirilebilir; öte yandan, sosyal medyanın gelişmesiyle birlikte eylem-etkinliklerin tam anlamıyla gerçekleştirilebilme olasılığı da artmıştır. Eylem-etkinlikler, daha önce de belirtildiği üzere, aşamalara ayrılmalı ve belli bir zamana yayılmalıdır; bir dönem içerisinde bir ya da daha fazla eylem-etkinlik uygunluğa, zamana, içeriğe ve sınıf başarımına bağlı olarak gerçekleştirilebilir. Sonuçta, her dil düzeyine uygun bir eylem-etkinlik tasarlamak, Fransızca öğretmenin yaratıcılığına ve süreci yönetme becerisine bağlı olacaktır.

SONUÇ

Bu çalışmada, ders içeriklerinin tanıtımı ve alıştırmalar dâhil olmak üzere, Fransızca ders kitaplarındaki etkinliklerin evrimi sorunsalı ele alınmıştır. Sosyal medyada, yani çevrimiçi ağda bulunan içerikler bu çalışmanın kapsamının dışında tutulmuştur. Özellikle 20. yüzyılın ortalarından itibaren, uygulanan yöntemlerin çerçevesi öğrenim anlayışı, dil anlayışı ve öğretim anlayışı bağlamında daha belirginleşmiştir. Bu araştırmada, yabancı dil olarak Fransızca öğretiminde belirginlik arz ettiği ve yaygın olarak kullanıldığı düşünülen yöntemler ve ders kitapları ele alınmaya çalışılmıştır.

Dilbilgisi-Çeviri (Geleneksel/Klasik) *Yöntemi*'nden günümüzün *Bildirişimsel Yaklaşım* ve *Eylem-Etkinlik Yaklaşımı* gibi daha seçmeci ve bütüncül yöntemlerine ya da yaklaşımlarına ilerlendiğinde göze çarpan belirginlikler şunlardır:

- Salt dil yetisi, yerini bildirişim yetisinin daha çok vurgulandığı bir Fransızca öğrenim-öğretim sürecine bırakmıştır; yani dile ilişkin bilginin belirli bir bildirişim niyetiyle ve bildirişim durumunda nasıl kullanılabilceği sorunsalı öne çıkartılmıştır; ders kitaplarındaki ders etkinlikleri de bunu destekler niteliktedir. Özellikle, sözlü dilde bildirişimi (bireysel olarak ya da grup içerisinde) teşvik eden bir anlayışla karşılaşmaktadır. 1950'ler öncesinde yazılı dile önem verilirken, ilerleyen dönemlerin yöntem kitaplarında sözlü dil ve bildirişim olguları vurgulanmıştır. Ancak, farklı öğrenim-öğretim ve değerlendirme bağlamları ele alındığında, öğrenci gereksinimlerine göre içerik hazırlama, uygulama ve değerlendirme yapmanın önemi ortaya çıkacaktır. Örneğin, Türkiye'de yabancı dil olarak Fransızca öğretiminin hedefleri ile değerlendirme biçimleri, Fransa'da ikinci dil olarak öğretilen Fransızcaninkilerden farklı olacaktır; çünkü Fransa'da ikinci dilini öğrenen bir birey için öncelik, gündelik yaşamda sözlü Fransızcanın kullanımı iken, Türkiye'deki Fransızca öğreneni için öncelik, sınavların özellikle yazılı olması da hesaba katıldığında, yazılı dil, dilbilgisi ya da kurallı dil olacaktır. Bu durumun farkına varan yeni Fransızca kitapları (yabancı dil bağlamında) dilbilgisine de gerekli önem vererek bildirişimsel yetiyi destekleyici içeriklere ağırlık vermektedir. Sonuçta, her ne kadar bildirişim amaç olsa da, dilin kurallı kullanımına ilişkin bilgi-beceri olmazsa olmazdır; yani, dilbilgisi gerek şarttır; ancak yeter şart değildir.
- Dilbilgisi açık ve tümdengelimli etkinliklerle verilirken, özellikle *İşitsel-Sözel Yöntem* ve *İşitsel-Görsel Yöntem* dönemlerinde örtük ve tümevarımsal bir yaklaşımla aktarılmıştır. Ancak, güncel yöntemler olan *Bildirişimsel Yaklaşım* ve *Eylem-Etkinlik Yaklaşımı* sırasında açık ve tümdengelimli dilbilgisi öğretimi yine ön plana çıkmıştır. Dil kuralları öğretilirken, özellikle 1990'lı yıllardan itibaren, örneğin metinlerden yola çıkarak belli bir bildirişim durumunu yansıtan dil öğeleri ya da tümceler üzerinde çalışılıp (bağlamdan kopuk, soyutlanmış ve tekil tümceler üzerinde çalışmak yerine) daha işlevsel bir yaklaşım sergilenmeye başlanmıştır.

- Söz varlığı öğretilirken de, herhangi bir sözcüğün sözlük anlamının verilmesinden ziyade belli bir metin ya da diyalogdaki kullanımından yola çıkılmış; bildirişimsel/anlamsal temelde farklı kullanımları ve tümce içindeki kullanımları üzerinde giderek daha fazla durulmuştur.
- Fransızca ders kitaplarında temalar belirlenirken dilsel işlev, kullanım sıklığı ve kolaylık-zorluk (kolaydan zora doğru) ölçütleri temel alınmıştır. Örneğin, Fransızca öğretim sürecinin başında selamlaşma, kendini tanıtmaya, basit bilgi verme, bilgi sorma, çevresini betimleme vb. dil işlevlerin ya da bildirişimsel hedeflerin/kazanımların öğrenciye öğretilmesi hedeflenmiştir. Bu hedefler, ders kitaplarında özellikle *Bildirişimsel Yaklaşım* ve *Eylem-Etkinlik Yaklaşımı* ile beraber öğrenciye açıkça belirtmeye başlanmıştır.
- Çeviriye verilen önem giderek azalmıştır; hatta çeviri, belli bağlamlar dışında Fransızca sınıfının dışında kalmıştır; çünkü öğrencinin otomatik olarak ya da doğrudan yabancı dilde düşünerek konuşması ve yazması beklenir olmuştur. Ancak, özellikle ileri dil düzeylerinde anadil ile yabancı dil arasında biçimsel-sözdizimsel ve anlambilimsel karşılaştırmalar yapabilmek adına çeviri etkinlikleri anlamlı olabilir.
- Kültür aktarımında değerler dizisi değişmiş, tarihte yer etmiş uygarlık öğeleri, yerini daha çok gündelik öğelerin aktarılmasına bırakmıştır. Aynı zamanda, çok kültürlülük ve çok dillilik teşvik edilmiştir.
- Öte yandan, öğrenci özerkliği, grup içinde rol alabilme ve özdeğerlendirme/özdenetim daha çok teşvik edilmeye başlanmıştır.
- Fransızcanın öğretimi sürecindeki ders kitaplarının evrimine bakıldığında, alıştırmalar daha da çeşitlendirilmiştir; açık soru-yanıt, yazdırım, dönüştürüm/değiştirim, boşluk doldurma, bağdaştırma vb. alıştırmaya türleri yerlerini korusa da, gerçek bildirişim durumlarında öğrencinin Fransızca kullandığı kapsamlı etkinlikler yaygınlaşmıştır. *Bildirişimsel Yaklaşım*'daki canlandırma ve benzetim gibi kurgusal alıştırmalar, yerini günümüzde daha çok, öğrencinin gerçek dilsel-bildirişimsel-kültürel edimler ortaya koyduğu, çok aşamalı ve bütüncül bir özellik arz eden eylem-etkinliklere bırakmıştır. Bu eylem-etkinliklerde hem bireysel hem de grup içi başarıya önemli yer tutmaktadır.
- Fransızca ders kitaplarındaki görsel öğeler de çeşitlilik kazanmıştır; elle çizilen resimler, yerini sıklıkla özgün fotoğraflara ve görsel belgelere bırakmıştır. Etkinliklerin özgün görsel belgeler üzerinden yapılması yaygınlaşmıştır.

Sonuçta, özellikle Anglosakson alanyazında ilgi gören *yöntem sonrası dönem* kavramı yanlış anlaşılmalıdır. Yabancı dil ders kitapları basılı ve/ya da elektronik ortamda var olmaya devam edecektir. Önemli olan, sürekli değişen teknolojiye de yararlanarak ve öğrenim-öğretim bağlamı ile öğrenci gereksinimlerini dikkate alarak ilkeli ve yöntemli bir seçmeci uygulama uygulamaktır; yani Puren'in (2019) de bahsettiği üzere sürekli hareket etmek ve ilerlemek temeldir.

KAYNAKÇA

- Alge, S., & Ripman, W. (1927). *Méthode Alge: Nouvelles leçons de français*. Librairie Fehr: St-Gall.
- Austin, J. L. (1962/1970). *Quand dire, c'est faire* (çeviren Gilles Lane). Paris: Éditions du Seuil.
- Bertocchini, P., & Costanzo, E. (2008). *Manuel de formation pratique pour le professeur de FLE*. Clamecy: CLE International.
- Blanchet, P. (2000, 1 Ocak). *Une méthode traditionnelle: Le Cours Mauger (1)* [Video]. Les Amphis de France 5. <https://www.canal-u.tv/chaines/les-amphis-de-france-5/didactique-des-langues/une-methode-traditionnelle-le-cours-mauger-1>
- Capucho, F., Denyer, M., Labascoule, J., & Royer, C. (2007). *Rond-Point 3: méthode de français basée sur l'apprentissage par les tâches*. Barcelone: Centre de Recherche et de Publication de Langues, S.L.
- Cicurel, F. (2011). *Les interactions dans l'enseignement des langues: agir professoral et pratiques de classe*. Paris: Les Éditions Didier.
- Conseil de l'Europe (1998/2001/2005). *Cadre européen commun de référence pour les langues: apprendre, enseigner, évaluer*. Paris: Les Éditions Didier.
- Cuq, J.-P. (2003). *Dictionnaire de didactique du français langue étrangère et seconde*. Paris: CLE International.
- Cuq, J.-P., & Gruca, I. (2017). *Cours de didactique de français langue étrangère et seconde*. Fontaine: Presses Universitaires de Grenoble.
- Dominique, P., Girardet, J., Verdelhan, M., & Verdelhan, M. (1989). *Le nouveau sans frontières 2*. Paris: Éditions CLE International.
- Galisson, R. (2000). La pragmatique lexicoculturelle pour accéder autrement, à une autre culture, par un autre lexique. *Mélanges CRAPEL*, 25, 47-73.
- Germain, C. (1993). *Évolution de l'enseignement des langues: 5000 ans d'histoire*. Paris: CLE International.
- Girard, D. (1972). *Linguistique appliquée et didactique des langues*. Paris: Armand Colin.
- Kumaravadivelu, B. (2003). *Beyond methods: macrostrategies for language teaching*. New Haven and London: Yale University Press.
- Kumaravadivelu, B. (2006). *Understanding language teaching: from method to postmethod*. New Jersey: Lawrence Erlbaum Associates, Inc., Publishers.
- Martinez, P. (1996). *La didactique des langues étrangères*. Paris: Presses Universitaires de France.
- Mauger, G. (1953/1967). *Cours de langue et de civilisation françaises I*. Paris: Librairie Hachette.
- Merriam, S. B. (2009). *Qualitative research: a guide to design and implementation*. San Francisco: Jossey-Bass.
- Moget, M.-T., & Neveu, P. (1975). *De vive voix*. Paris: Librairie Marcel Didier.

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Turkish Republic of Northern Cyprus, April 28-30, 2023**

- Oxford, R. L. (2011). *Teaching and researching language learning strategies*. Great Britain: Pearson Education Limited.
- Öztaş, K. (1968). *Fransızca Yardımcı Ders Kitabı: Lise 1*. Ankara: Dil Yayınları.
- Pastiaux, G., & Pastiaux, J. (2011). *La pédagogie*. Paris: Nathan.
- Piaget, J. (1970). *L'épistémologie génétique*. Paris: Presses Universitaires de France.
- Puren, C. (1988/2012). *Histoire des méthodologies de l'enseignement des langues*. Paris: CLE International.
- Puren, C. (2019, 22 Kasım). *La perspective actionnelle avec Christian Puren (Partie 1)* [Video]. Culture FLE-Paroles d'expert.e.s. <https://www.youtube.com/watch?v=HBNfti8HDzs>
- Seara Rodriguez, A. (2001). L'évolution des méthodologies dans l'enseignement du français langue étrangère depuis la méthodologie traditionnelle jusqu'à nos jours. *Cuadernos del Marqués de San Adrián: Revista de humanidades*, 1, 139-161. https://qinnova.uned.es/archivos_publicos/qweb_paginas/4469/revista1articulo8.pdf
- Schott-Bourget, V. (1994). *Approches de la linguistique*. Paris: Éditions Nathan.
- Tagliante, C. (2006). *La classe de langue*. Paris: CLE International.
- Thornbury, S. (2020, 22 Temmuz). *My 7 favourite language teaching methods* [Video]. Cambridge Day 2020. <https://www.youtube.com/watch?v=XERPdwe0HHQ>

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Bilgilerinize arz edilir,

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